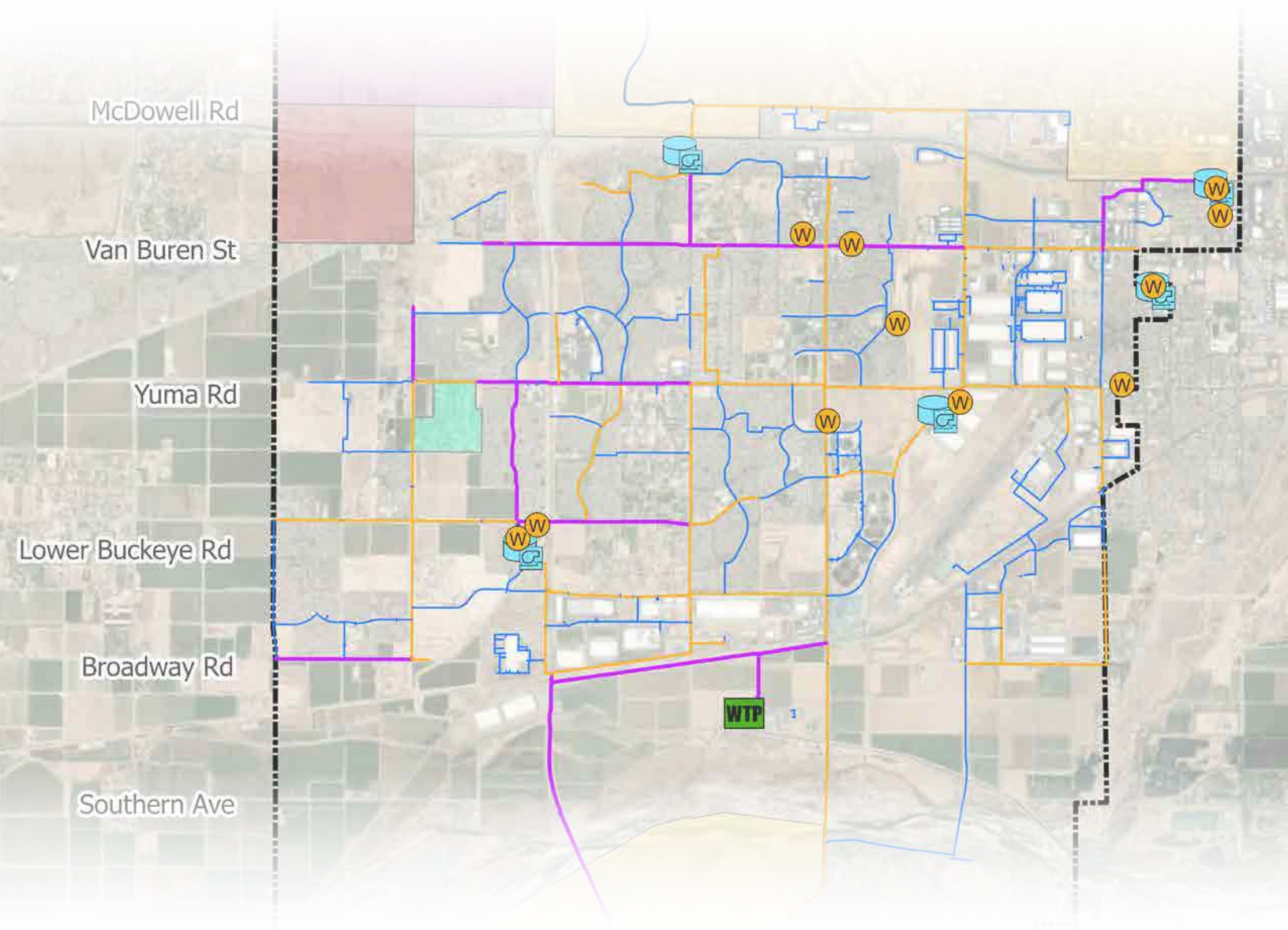


2024 Integrated Water Master Plan

FINAL / April 2025





2024 Integrated Water Master Plan

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Abbreviations

\$/lf	cost per linear foot
A.A.C.	Arizona Administrative Code
AACE	Association for the Advancement of Cost Engineering
AACEI	Association for the Advancement of Cost Engineering International
AADF	average annual daily flow
AAWS	Analysis of Assured Supply
ac-ft	acre-feet
AD	average day
Adaman	Adaman Mutual Water Company
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AFY	acre-feet per year
AMA	Active Management Area
AOHI	area of hydrologic impact
APS	Arizona Public Service
ARC	Arizona Reconsultation Committee
AS&R	annual storage and recovery
ASR	aquifer storage and recovery
AWBA	Arizona Water Banking Authority
AWP	Advanced Water Purification
AWS	Assured Water Supply
AWTF	advanced water treatment facility
AZ-303	Arizona State Route 303
bls	below land surface
BOR	Bureau of Reclamation
BPS	booster pump station
BWCDD	Buckeye Water Conservation Drainage District
CAGR	Central Arizona Groundwater Replenishment District
CAP	Central Arizona Project
Carollo	Carollo Engineers, Inc.
CAWCD	Central Arizona Water Conservation District
CAWS	Certificates of Assured Water Supply
CCI	Construction Cost Index
CIP	Capital Improvement Projects
City	City of Goodyear
CMAR	Construction Manager at Risk
CSIF	CAP/SRP Interconnection Facility

d/D	depth over diameter
DAWS or Designation	Designation of Assured Water Supply
DCP	Drought Contingency Plan
DPP	Drought Preparedness Plan
DPR	direct potable reuse
DU	dwelling unit
DWF	dry weather flow
ENR CCI	Engineering News Record Construction Cost Index
ft	feet
ft bgs	feet below ground surface
ft/day	feet per day
ft/ft	feet per foot
ft/sec	feet per second
GIS	Geographic Information System
GMA	Groundwater Management Act
gpd	gallons per day
gpd/ac	gallons per day per acre
gpm	gallons per minute
GRIC	Gila River Indian Community
GSF	Groundwater Savings Facility
HGL	hydraulic grade lines
HOA	Homeowners Association
HSI	Hydro Systems, Inc.
I-10	Interstate Highway 10
ICS	intentionally created surplus
IFC	International Fire Code
IGFR	Irrigation Grandfathered Rights
IIP	Infrastructure Improvement Plan
in	inch(es)
INA	Irrigation Non-Expansion Area
IPR	indirect potable reuse
IWMP	Integrated Water Master Plan
LTSC	long-term storage credit
M&I	Municipal and Industrial
MAF	million acre-feet
MCC	motor control center
MD	maximum day

MDAWS	Modified Designation of Assured Water Supply
MG	million gallons
mgd	million gallons per day
mi	mile(s)
MSA	Member Service Area
NIA	Non-Indian Agriculture
PFAS	polyfluoroalkyl substances
PGAN	Phoenix Goodyear Airport North
PGAS	Phoenix Goodyear Airport South
PH	peak hour
PRV	pressure reducing valve
psi	pounds per square inch
PVC	polyvinyl chloride
PWWF	peak wet weather flow
RO	reverse osmosis
RPAG	Recovery Planning Advisory Group
SAT	soil aquifer treatment
SCADA	supervisory control and data acquisition
SPC	system pressure criteria
sq mi	square mile(s)
SRP	Salt River Project
SRVWUA	Salt River Valley Water Users' Association
SSO	sanitary sewer overflows
STEM	science, technology, engineering, and math
SWTP	surface water treatment plant
TDS	total dissolved solids
US&R	Underground storage and recovery
USBR	United States Bureau of Reclamation
USF	Underground Storage Facility
UWSRA	Underground Water Storage and Recovery Act
WERT	Water Emergency Response Team
WPA	water planning area
WPA 1	Water Planning Area 1
WPA 2	Water Planning Area 2
WPA 3	Water Planning Area 3
WPA 4	Water Planning Area 4
WPA 5	Water Planning Area 5
WRF	wastewater reclamation facility

WRF	water reclamation facility
WS	water storage
WSRV	West Salt River Valley
WWF	wet weather flow

CHAPTER 1 INTRODUCTION

The City of Goodyear (City) began this Integrated Water Master Plan (IWMP) to plan the water resources, water, wastewater, and reclaimed water infrastructure to support growth using a common set of flow projection assumptions. The IWMP assumptions are based on the City's 2035 General Plan.

1.1 2016 Integrated Water Master Plan

The City's previous master plan was the 2016 Integrated Water Master Plan (IWMP). This plan brought together the water resources and infrastructure systems into one coordinated plan with flow projections based on the General Plan land use.

One of the key outcomes of the 2016 IWMP was a set of Capital Improvement projects that when implemented, enables the City to strengthen its water delivery infrastructure after the financial stresses of the Great Recession. The City worked with a Citizens committee to help obtain support for the additional infrastructure needed, and then worked very hard to implement the 2016 IWMP's recommendations. Because of these actions, the City began the 2024 IWMP in a much stronger position for water supply and delivery infrastructure.

The 2016 IWMP outlined a strategy to deliver the City's Central Arizona Project (CAP) allocation by wheeling water through the Interconnect at the Granite Reef Dam to the Salt River Project (SRP) canals and then pumping the water from there to a surface water treatment facility within the City. Up until this time the City had no way to take physical possession of its CAP allocation, so recharging the CAP water in remote facilities was the only option. As a result, the City was not able to count the full CAP allocation in its water resource portfolio. After the 2016 IWMP was completed, the City was able to construct Phase 1 of the water treatment plant, which significantly advanced the City's position as a reliable water delivery provider for a growing community.

The surface water treatment plant was located near the 157th Avenue Water Reclamation Facility so that in the future a direct potable reuse (DPR) facility could be built to treat reclaimed water and deliver it for potable use at a lower infrastructure cost because the facilities are co-located.

1.2 2024 IWMP Project Objectives

After the 2016 IWMP was completed, numerous changes occurred, creating the need for the 2024 IWMP. In addition to the new surface water treatment plant, the City has experienced explosive growth in Central Goodyear with unprecedented industrial growth and increased housing densities with the construction of a significant number of high-density developments. To illustrate the extent of growth since the last master plan, Figure 1.1 shows the water distribution system pipes that have been added to the Goodyear water system since the 2016 IWMP.

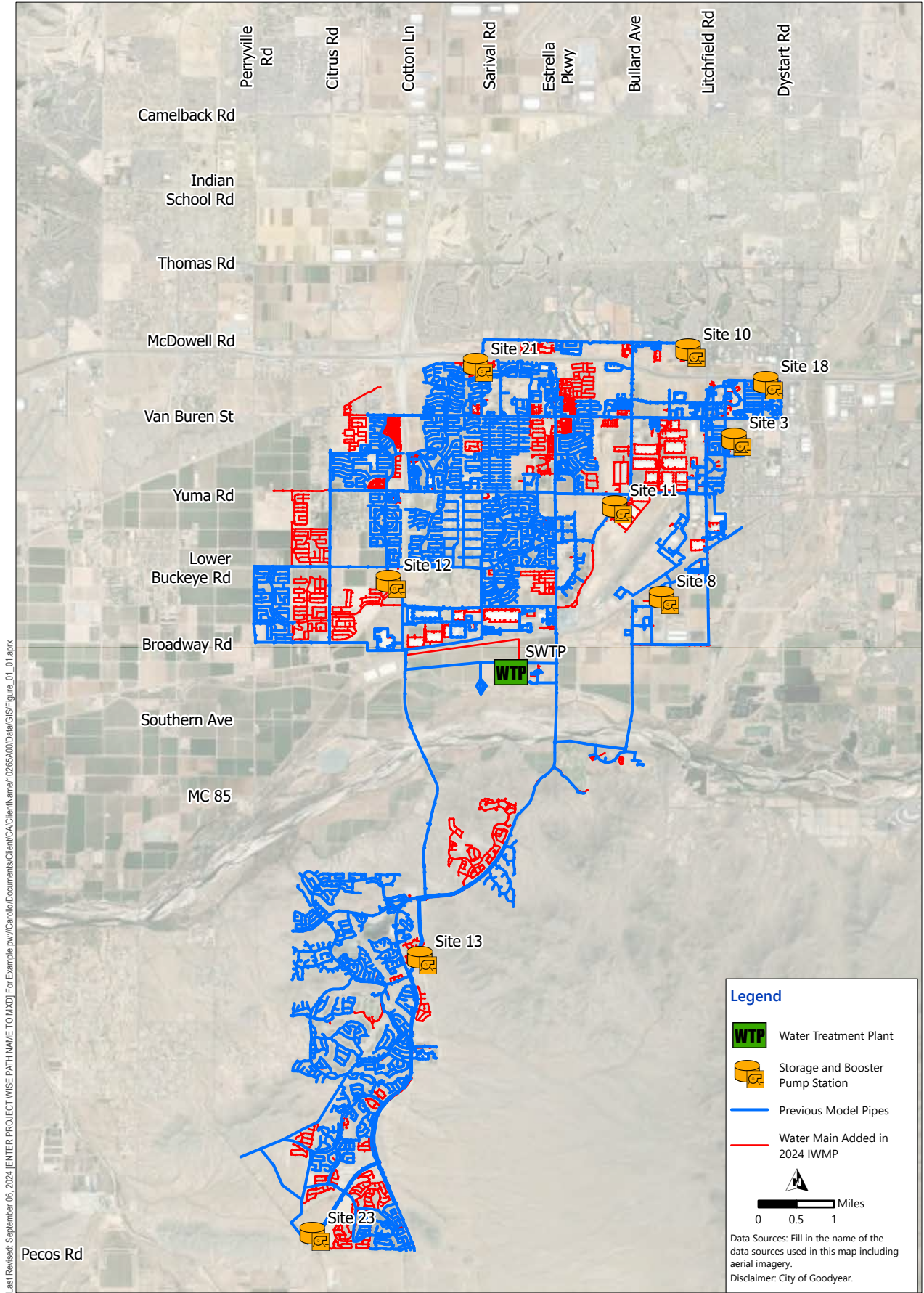


Figure 1.1 Water Mains Added to the Goodyear Water System Since the 2016 IWMP
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

In June 2023, the Arizona Department of Water Resources (ADWR) issued a determination that groundwater resources were over-allocated and new development within the West Salt River Valley groundwater sub-basin required a water supply other than groundwater. During this same time period, the City and neighboring cities need to renew their Designation of Assured Water (DAWS) to demonstrate that water supplies are adequate to support growth in the coming years. This DAWS renewal is being done against a backdrop of cuts to the Colorado River allocations due to drought, and an increased interest in development in the Rainbow Valley sub-basin which was not included in ADWR's moratorium on development using groundwater.

The City has several specific objectives which the 2024 IWMP addresses. These objectives include:

1. Submit an application and support approval of the City's modified DAWS.
2. Establish flow projections based on growth defined in the City's 2035 General Plan for development through 2040 that can be used to establish flow projections upon which the timing of major capital improvements can be established.
3. Determine the next steps to take to strengthen the City's water resource portfolio, including water supplies to serve future development in Rainbow Valley.
4. Evaluate the adequacy of the City's water, wastewater, and reclaimed water infrastructure for current and projected development, including land areas where housing density has grown, potentially increasing water demand.
5. Develop strategies to fully utilize the City's reclaimed water resource to augment the City's water resource portfolio.
6. Develop a Capital Improvement Program to help justify funding requirements and guide expansion of the water, wastewater, and reclaimed water systems.

1.3 2024 IWMP Chapters

1.3.1 Chapter 2: Planning Framework

The Planning Framework Chapter contains a definition of the Goodyear planning area boundary, and the City's land use plan that defines the type of development to be used throughout the City. The City's water billing data is used to develop water unit demands to calculate water use. The City's population projections are used to establish growth rates for the planning periods of the 2024 IWMP. Then the flow projections are established for the water, wastewater, and reclaimed water systems.

1.3.2 Chapter 3: Water Resources

The Water Resources Chapter summarizes the regulations governing water resources in the State of Arizona. The City's water resource portfolio is described, including surface water, groundwater, and reclaimed water supplies. Water resources are compared against the flow projections established in Chapter 2 for drought scenarios to determine the conditions under which the City can supply projected demands and the conditions under which demands will need to be curtailed.

1.3.3 Chapter 4: Water Infrastructure Master Plan

The Water Infrastructure Master Plan contains an evaluation of the City's water delivery system under current conditions and under the planning periods established for the 2024 IWMP. The timing of the next expansion to the surface water treatment plant is established, along with the timing of additional well production and treatment. The requirements to create a new pressure zone in the Central zone are established. Infrastructure needed to serve new development throughout the City, including Rainbow Valley is defined.

1.3.4 Chapter 5: Wastewater Infrastructure Master Plan

The Wastewater Infrastructure Master Plan contains an evaluation of the City's wastewater collection system under current conditions and under the planning periods established for the 2024 IWMP. The timing of the next expansion to the wastewater reclamation facilities is established. Infrastructure needed to serve new development throughout the City, including Rainbow Valley, is also defined.

1.3.5 Chapter 6: Reclaimed Water Infrastructure Master Plan

The Reclaimed Water Infrastructure Master Plan contains a plan to expand the reclaimed water system so that the City can fully benefit from the reclaimed water produced within the City. This plan includes improvements to the soil aquifer treatment (SAT) site, aquifer storage and recovery wells, and a spreading basin in Rainbow Valley.

1.3.6 Chapter 7: Capital Improvement Program

The Capital Improvement Program Chapter contains the unit costs that were used to identify the costs for recommended infrastructure components. Then the planning level costs for water, wastewater, and reclaimed water system projects are provided, phased by planning period. Projects that would be funded by developers are also given but are not included in the City's CIP project list.

CHAPTER 2 PLANNING FRAMEWORK

2.1 Introduction

This 2024 IWMP requires a common set of assumptions that define the service area, growth rate, timing of development, population growth, and flow projections for water resources, and the water, wastewater, and reclaimed water infrastructure systems. Planning water resources are also needed as part of the City's modified DAWS application that is being completed as a part of the IWMP. A common set of assumptions is critical to make sure that capital projects are coordinated among water and wastewater systems, and that a defensible set of Capital Improvement Projects (CIP) is provided in the IWMP.

The scope of work for the City's IWMP includes this planning framework that defines the water, wastewater, and reclaimed water flow projections for the existing (2023), five-year (2028), ten-year (2033), 15-year (2038), and buildout planning periods. The recommendations of this IWMP are based on this planning framework.

The planning framework chapter includes the following major sections:

- Study Area.
- Land Use Plan.
- Population Growth Projections.
- Water Demand Projections.
- Wastewater Flow Projections.
- Reclaimed Water Flow Projections.

2.2 Study Area

The City is located in Maricopa County, approximately 13 miles west of central Phoenix. The Interstate Highway 10 (I-10) passes through the northern part of the City and crosses the Arizona State Route 303 North (AZ-303). The Gila River runs through the planning area approximately 5 miles south of the I-10. The City Planning Area encompasses 250 square miles (sq mi). The planning area, shown in Figure 2.1, includes City boundaries as well as the five water planning areas (WPA).

- Water Planning Area 1 (WPA 1) consists of the EPCOR and Liberty Utilities Planning Areas. The population and water demand projections for the EPCOR and Liberty Utilities area are not included in this plan. However, the City collects wastewater from the EPCOR service area, so the wastewater flow projections are included for the EPCOR service area. Figure 2.2 presents the wastewater service area boundary.
- Water Planning Area 2 (WPA 2) is from the I-10 to the Gila River. Arizona Water Company provides service to a small area on the northeast corner of Van Buren and Perryville Road. The Utility of Greater Buckeye Inc. provides service to an area at the southeast corner of Yuma Road and Citrus Road. There are also some areas that have homes with septic systems and therefore do not contribute flows to the City's wastewater system.

- Water Planning Area 3 (WPA 3) is located between the Gila River to Pecos Road. Estrella Mountain Ranch is the primary development in this planning area, but it also includes King Ranch, Sierra Vista Foothills, and a portion of Terrasante.
- Water Planning Area 4 (WPA 4) is located between Pecos Road and Atterson Road. This planning area is currently undeveloped but has several planned developments, including a portion of Terrasante, Rainbow Valley, Estrella Highlands, Estrella, Madeira, and Arnold Baker 320.
- Water Planning Area 5 (WPA 5) is located between Patterson Road to the City's southern planning area. Amaranth is the primary planned development in WPA 5.

2.3 Land Use Plan

This section describes the City's land use plan. Land use is used to establish water demand projections which then become wastewater and reclaimed water flows.

Land use classifications were obtained from the City's General Plan 2035, supplemented by specific development plans when available. In the absence of a development report, the Geographic Information System (GIS) aerial photographs were used to determine the type of development. For residential land areas, the parcel layer was used to determine the housing density per acre. When needed, land use classifications in the GIS were modified to more accurately represent land uses corresponding to the actual development.

Figure 2.3 presents the land use classifications used for this IWMP.

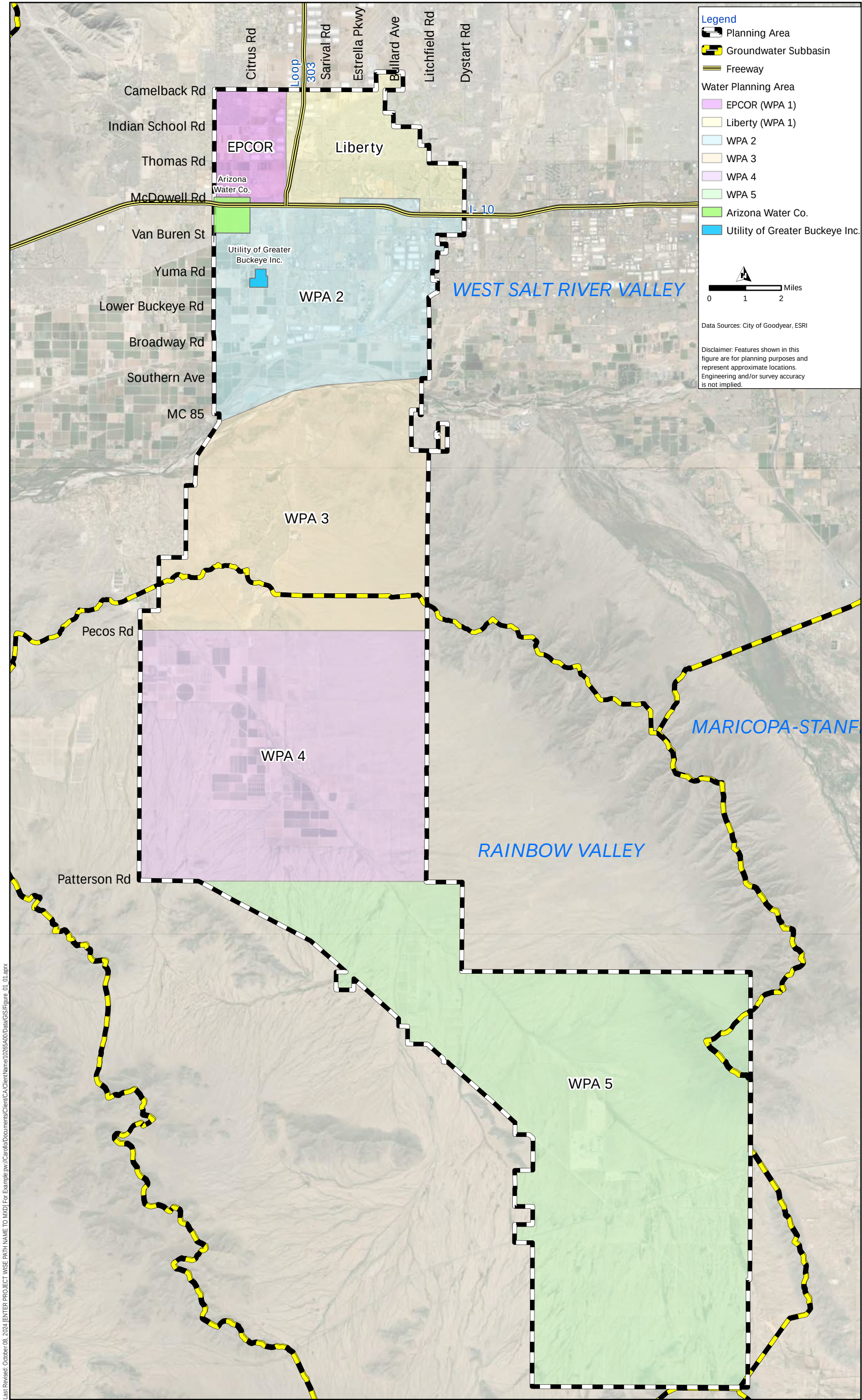


Figure 2.1 City of Goodyear Planning Area
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

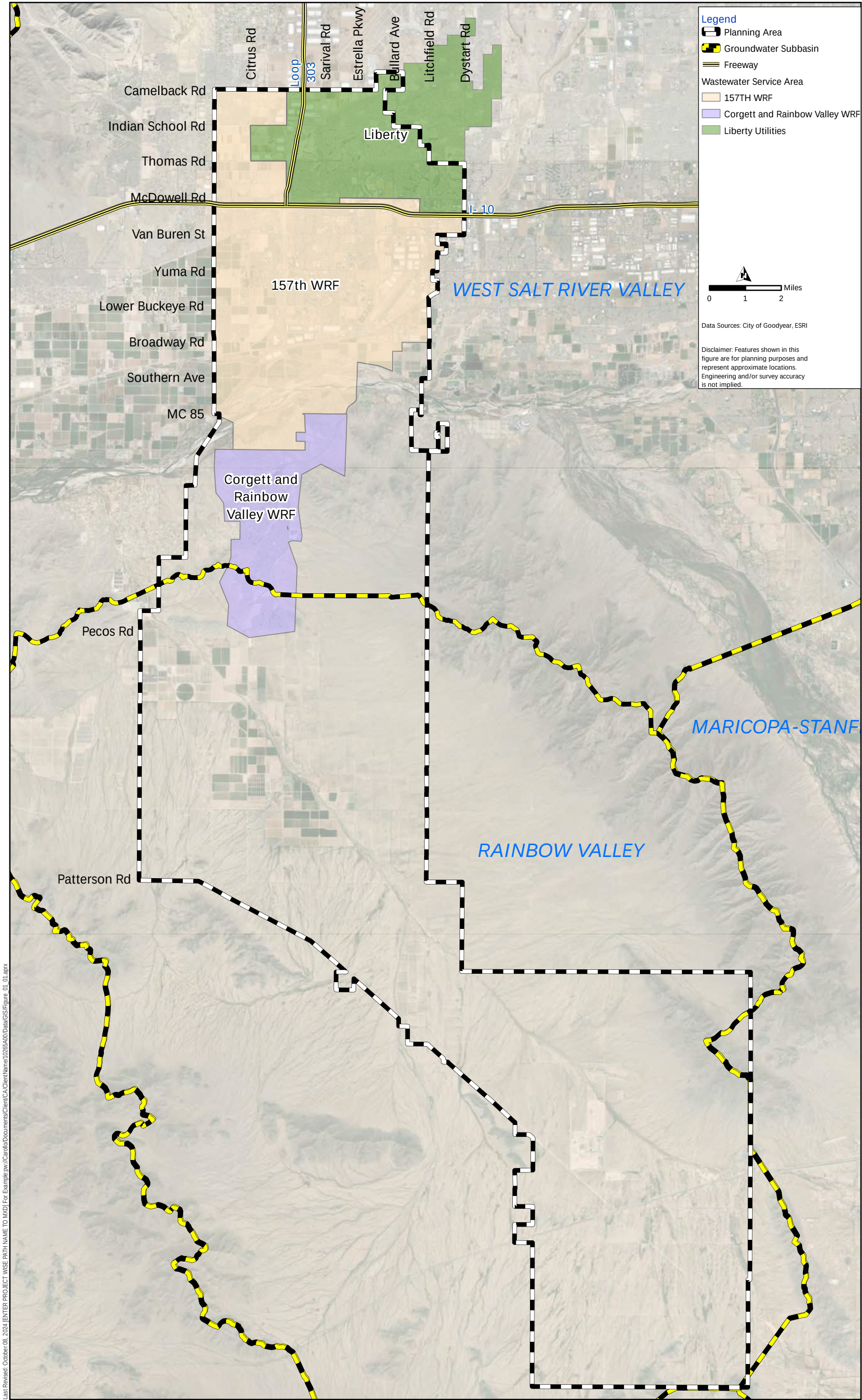
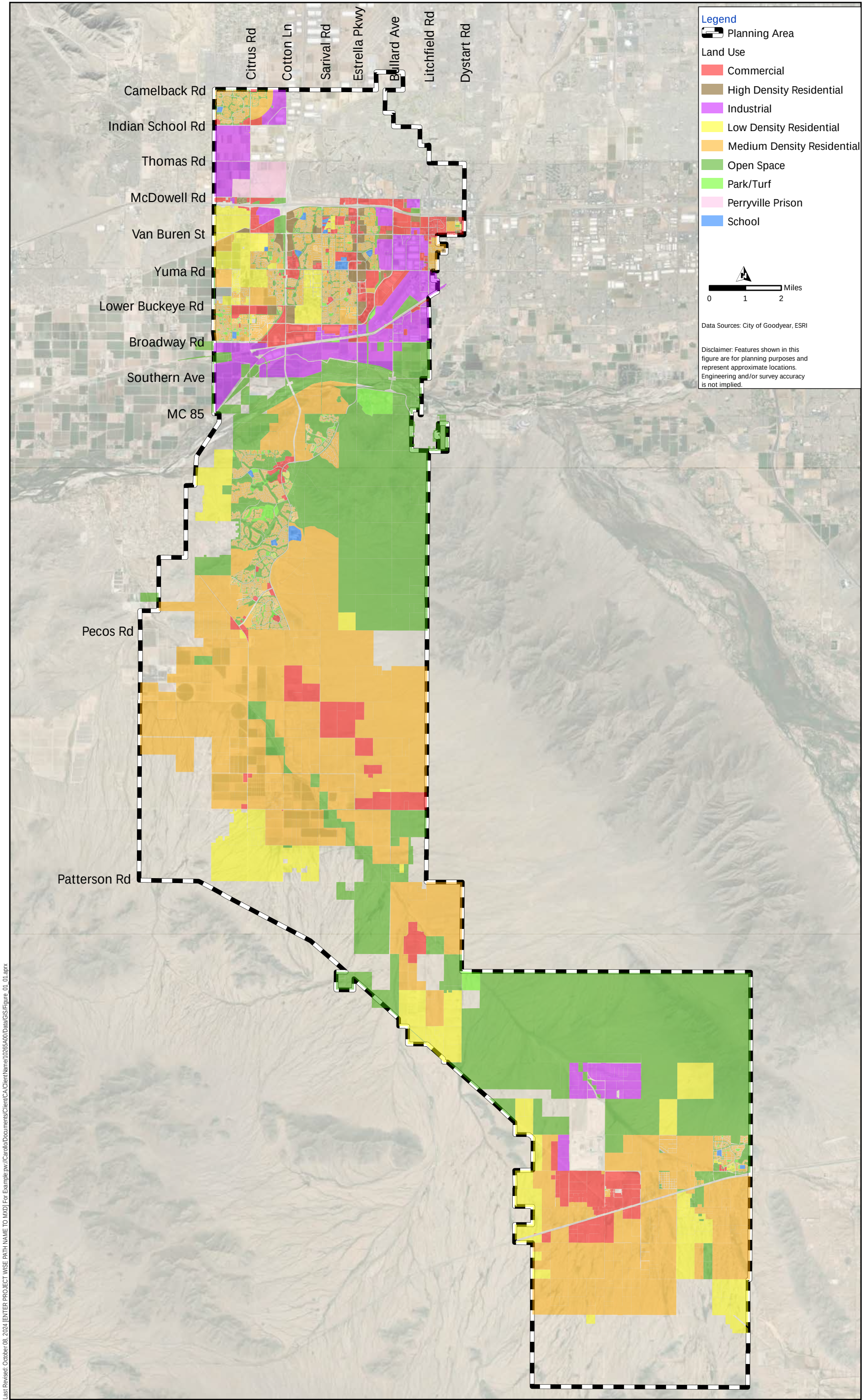


Figure 2.2 Wastewater Service Area
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN



Last Revised: October 08, 2024 [ENTER PROJECT WISE PATH NAME TO MXD] For Example: p:\Carollo\Documents\Client\CA\ClientName\10255A00\Data\GIS\Figure_01_01.aprx

Figure 2.3 Land Use Classifications
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

2.4 Population Growth Projections

Estimated population growth projections in the IWMP are used to align the rate of water demand growth throughout the City with the anticipated rate of population increase. The population projection used in this IWMP is influenced by the City's population projection in the 2022 revised ADWR report. Population growth was also set to align with the population growth rate in the general Plan 2035.

A few assumptions were made on the land use density to predict the estimated annual growth. The residential land use has an assumed population density of 2.3 people/DU (dwelling unit). Low-density, medium-density, and high-density residential housing densities are assumed to be 4, 6, and 18 DU per acre respectively.

Table 2.1 presents the historical population for the years 2019 to 2023 and the projected population through buildout. Also shown in Table 2.1 is the water service area population, which excludes the population north of McDowell Road that is served by EPCOR and Liberty Utilities. As shown in Table 2.1, the City's water service area population is expected to more than double by 2038, increasing from 63,830 people in 2023 to 132,239 in 2038. The population growth rate for the planning period ranges from 5.0 percent (years 2023 to 2028) to 3.8 percent (years 2033 to 2038) per year. Figure 2.4 presents the historical water service area population for years 2019 to 2023 and projected water and sewer service area population through 2038.

Table 2.1 City of Goodyear Water and Wastewater Service Area Historical and Projected Populations

Year	Population In Water Service Area ⁽¹⁾	Population in Sewer Service Area ⁽²⁾
2019	53,939	
2020	58,896	
2021	58,794	
2022	63,830	
2023	65,367	71,971
2028	83,371	92,530
2033	104,713	116,811
2038	126,435	139,689
Buildout	706,762	723,867

Notes:

- (1) Historical water service area population is from the City of Goodyear Water Withdrawal and Use Annual Report.
- (2) Historical population in the sewer service area of WPA is not known.

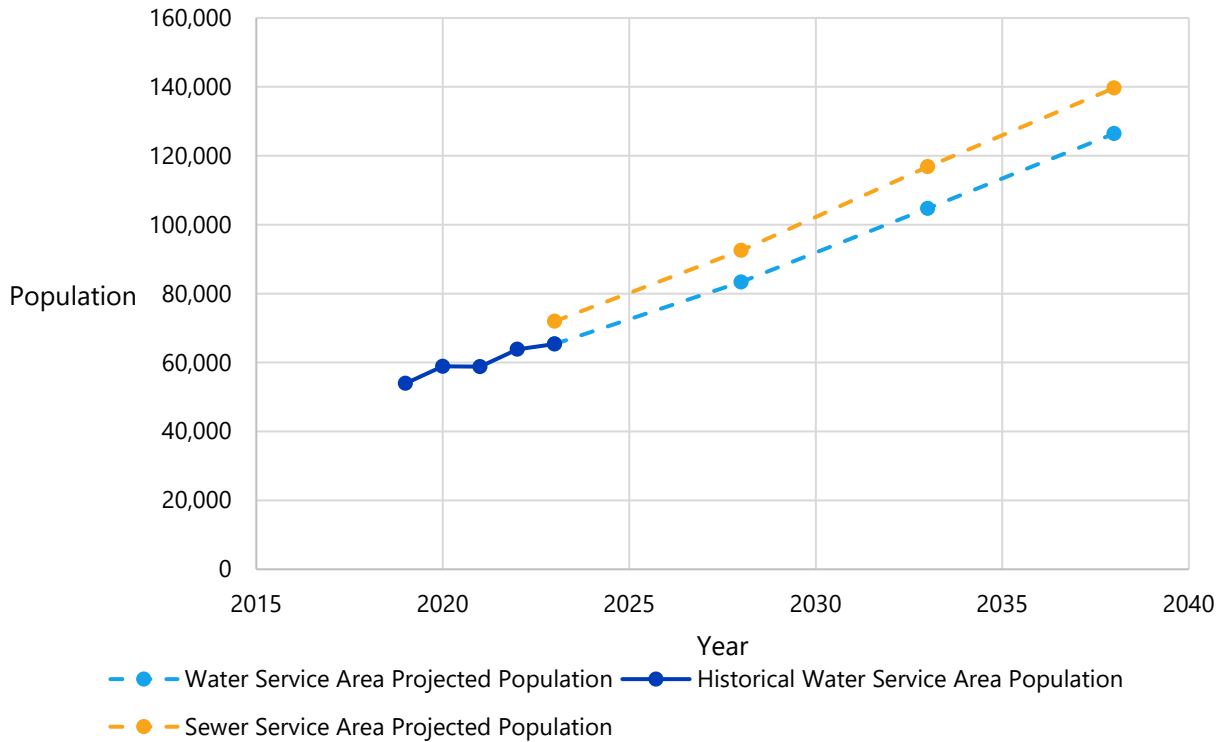


Figure 2.4 Population Growth Projections

2.4.1 Future Development

The rate and location of growth within the City was established based on population growth estimates applied to undeveloped lands and on the expected timing of future development. Undeveloped lands that are expected to develop in the future were assigned a developed percentage for each future planning period. The development percentages were then adjusted as required to match the population projections. Land areas for which development plans are not established were assumed to be fully developed by buildout.

There are several residential developments in WPAs 3 and 4 that are expected to start construction within the next fifteen years. These developments are Arnold Baker 320, Estrella, Estrella Highlands, King Ranch, Sierra Vista Foothills, Rainbow Valley, and Terrasante. Figure 2.5 presents the planned developments in WPAs 3, 4, and 5.

The status of development in each planning period is presented graphically to visualize the rate and location. Figure 2.6, Figure 2.7, Figure 2.8, and Figure 2.9 present the 2023, 2028, 2033, 2038 development percentages, respectively. Figure 2.10 presents the areas that are assumed to be fully developed by buildout. The lands that are shown as developing by buildout are the planned developments that currently have an analysis of assured water supply, or other means of obtaining a water supply. Although other land areas are shown as potentially developing based on the land use plan in Figure 2.3, without a potential water supply, development planning for these land areas may be deferred to a future time when the necessary water supplies are identified.

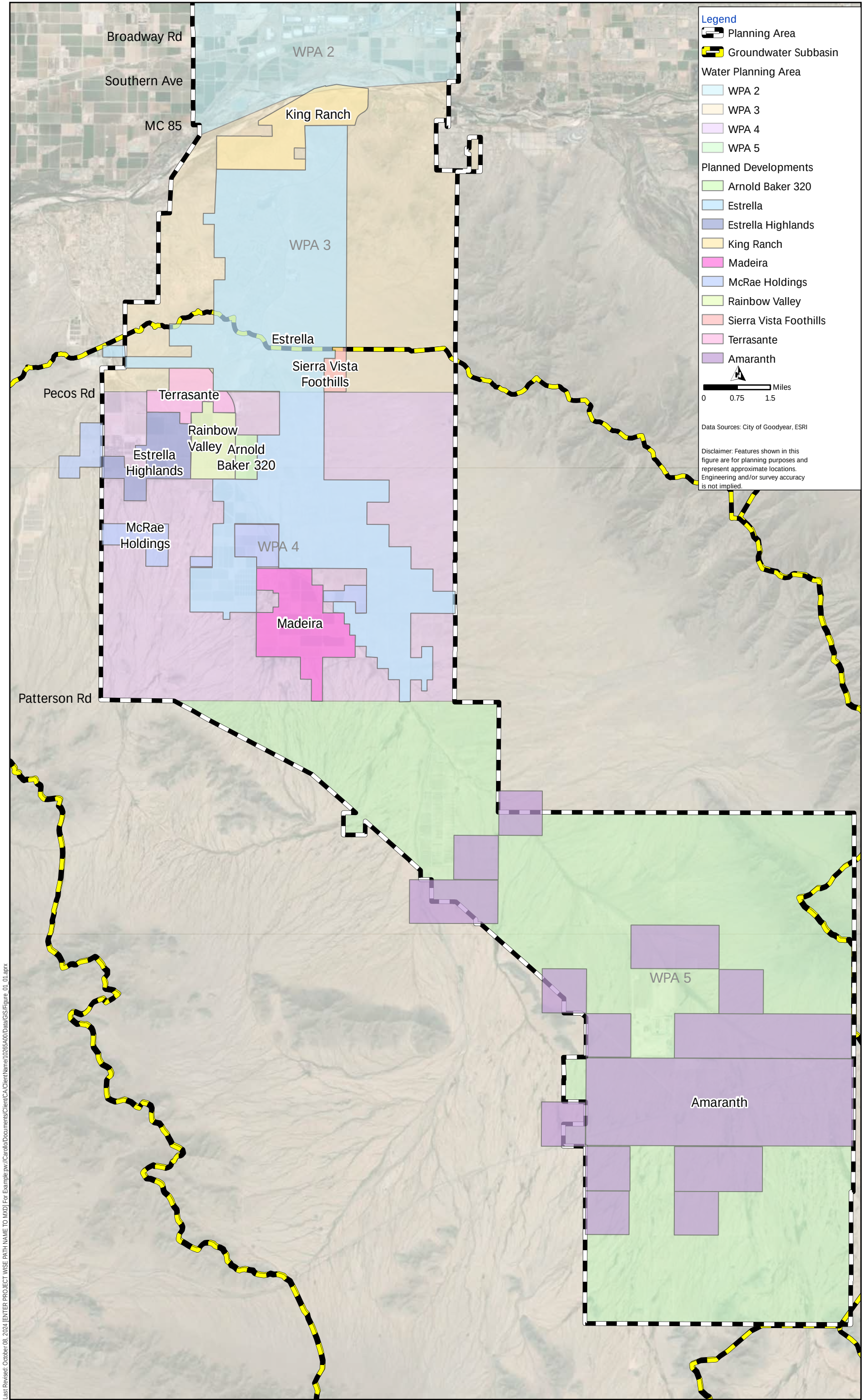


Figure 2.5 Planned Developments in WPA 3, WPA 4, and WPA 5
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

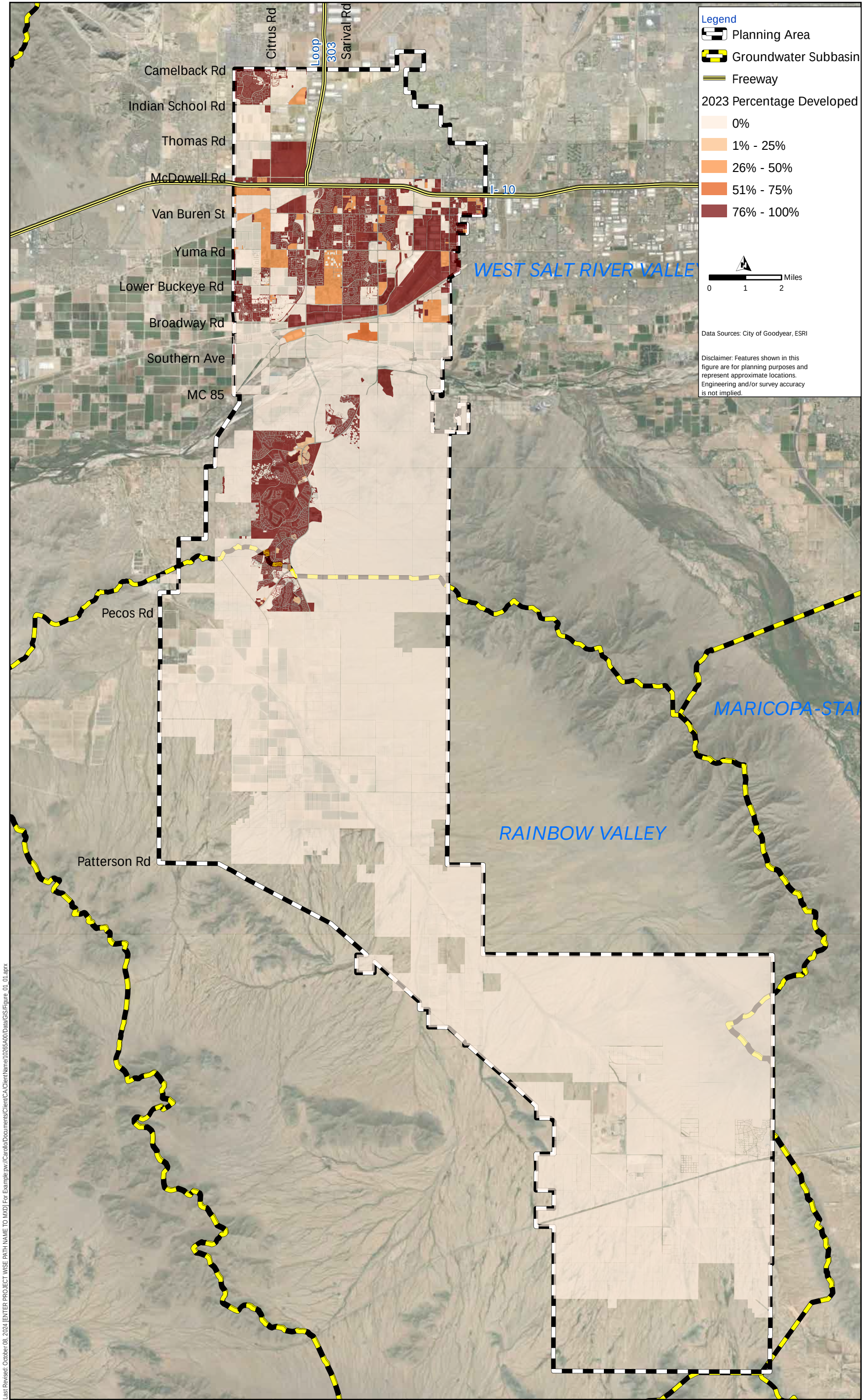


Figure 2.6 2023 Percentage Developed
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

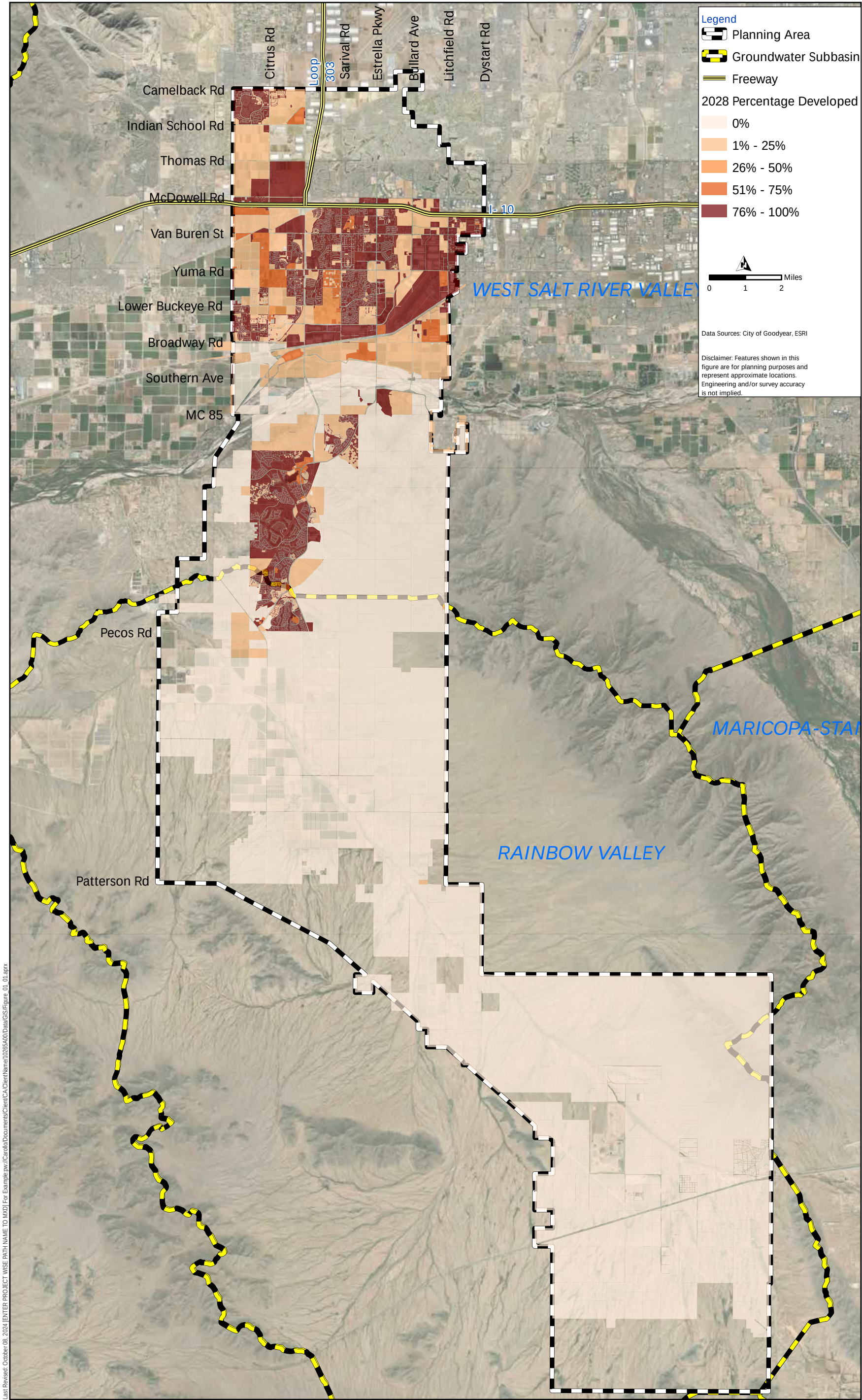


Figure 2.7 2028 Percentage Developed
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

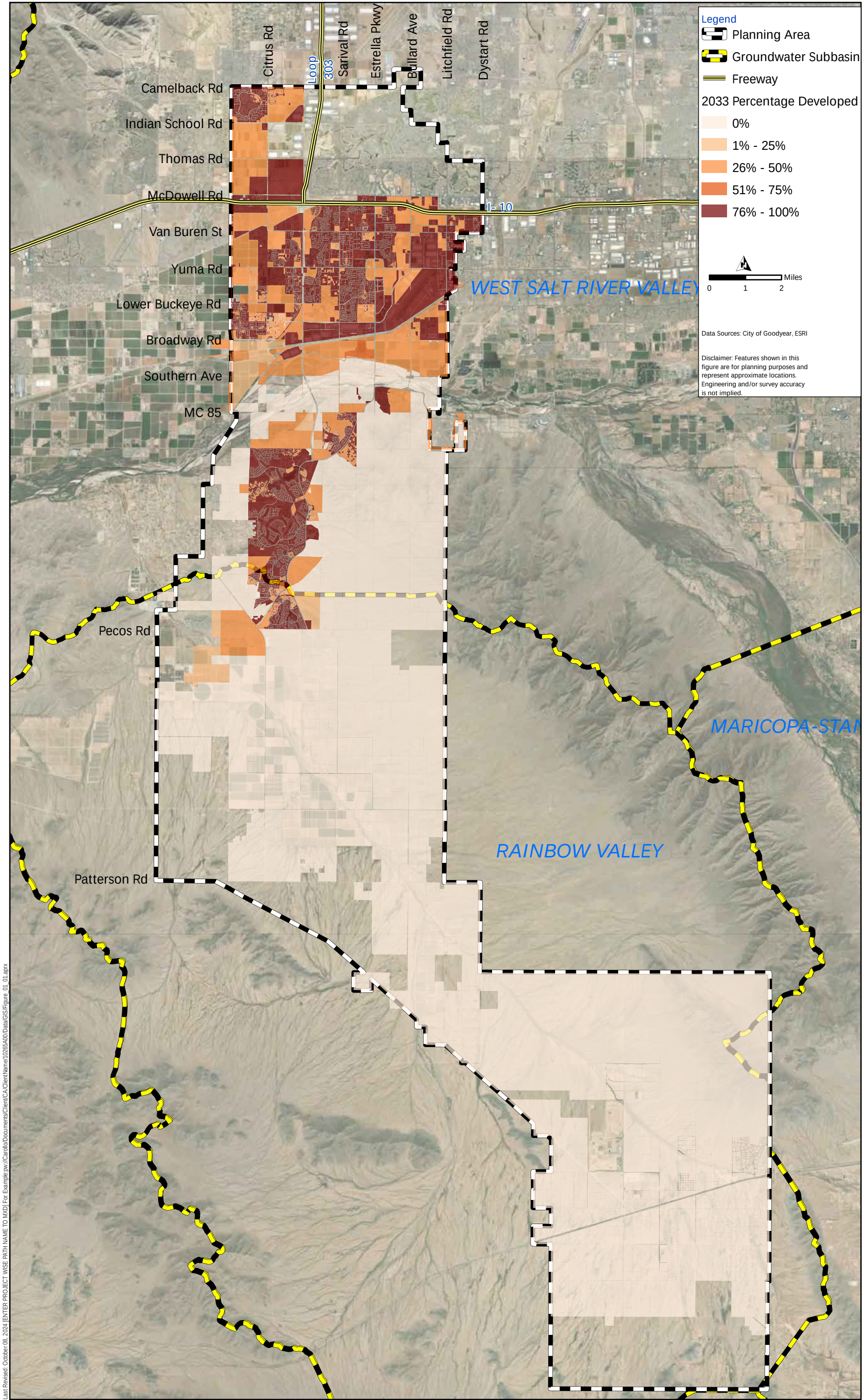


Figure 2.8 2033 Percentage Developed
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

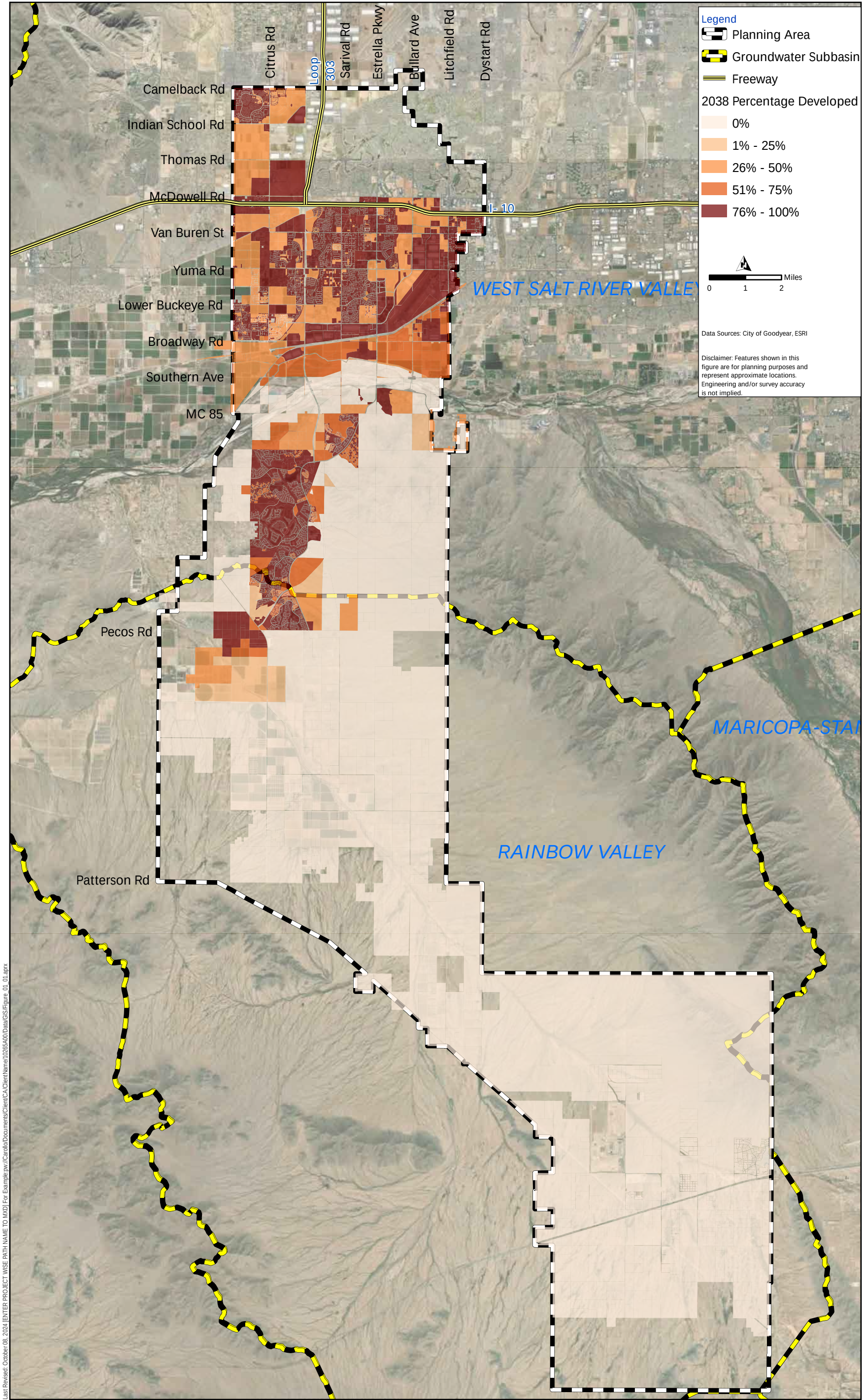


Figure 2.9 2038 Percentage Developed
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

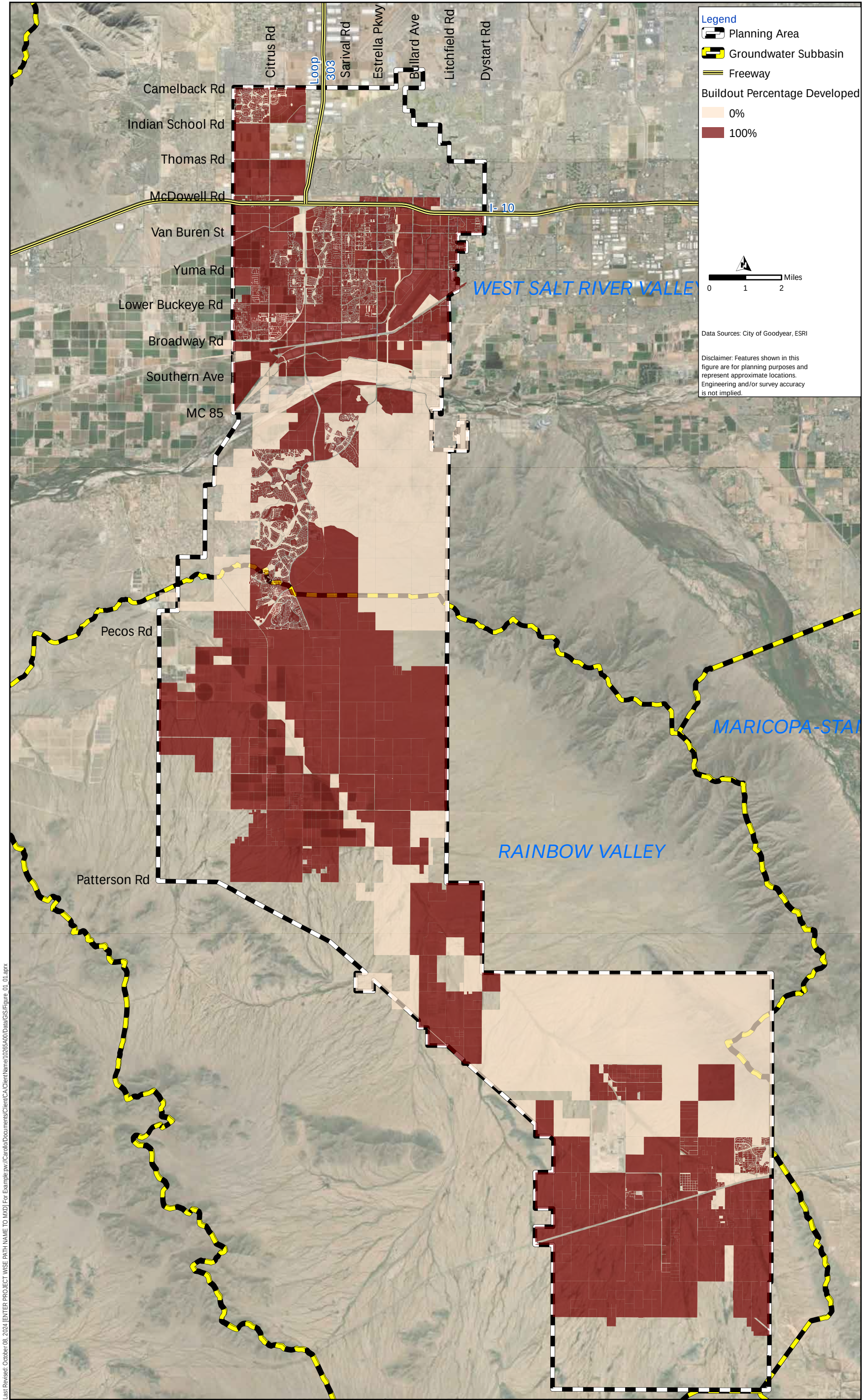


Figure 2.10 Buildout Percentage Developed
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

2.5 Water Demand Projections

This section summarizes historical water demand and consumption levels, unit water demands by land use classification, and the projected future water demands.

2.5.1 Historical Water Consumption and Demands

2.5.1.1 Historical Water Consumption and Demands

The City's historical water consumption and demands were evaluated to establish the following:

- Daily peaking factors.
- Unit water demands by land use classification.

The unit water demands by land use classification serve as the basis for the future water demand projections. Future development by land use category is assumed to have the same water use per acre as existing development.

Table 2.2 presents the City's yearly water demand value by source for the years 2017 through 2023. Figure 2.11 presents the City's yearly potable water demand graphically.

Table 2.2 Historical Water Demand by Source

Year	Well Total (mgd)	Surface Water (mgd)	Liberty Utilities (mgd) ⁽¹⁾	Total (mgd)
2017	8.5	0.0	0.1	8.6
2018	8.5	0.0	0.3	8.8
2019	8.5	0.0	0.3	8.8
2020	10.2	0.0	0.1	10.4
2021	11.0	0.8	0.0	11.9
2022	7.7	3.8	0.0	11.5
2023	8.9	3.6	0	12.5

Notes:

mgd - million gallons per day

(1) Water delivered to Liberty Utilities.

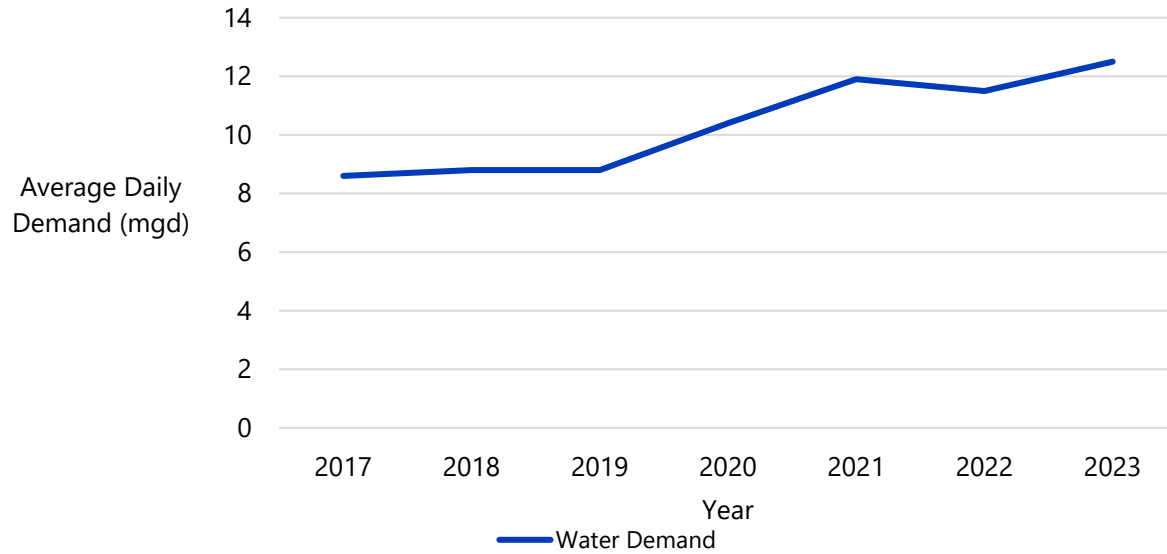


Figure 2.11 Average Water Demand for Years 2017 through 2023

The City's customer billing database contains monthly customer billing information for approximately 21,405 accounts, and each account contains information on water use, customer classification, and geographic location. Table 2.3 presents the City's monthly water consumption for the years 2019 through 2023. Figure 2.12 presents the monthly water consumption for each year. As shown in Figure 2.12 the maximum month water consumption changes seasonally based on weather and customer usage patterns. Peaking factors developed from this monthly data are used to adjust water demands on a seasonal basis to plan infrastructure needs during peak demand periods. The City's maximum water demand day generally falls into the maximum month. The maximum daily demand is usually 10 to 15 percent higher than the maximum monthly demand. The maximum day (MD) to average daily peaking factor of 1.7 was used in the 2016 IWMP and remains a reasonable factor to use to estimate maximum daily demands.

Table 2.3 Historical Monthly Consumption

Month	2019	2020	2021	2022	2023
January	5.9	5.8	5.6	5.9	6.1
February	5.6	5.4	5.3	6.0	5.9
March	5.2	5.0	5.9	8.2	7.2
April	5.3	6.7	8.6	7.6	7.2
May	8.2	7.3	8.6	9.5	9.5
June	7.8	9.0	10.8	11.8	10.9
July	8.8	12.8	12.4	11.8	12.5
August	11.5	11.0	9.5	10.8	14.3
September	9.6	11.8	9.6	13.4	14.0
October	8.2	10.6	10.3	9.9	12.9
November	9.1	9.1	8.5	10.6	11.0
December	5.3	9.2	9.4	7.1	10.4
Maximum	11.5	12.8	12.4	13.4	14.3
Minimum	5.2	5.0	5.3	5.9	5.9
Average	7.5	8.7	8.7	9.4	10.2
Maximum Month/Average Day Peaking Factor	1.5	1.5	1.4	1.4	1.4

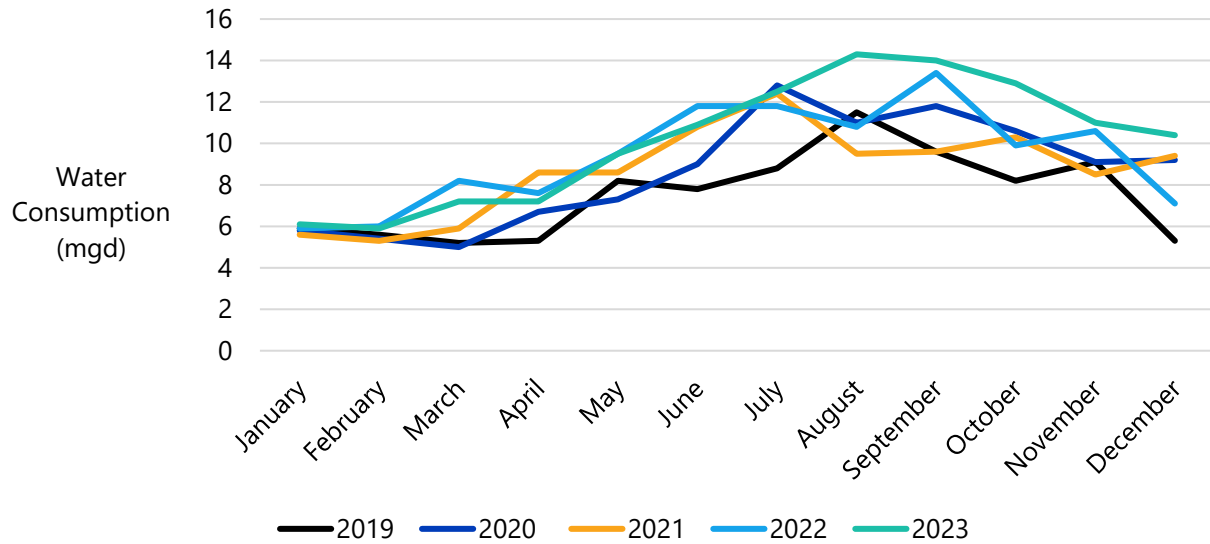


Figure 2.12 Monthly Billing Data for Years 2019 through 2023

2.5.2 Unit Water Demands

Unit water demands are an estimate of average annual water use expressed on a per-acre basis for each land use classification. Unit water demands were established based on 2022 and 2023 water consumption data, currently developed land within the study area, and the 2022 ADWR Annual Water Use Report. The unit water demands then served as the basis for estimating future water use for undeveloped lands.

The unit water demands were calculated using the following steps:

1. The City's customer billing records for 2023 were organized and summed up by land use type.
2. The parcels within the study area were designated as either developed or undeveloped to obtain a measure of the developed acreage. The developed net acreage was assumed to be 85 percent of gross developed acreage to account for streets, sidewalks, alleys, etc. that are covered by the parcel but do not contribute to the flow.
3. Total water consumption was divided by the developed net acres for each land use classification to get the unit water demands.

Table 2.4 presents the unit water demands calculated from billing data and land use, which were then used to develop demand projections in each planning year. The water demand factors in Table 2.4 are lower than the planning level unit demand factors that the City uses for planning new developments. It is common practice, and appropriate to use higher planning level unit demand factors for development that has not yet been constructed to make sure that infrastructure is appropriately sized for future flows. The unit demand factors based on actual water use are appropriate for water resources and treatment plant infrastructure planning.

Table 2.4 Residential Water Demand Factors

Residential/Non-Residential	Land Use Classification	Unit Water Demand Used in the IWMP Projections (gpd/ac)
Residential	Low Density Residential	400
	Medium Density Residential	1,600
	High Density Residential	1,900
Non-Residential	Commercial	690
	Industrial	520
	Park/Turf	1,620
	School	1,870
	Open Space	0

gpd/ac - gallons per day per acre

The calculated unit water demands were compared with the consumption based on customer billing data as a check on the land use-based water consumption projections. Table 2.5 presents the comparison between 2023 billed water consumption and 2023 projected water consumption by land use classification. The results show that the calculated consumption is close to the billing data to within 0.8 percent, which is a strong correlation.

The City has estimated non-revenue water at 6.3 percent. Non-revenue water is the water not accounted for in underreporting meters and leakage in the water distribution system. In Arizona, non-revenue water is expected to be below 10 percent, and the City is effectively managing non-revenue water. Unmetered water is primarily water used by the City in the water treatment process. This water includes the brine streams from water production Sites 11 and 12 that have reverse osmosis (RO) treatment, and process water from the surface water treatment plant. This water is delivered to the wastewater collection system and is not released into the water distribution system. Construction water is used primarily for dust control at construction sites. The delivery point for this water varies and would be eliminated with buildout.

Table 2.5 Unit Demand Factor and Billing Data Comparison

Land Use Classification	Developed Acreage (acres)	Unit Water Demand (gpd/ac)	Calculated Water Demand (mgd)	2023 Customer Billing Consumption (mgd)
Low Density Residential	459	400	0.2	0.2
Medium Density Residential	3,886	1,600	6.2	6.4
High Density Residential	149	1,900	0.3	0.4
Commercial	1,768	690	1.2	1.3
Industrial	1,783	520	0.9	0.7
Park/Turf	512	1,620	0.8	0.9
School	259	1,870	0.5	0.2
Open Space	0.00	0.00	0.00	0.0
Total Customer Consumption (mgd)			10.1	10.2
Non-Revenue Water (mgd) ⁽¹⁾			0.65	0.64
Unmetered + Construction ⁽³⁾			1.4	1.39
Water Demand (mgd)			12.15	12.23
Percent Difference			- 0.65 %	

Notes:

- (1) Non-revenue water is calculated as 6.3% of the total water consumption.
- (2) Water Demand is equal to Total Customer Consumption + Non-Revenue Water + Unmetered + Construction (estimated to be 1.4 mgd).
- (3) The Unmetered + Construction for the 2023 Customer Billing Consumption is based on the 2022 ADWR Report. The total demand from construction is 0.35 mgd and the total demand for unmetered demand is 1.04 mgd.

Table 2.6 contains the unit water demands to be used for development planning purposes for sizing infrastructure in developments that have not yet been constructed.

Table 2.6 Unit Demands to be used for Development Planning

Land Use	Allocation	Unit
Single Family	402	gpd/unit
Single Family (WPA 3)	317	gpd/unit
Multi-Family	135	gpd/Unit
Commercial	1700	gpd/ac
Industrial	1000	gpd/ac

2.5.3 Water Demand Projections

The following assumptions were made in preparing the water consumption and demand projections:

- Water consumption for the parcels that are currently 100 percent developed were assumed to be the same as 2023 consumption.
- Water consumption for the parcels that are currently undeveloped were calculated based on the estimated developed acreage multiplied by the unit water demand for the land use classification of the parcel.
- Water demand projections are based on the water consumption plus an additional 6.3 percent due to non-revenue water and another 1.40 mgd due to unmetered plus construction use. The 1.40 mgd is an estimate based on the 2022 ADWR Report. The unmetered plus construction water use is used for flow projections but will not be included in the hydraulic model.

Table 2.7 presents the historical and projected water consumption and water demand. Figure 2.13 presents the water demand projections graphically. Table 2.8 summarizes the water demand projections by land use classification. The City's water demand is projected to increase by 70 percent in the next 15 years from 12.3 mgd to 20.3 mgd, with medium density residential classifications constituting 4.7 mgd of the increased demand.

Table 2.7 Historical and Projected Water Consumption and Demand

Year	Water Consumption (mgd)	Water Demand (mgd)
Historical⁽¹⁾		
2019	7.5	8.8
2020	8.7	10.4
2021	8.9	11.9
2022	9.4	11.4
2023	10.3	12.3
Projected		
2028	12.0	14.2
2033	14.7	17.0
2038	17.8	20.3
Buildout	79.9	84.9

Notes:

(1) Historical water demand is from the City of Goodyear Water Withdrawal and Use Annual Report.

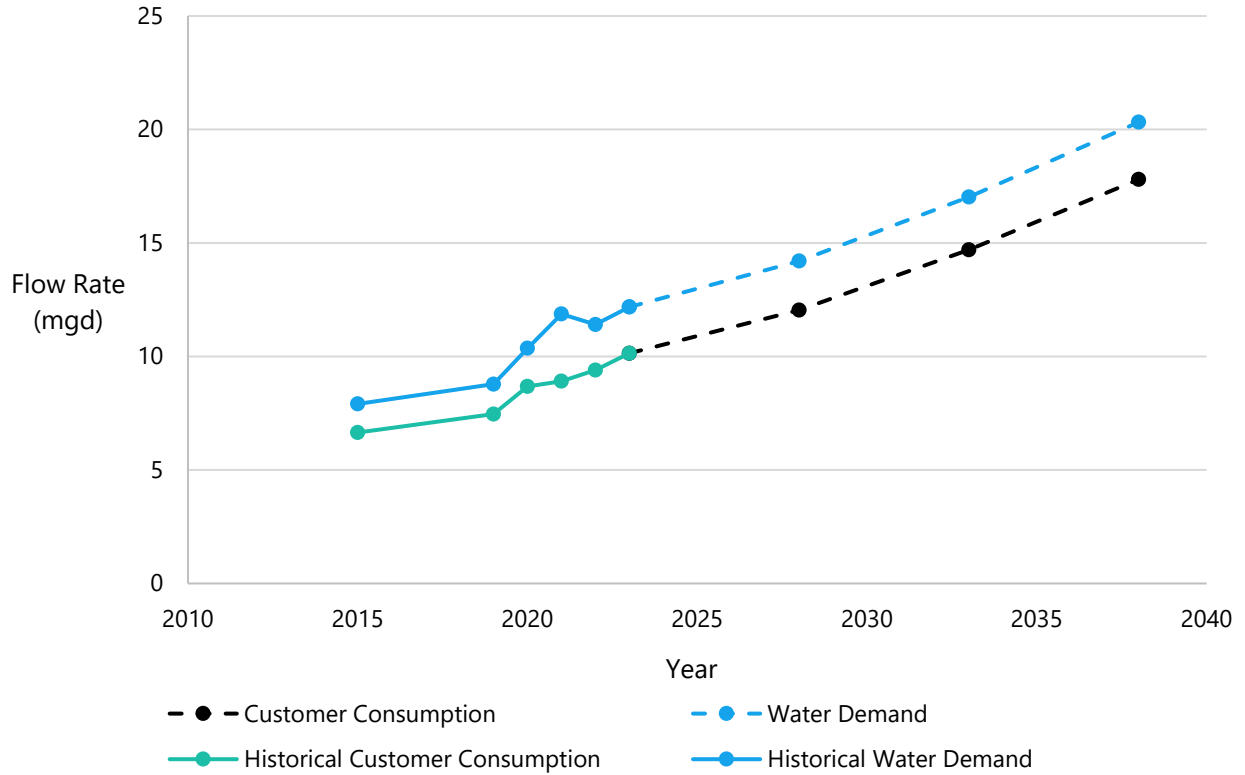


Figure 2.13 Historical and Projected Water Consumption and Water Demand

Table 2.8 Water Demand Projections by Land Use Classification

Land Use Classification	Projected Water Demand (mgd)				
	2023	2028	2033	2038	Buildout
Low Density Residential	0.18	0.28	0.39	0.43	4.10
Medium Density Residential	6.22	6.99	8.55	10.87	63.27
High Density Residential	0.28	0.69	0.87	1.00	1.44
Commercial	1.22	1.43	1.67	1.80	5.38
Industrial	0.93	1.25	1.67	2.04	3.36
School	0.48	0.47	0.48	0.48	0.53
Park/Turf	0.83	0.94	1.07	1.18	1.79
Total Customer Consumption	10.14	12.05	14.70	17.80	79.87
Non-Revenue Water (mgd) ⁽¹⁾	0.64	0.76	0.93	1.12	5.03
Unmetered + Construction	1.40	1.40	1.40	1.40	0.00
Water Demand (mgd)	12.18	14.21	17.03	20.32	84.90

Notes:

(1) Non-revenue water is calculated as 6.3% of the total water Consumption.

Table 2.9 and Table 2.10 present the projected water demand categorized by planning area and by Rainbow Valley Sub-basin developments. WPA 2 shows the greatest increase in water demand through 2038 because this zone is closest to the existing water infrastructure and is more likely to expand in the near-term. An understanding of water demands by planning area is useful in planning infrastructure requirements.

The developments in the Rainbow Valley Sub-basin are projected to have a demand of approximately 3.2 mgd in the next 15 years. Of those developments, Estrella contributes the highest demand and has the highest growth within the planning periods.

Table 2.9 Water Demand Projections by Planning Area

Water Planning Area	Projected Water Demand (AFY)				
	2023	2028	2033	2038	Buildout
WPA 2	8,980	10,380	11,760	12,670	14,820
WPA 3	4,680	5,400	6,560	8,110	13,980
WPA 4	0.00	140	760	1,950	36,770
WPA 5	0.00	0	0	0	29,580
Total	13,660	15,920	19,080	22,730	94,610

AFY - acre-feet per year

Table 2.10 Water Demand Projections by Rainbow Valley Sub-basin Developments

Developments by Planning Area	Projected Water Demand (AFY)				
	2023	2028	2033	2038	Buildout
WPA 3					
Estrella (Inside the Rainbow Valley Sub-basin)	870	1,000	1,320	1,760	3,170
Sierra Vista Foothills	0	0	0	240	460
Terrasante	0	50	230	520	520
Outside the Identified Developments	0	0	0	0	140
Total	870	1,050	1,550	2,520	4,290
WPA 4					
Arnold Baker 320	0	0	0	140	510
Estrella (Inside the Rainbow Valley Sub-basin)	0	0	0	0	12,840
Estrella Highlands	0	0	250	560	2,230
Madeira	0	0	0	0	3,300
McRae Holdings	0	0	0	0	2,130
Rainbow Valley	0	90	180	610	1,610
Terrasante	0	40	330	640	640
Outside the Identified Developments	0	0	0	0	13,510
Total	0	130	760	1,950	36,770
WPA 5					
Amaranth	0	0	0	0	19,700
Outside the Identified Developments	0	0	0	0	9,880
Total	0	0	0	0.00	29,580

2.5.4 Current, Committed, and Projected Water Demands

The City has designated parcels as a current, committed, and planned for water resources planning purposes. A parcel categorized as current has been developed and is receiving water. A parcel classified as committed has been platted and the City has a formal commitment to supply water. Parcels classified as planned have a future water use estimate that provides an indication of how much water needs to be obtained to serve the land areas through buildout. The City reports the committed water resources each year on the ADWR annual report to demonstrate that the City has enough water supplies to serve water to customers that will be coming. The parcel designation is updated with changes on an ongoing basis. Figure 2.14 presents the parcels labeled as current, committed, and planned for the master plan development. Parcel designations may change in future planning years. Table 2.11 summarizes the current, committed, and planned customer consumption and required demand.

Table 2.11 Water Demand Projections by Current, Committed, and Planned

Land Use	Net Acres	Consumption (AFY)	Demand (AFY)
Current ⁽¹⁾	10,116	11,290	13,570
Committed	2,024	3,480	3,700
Projected	53,979	74,550	79,250
Total Water Demand	66,119	89,320	96,520

Notes:

(1) Current Demand includes Unmetered + Construction of 1,568 AFY (1.4 mgd).

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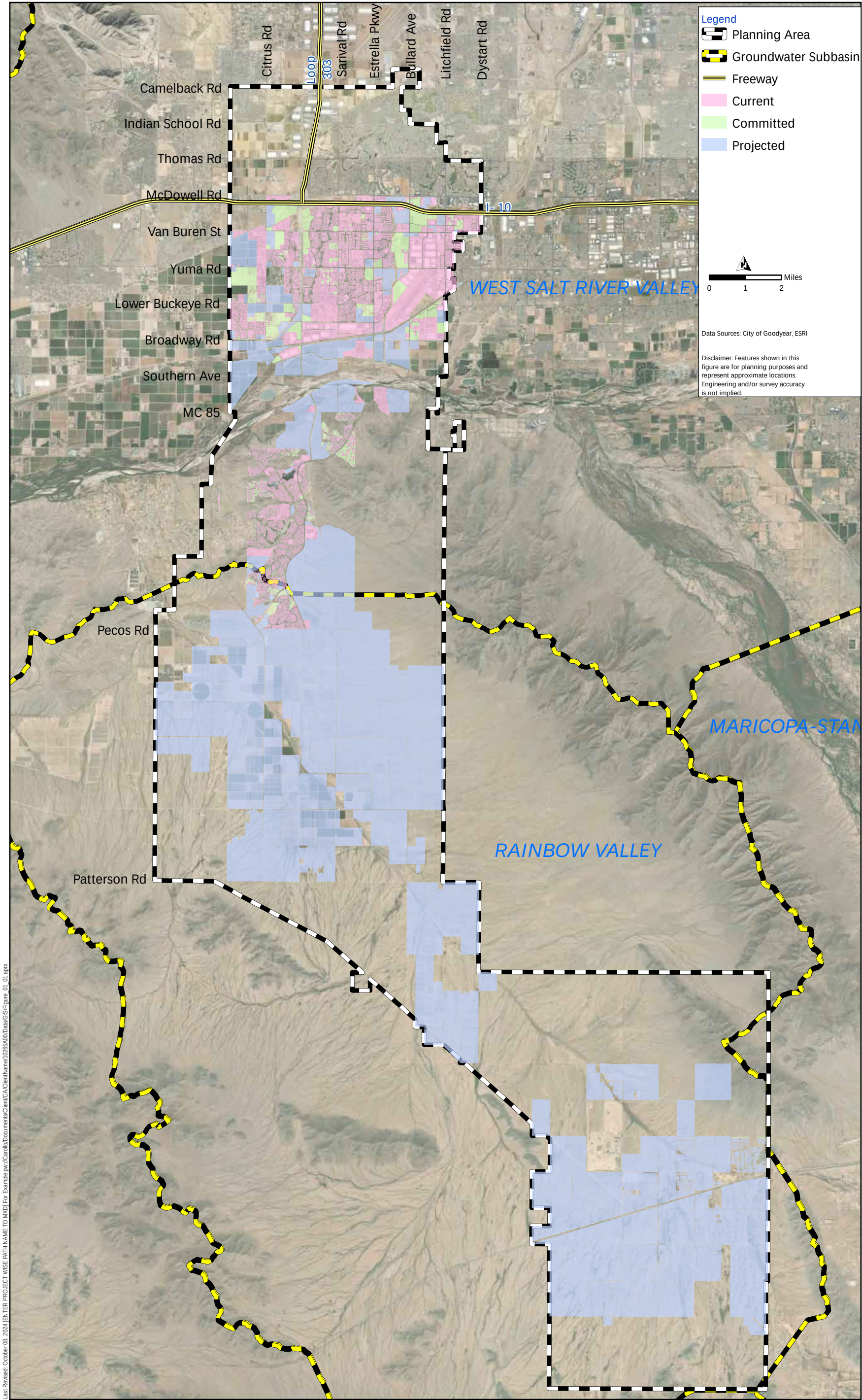


Figure 2.14 Current, Committed, and Projected Areas
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

2.5.5 Water Conservation

The City is in an arid climate where limited water resources are becoming increasingly expensive. A part of any water resources strategy in Arizona is to make the best use of currently available water resources. To initially determine how well the City is using its water resources, an evaluation of how much water is delivered to City customers is returned to the wastewater system where the water can be treated and reused. Table 2.12 presents this evaluation.

Table 2.12 Evaluation of Goodyear Potable Water Supplies that Become Wastewater

Calculation Variable	Item	Amount (mgd)
a	2023 Water Demand	12.2
b	2023 Potable Water Consumption	10.2
c	City's unmetered water delivered to the collection system	0.9
d	Metered Demand for Turf Irrigation	0.9
e = b-d	Potable Water Delivered to Customers with a Wastewater Return Flow	9.3
f	Wastewater Flow to Water Reclamation Facilities	6.5
g	Wastewater Flow Originating Outside Goodyear Potable Water Delivery Area (North of I-10)	0.45
h = f-g-c	Wastewater Flow Originating in Potable Water Delivery Area	5.15
i = h/e	Wastewater to Delivered Potable Water Ratio	0.55
j = h/a	Wastewater Return Rate	0.42

Notes:

- (1) Water demand and consumption are taken from Table 2.5.
- (2) Wastewater flows are taken from flow monitoring in the summer of 2023 and water reclamation plant inflow records, 2023.

The metered demand for turf irrigation only considers potable water deliveries. Reclaimed water is sent to the Buckeye Irrigation District, reclaimed water supply pond, and irrigated common areas in Estrella Mountain Ranch. Estrella has used reclaimed water for turf irrigation exclusively in the last couple of years, but they also have access to private wells to fill the lakes if necessary. Despite this fact, the wastewater to potable water ratio in Table 2.12 is high relative to other Maricopa County communities, indicating a lower outdoor water use. The 2016 IWMP indicated that 60 percent of total water demand was used outside. Table 2.12 shows that only 42 percent of total water use is outside consumptive use. In the eight years since the 2016 IWMP was completed, outdoor water use has decreased slightly. A portion of the City's demand growth in the past eight years has been industrial and commercial demands with little outdoor water use, which has increased the wastewater return rate.

In May 2018 the City's Water Conservation Committee completed a series of recommendations for improving water conservation which are documented in a Recommendation Plan Report. We recommend continued implementation of the recommendations in the Recommendation Plan Report to continue reducing water use for current and future water customers. Opportunities still exist to reduce outdoor consumptive water use and water use at commercial and industrial sites.

2.6 Wastewater Flow Projections

2.6.1 Historical Wastewater Flows

The City's historical wastewater flow information was evaluated to establish seasonal flow patterns and prepare future wastewater flow projections. Table 2.13 presents the City's historical wastewater flow from 2019 through 2023 at all the City's wastewater reclamation facilities (WRF). Historical flows are shown graphically in Figure 2.15. Wastewater flows have fluctuated from year to year over this period, due at least in part to the flows from industrial sites like Microsoft.

Table 2.13 Historical Monthly Wastewater Flows

Month	Average Monthly Historical Wastewater Flow at all the City's WRFs (mgd)				
	2019	2020	2021	2022	2023
January	4.37	5.07	5.81	5.32	6.00
February	4.03	5.46	5.83	5.27	6.21
March	4.3	5.23	7.16	5.17	6.40
April	4.17	4.97	5.85	5.59	7.01
May	4.21	5.32	6.45	5.65	6.84
June	4.8	5.8	5.87	5.77	6.23
July	4.95	6.06	6.18	5.91	6.43
August	5.19	5.51	5.88	5.69	6.11
September	4.73	5.29	4.81	6.30	5.26
October	4.63	5.48	4.96	5.85	5.93
November	4.53	5.34	5.07	5.88	5.40
December	4.31	5.18	5.13	5.97	6.40
Maximum	5.19	6.06	7.16	6.30	7.01
Minimum	4.03	4.97	5.75	5.17	5.26
Average	4.52	5.39	4.81	5.70	6.19
Monthly Peaking Factor	1.15	1.12	1.25	1.11	1.13
Water to Wastewater Ratio	0.51	0.52	0.40	0.50	0.42

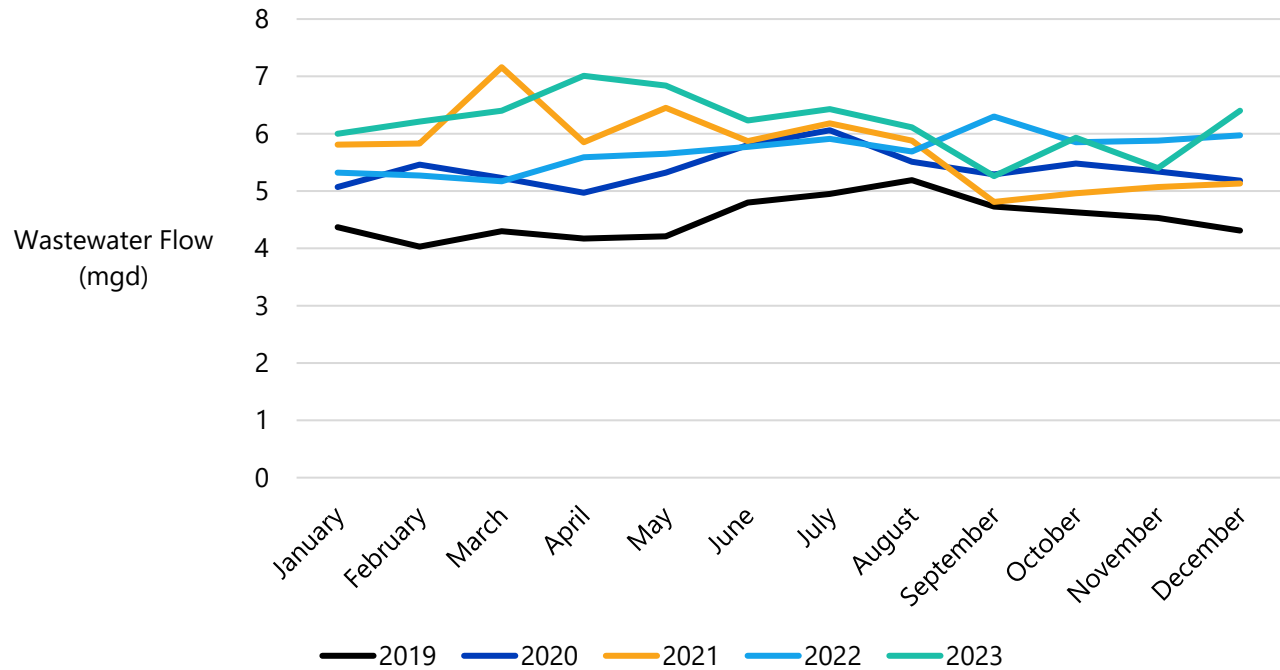


Figure 2.15 Monthly Flowmeter Data for Years 2019 through 2022

2.6.2 Flow Monitoring Field Test

ADS conducted a flow monitoring program to determine wastewater flows throughout the collection system in June 2023. Flow monitoring was performed over a two-week period at 16 flow monitoring sites. In addition to the flow monitoring sites, data was collected at the WRFs at 1-hour intervals.

Observations from the flow monitoring sites helped identify average and peak sewer flows. Data collected from the flow monitoring program was used to establish basin flows, develop diurnal patterns, and to calibrate the collection system hydraulic model.

The sites for temporary metering were selected through discussions with the City. Figure 2.16 shows the location of the flowmeters and their tributary areas.

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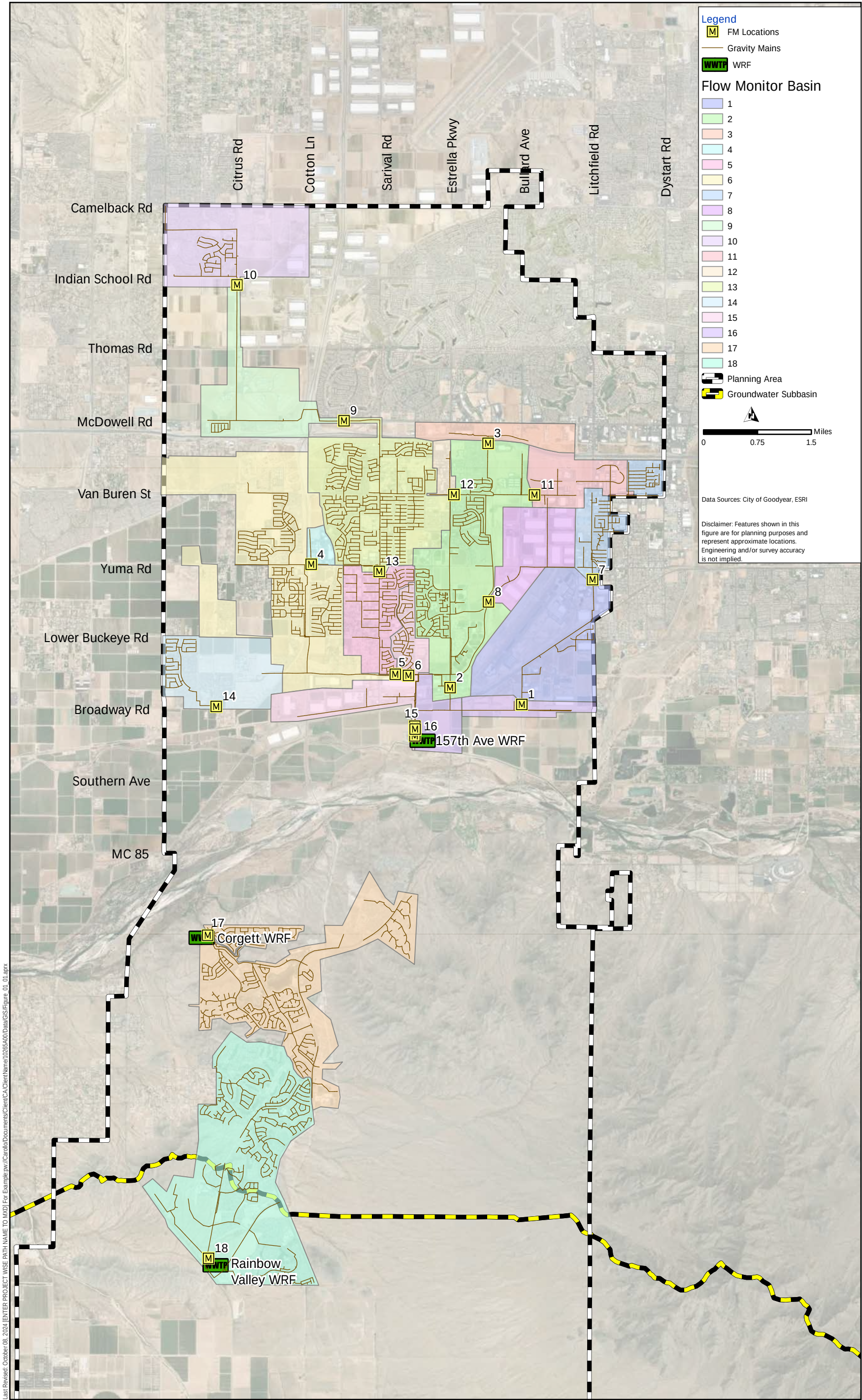


Figure 2.16 Wastewater Flow Monitoring Basins
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

2.6.3 Wastewater Flow Projections

Wastewater flows were developed for each WRF basin using flow monitoring data and the wastewater return rate. These factors represent the portion of potable water returned to the collection system as wastewater flow.

The following assumptions were made when developing the projected wastewater flows:

- Septic systems were assumed to not connect to sewer until buildout.
- Future wastewater flows were based on the return to sewer ratio for each of the wastewater WRFs as shown in Table 2.14. It is assumed that future developments in WPA 4 will connect to the Rainbow Valley WRF and developments in King Ranch will connect to the 157th Avenue WRF. All developments in WPA 5 are assumed to have a water to wastewater ratio of 49 percent.

Using this approach, the land use classification, growth rates, growth timing, and other assumptions built into the water projections apply to the wastewater flows at each planning period.

Table 2.15 summarizes the projected wastewater flows through buildout by land use classification. Figure 2.17 shows the total projected wastewater flow at each planning period. Figure 2.18 presents the flow projections into each of the WRFs. In the next fifteen years, the 157th Avenue WRF is projected to have the highest increase flow of about 2.4 mgd. Rainbow Valley is also expected to have a greater increase in flow due to the new developments in WPA 4.

Table 2.14 Wastewater Flow Projections by WRF

WWTP	Projected Wastewater Flow (mgd)				
	2023	2028	2033	2038	Buildout
157th Avenue	5.22	6.16	7.13	7.84	10.69
Corgett	0.47	0.53	0.59	0.64	0.70
Rainbow Valley	0.54	0.62	0.92	1.47	8.38
Waterman Wash	0.00	0.00	0.00	0.00	2.41
WPA 5	0.00	0.00	0.00	0.00	12.17
Total	6.23	7.31	8.64	9.95	34.35

Table 2.15 Wastewater Flow Projections by Land Use Classification

Land Use Classification	Projected Wastewater Flow (mgd)				
	2023	2028	2033	2038	Buildout
Low Density Residential	0.10	0.16	0.23	0.25	1.85
Medium Density Residential	3.23	3.60	4.22	5.01	24.80
High Density Residential	0.17	0.40	0.51	0.59	0.84
Commercial	0.71	0.82	0.95	1.03	2.55
Industrial	0.57	0.82	1.15	1.43	2.32
School	0.25	0.25	0.25	0.25	0.27
Perryville Prison	0.84	0.84	0.84	0.84	0.84
Park/Turf	0.36	0.42	0.49	0.55	0.88
Total	6.23	7.31	8.64	9.95	34.35

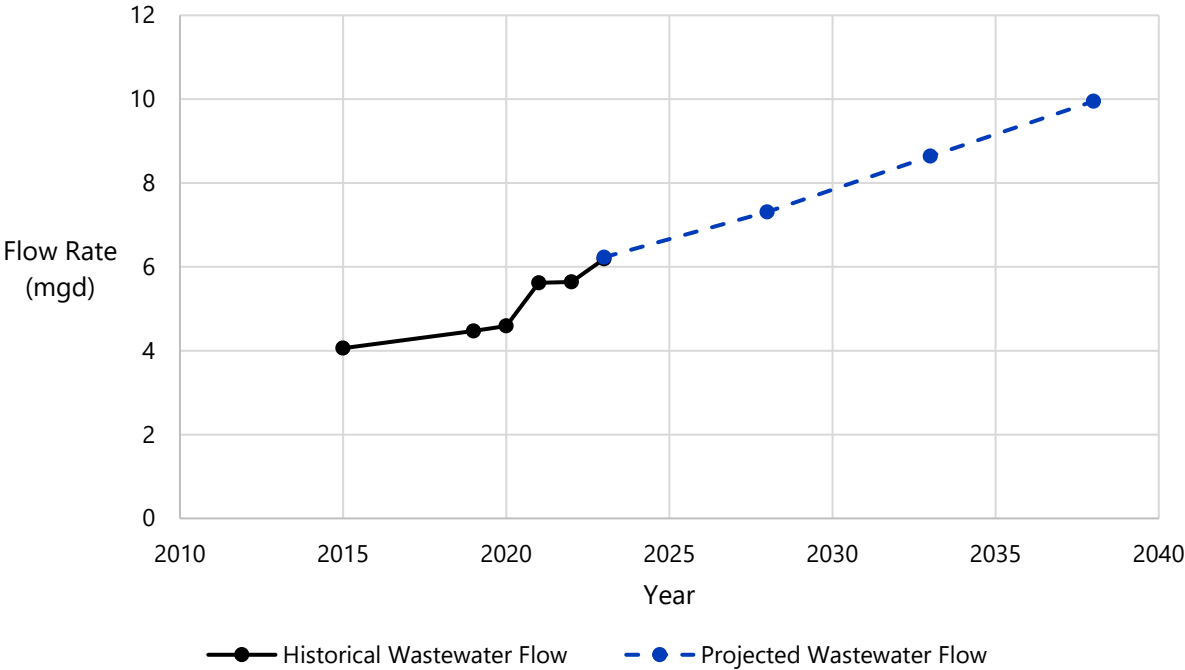


Figure 2.17 Historical and Projected Wastewater Flows

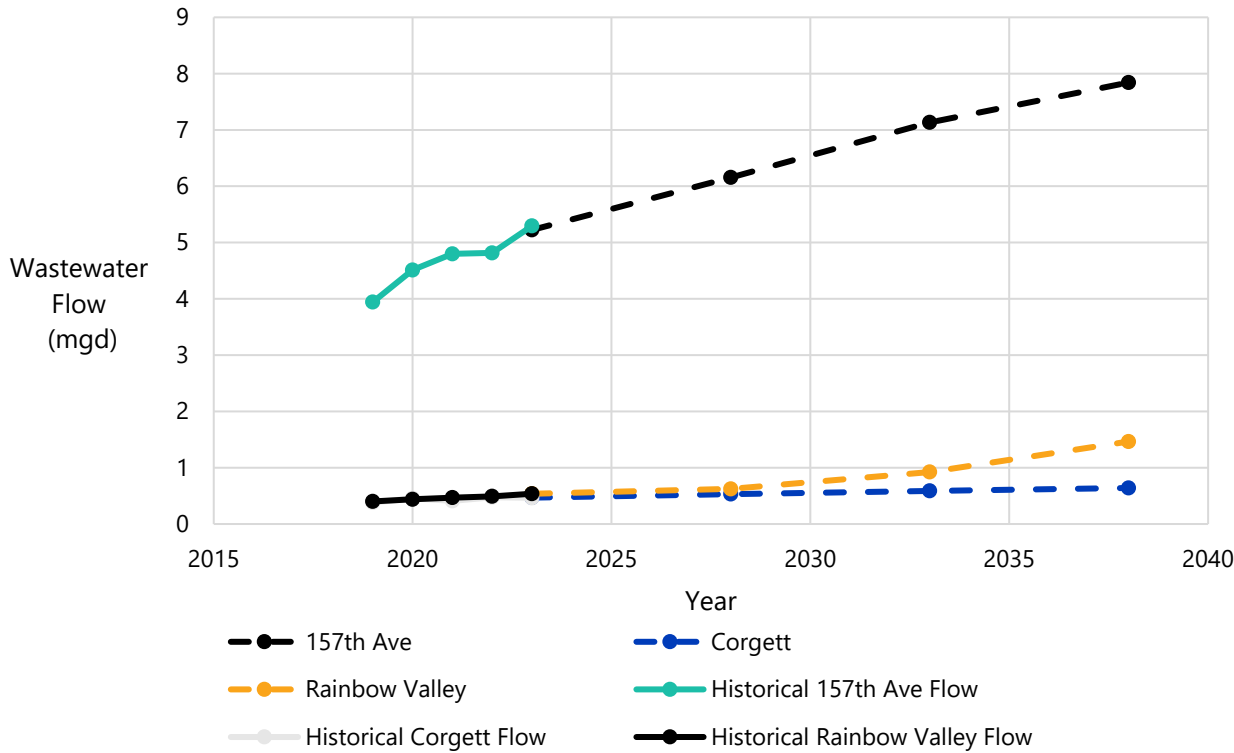


Figure 2.18 Wastewater Flow Projections into the WRFs

Table 2.16 presents the City's wastewater projections by wastewater flow basin and Table 2.17 presents the Rainbow Valley Sub-basin developments projected wastewater flow.

Table 2.16 Wastewater Flow Projections by Flowmeter Basin

Flow Monitoring Basin	Projected Wastewater Flow (mgd)				
	2023	2028	2033	2038	Buildout
1	0.33	0.39	0.45	0.49	0.55
2	0.70	0.86	0.96	1.04	1.27
3	0.05	0.07	0.08	0.09	0.11
4	0.01	0.01	0.01	0.01	0.02
5	0.16	0.17	0.18	0.18	0.19
6	0.73	0.90	1.11	1.21	1.69
7	0.26	0.29	0.29	0.29	0.30
8	0.10	0.11	0.12	0.12	0.15
9	0.89	0.92	0.95	0.97	1.04
10	0.32	0.40	0.50	0.57	0.81
11	0.08	0.09	0.10	0.11	0.14
12	0.03	0.03	0.03	0.03	0.03
13	0.86	0.91	0.95	0.98	1.08
14	0.27	0.30	0.35	0.39	0.50
15	0.28	0.30	0.33	0.36	0.38
16	0.00	0.03	0.06	0.09	0.13
17	0.61	0.69	0.77	0.84	0.96
18	0.54	0.59	0.72	0.86	1.24
Outside the Flow Monitoring Basin Boundaries	0.01	0.25	0.68	1.32	23.76
Total	6.23	7.31	8.64	9.95	34.35

Table 2.17 Wastewater Flow Projections by Rainbow Valley Sub-basin Developments

Land Use Classification	Projected Wastewater Flow (mgd)				
	2023	2028	2033	2038	Buildout
WPA 3					
Estrella (Inside the Rainbow Valley Sub-basin)	0.18	0.22	0.29	0.39	0.76
Sierra Vista Foothills	0.00	0.00	0.00	0.05	0.11
Terrasante	0.00	0.01	0.05	0.12	0.12
Other	0.00	0.00	0.00	0.00	0.02
Total	0.18	0.23	0.34	0.56	1.01
WPA 4					
Arnold Baker 320	0.00	0.00	0.00	0.03	0.12
Estrella (Inside the Rainbow Valley Sub-basin)	0.00	0.00	0.00	0.00	3.07
Estrella Highlands	0.00	0.00	0.06	0.13	0.53
Madeira	0.00	0.00	0.00	0.00	0.79
McRae Holdings	0.00	0.00	0.00	0.00	0.51
Rainbow Valley	0.00	0.01	0.04	0.13	0.38
Terrasante	0.00	0.00	0.07	0.15	0.15
Other	0.00	0.00	0.00	0.00	3.23
Total	0.00	0.01	0.17	0.44	8.78
WPA 5					
Amaranth	0.00	0.00	0.00	0.00	8.10
Other	0.00	0.00	0.00	0.00	4.06
Total	0.00	0.00	0.00	0.00	12.16

2.7 Reclaimed Water

2.7.1 Flow Projections

Reclaimed water flows are important for planning water resources with reclaimed water as a supply component. Additionally, reclaimed water flow projections are used to plan and size reclaimed water infrastructure. Reclaimed water production estimates are based on the City's historical wastewater flow records and wastewater return flow records. Wastewater return flow is assumed to be 93 percent based on experience with numerous wastewater plants. Table 2.18 presents the total projected reclaimed wastewater flow at each planning period.

Table 2.18 Historical and Projected Reclaimed Water Flows

Year	Reclaimed Water Flow (mgd)					
	157th Avenue	Corgett	Rainbow Valley	Waterman Wash	WPA 5	Total
Historical						
2019	3.67	0.35	0.37	0.00	0.00	4.39
2020	4.20	0.42	0.41	0.00	0.00	5.03
2021	4.46	0.38	0.44	0.00	0.00	5.28
2022	4.48	0.44	0.46	0.00	0.00	5.38
Projected						
2023	5.11	0.46	0.53	0.00	0.00	6.10
2028	5.72	0.49	0.58	0.00	0.00	6.79
2033	6.63	0.55	0.86	0.00	0.00	8.04
2038	7.29	0.60	1.36	0.00	0.00	9.25
Buildout	9.94	0.65	7.80	2.24	11.31	31.94

Table 2.19 presents the reclaimed water by Rainbow Valley Sub-basin developments. This table is important to plan reclaimed water resource availability in Rainbow Valley and for sizing the capacity of the Rainbow Valley WWTP.

Table 2.19 Reclaimed Water Flow Projections by Rainbow Valley Sub-basin Developments

Water Planning Area and Development	Projected Reclaimed Water Demand (mgd)				
	2023	2028	2033	2038	Buildout
WPA 3					
Estrella (Inside the Rainbow Valley Sub-basin)	0.18	0.20	0.27	0.36	0.71
Sierra Vista Foothills	0.00	0.00	0.00	0.05	0.10
Terrasante	0.00	0.01	0.05	0.11	0.11
Other	0.00	0.00	0.00	0.00	0.02
Total	0.18	0.21	0.32	0.52	0.94
WPA 4					
Arnold Baker 320	0.00	0.00	0.00	0.03	0.11
Estrella (Inside the Rainbow Valley Sub-basin)	0.00	0.00	0.00	0.00	2.86
Estrella Highlands	0.00	0.00	0.05	0.12	0.50
Madeira	0.00	0.00	0.00	0.00	0.73
McRae Holdings	0.00	0.00	0.00	0.00	0.47
Rainbow Valley	0.00	0.02	0.04	0.13	0.36
Terrasante	0.00	0.01	0.07	0.14	0.14
Other	0.00	0.00	0.00	0.00	3.00
Total	0.00	0.03	0.16	0.42	8.17
WPA 5					
Amaranth	0.00	0.00	0.00	0.00	7.53
Other	0.00	0.00	0.00	0.00	3.78
Total	0.00	0.00	0.00	0.00	11.31

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CHAPTER 3 WATER RESOURCES

3.1 Introduction

This chapter presents the water resources master plan for the City as part of the 2024 IWMP. The City has a diverse water resources portfolio consisting of surface water, groundwater, wastewater effluent (reclaimed water), and stored water credits. The City's surface water comes from the Colorado River and is delivered through the SRP canal system to City-owned water conveyance infrastructure that supplies Goodyear's Surface Water Treatment Plant (SWTP). The City owns and operates potable groundwater production wells distributed throughout the northern part of the City's water service area and also receives groundwater from the Adaman Mutual Water Company (Adaman). Reclaimed water produced at the City's water reclamation facilities is delivered for beneficial uses including irrigation and for recharge at the City's SAT site to promote aquifer sustainability and offset potable groundwater pumping.

The City has obtained and maintains a DAWS from the ADWR. This demonstrates that the City has secured the water resources required to provide a physical, legal, and continuously available water supply for its water service area for 100 years.

This chapter of the IWMP contains the following sections:

- Regulatory Framework.
- Water Resources Portfolio.
- Water Supply and Demand Balance.
- Future Water Supply Opportunities.
- Water Supply Development Strategies for Rainbow Valley.
- Drought Response and Water Conservation.
- Recommended Strategies to Manage water Supplies and Demands.

The water resources plan of the IWMP provides strategic direction for the City in deploying water resources to meet demands of current customers and future growth. The recommendations acknowledge a need for the City to provide a physical supply to meet demands while maintaining consistency with the management goal of the Phoenix Active Management Area (AMA). This means achieving safe yield of groundwater by utilizing renewable supplies to meet demands or through groundwater replenishment.

3.2 Regulatory Framework

Arizona water law has multiple systems of water rights that separately govern the use of Arizona surface water, CAP water, groundwater and reclaimed water. The State of Arizona developed its water laws beginning in 1919 with the Public Water Code regulating Arizona surface water. The more recent major body of water law was enacted in 1980 and is commonly referred to as the Groundwater Code. The Groundwater Code identifies areas where groundwater supplies are in jeopardy because of severe overdraft and need intensive management. These are known as the AMAs.

Generally, Arizona's water laws are intended to provide for and promote orderly use of the State's available water resources. Additional statutes also impact the acquisition and use of Colorado River water, including the CAP, and reclaimed water (referred to as "effluent" in the statutes).

Arizona's water statutes are complex, but necessary to protect and efficiently use this valuable resource. A combination of statutes, rules, court decisions, and other legal agreements collectively govern the quantity of water available to the City. These documents and rulings specify how water can be conveyed, and how and where the City can use it. Understanding how these legal and institutional issues impact the strategies and tactics needed to protect the City's water supplies is key to maintaining a robust water resources portfolio. It is also required to effectively manage existing water resources while planning for the acquisition of future water supplies needed to serve growth.

The following sections summarize and highlight some of the key components of many of the regulations and institutional constraints important to water resources planning for the City. Since these brief regulation summaries are interpretations, the City is encouraged to rely on official regulatory language and legal interpretation when implementing management strategies.

3.2.1 1980 Groundwater Management Act

Prior to 1980, specific areas of Arizona observed declining groundwater levels at alarming rates. A combination of local, state, and federal interests recognized the continued decline of groundwater levels threatened the economy and welfare of the State. To reverse this trend, the Legislature enacted the Groundwater Management Act (GMA) or Groundwater Code, which in specific areas of Arizona regulates the use of groundwater to maintain a balance between withdrawal and natural and artificial recharge. This balance is known as "safe yield".

The GMA created four initial AMAs in locations that were experiencing severe groundwater overdraft and were potentially at risk for continued declining groundwater levels with existing and projected urban growth. The City is within the Phoenix AMA. The statutory water management goal for the Phoenix AMA is to achieve safe yield by 2025.

The GMA has five primary provisions that apply to the City and the Phoenix AMA:

- Establishment of a program of groundwater rights and permits.
- Preparation of five water management plans for each AMA (for four decades beginning in 1980, and a final management plan for years 2020 through 2025) including mandatory conservation requirements.
- Development of a program that demonstrates an assured water supply for new growth.
- Metering and measuring water pumped from wells (with some exceptions for wells pumping less than 35 gallons per minute [gpm]).
- Reports on annual water withdrawal and use.

3.2.2 Assured Water Supply

The Assured Water Supply (AWS) program included in the 1980 GMA was strengthened by the adoption of the AWS administrative rules in 1995. Individuals wishing to develop and sell subdivided land with an AMA (defined as six or more subdivided lots) must demonstrate the availability of sufficient renewable water supplies to meet the proposed new development's demands for 100 years. One way to demonstrate this is for a water provider, such as the City, to establish and maintain a DAWS (or Designation); new subdivisions can then be approved for development within the water provider's service area.

There are five requirements for demonstrating an AWS:

- Sufficient water supplies must be physically, legally, and continuously available for a 100-year period.
- The water provider must have the financial capability to install the required facilities to treat and deliver water.
- The quality of the water sources must meet the Arizona Department of Environmental Quality's requirements.
- Uses of the water must be consistent with the Management Goal of the AMA.
- Uses of the water must be consistent with the conservation requirements of the AMA Management Plan.

The AWS Rules limit the amount of groundwater a City with a Designation (designated municipal provider) may withdraw to be consistent with the management goal of the AMA. Understanding this provision is complicated and based on several legal distinctions, but critical to determining how water supplies must be managed by a designated provider such as the City.

The difference between physical water management and "paper water" accounting is important. For example, all water physically located underground for the purposes of determining the amount of water that is "physically available," is considered groundwater. This "underground water" may have several legal titles such as long-term storage credits (LTSCs), incidental recharge credits, etc. However, because of the physical availability of the AWS designation criteria, the credits held by a water provider are meaningless if there is insufficient water physically present in the aquifer to pump. Physical availability must be achieved and maintained prior to applying the paper water accounting process.

There is a component of legally defined groundwater the City can use without incurring a replenishment obligation. This groundwater is maintained in the provider's groundwater allowance account. This account is comprised of several legal subclasses of water, described as follows:

- The initial, or "Phase-In," groundwater allowance is computed as a percentage of the provider's historical water use.
- Incidental recharge is considered water that has returned to the aquifer from system leaks, excess water applied to landscapes, and stormwater flow. The groundwater allowance account is increased annually by an incidental recharge factor applied to the provider's total water use.

The groundwater allowance may also be increased through extinguishment of Grandfathered Groundwater Rights, which require a provider to seek, obtain and pledge these credits to their groundwater allowance account. A provider may also increase its allowable groundwater pumping by becoming a member service area of the Central Arizona Groundwater Replenishment District (CAGRD) (refer to Section 3.2.4). A portion of remediated groundwater pumped as part of the Phoenix-Goodyear Airport North (PGAN) and Phoenix-Goodyear Airport South (PGAS) Superfund sites, within the City's service area, was approved by ADWR for inclusion in the City's groundwater allowance.

3.2.3 Groundwater Rights

The GMA established several classes of groundwater rights pertaining to most groundwater pumping within an AMA. These rights include:

- **Service Area Rights** – This is the classification of the groundwater rights held by the City. These may also be issued to irrigation districts for the delivery of groundwater to their member lands. Service area rights are unique in that they have the ability to be expanded, and they are the only groundwater rights that can still be created within an AMA. There are specific procedures for expanding/extending existing service area rights, and for establishing new or "satellite" service areas.
- **Irrigation Grandfathered Rights (IGFR)** – These rights are, in general terms, held by commercial agricultural landowners.
- **Type 1 Non-Irrigation Grandfathered Right (Type 1 Rights)** – These rights are derived from lands that were originally relying on IGFRs, but for specific reasons retired the land from agriculture and needed a legal right for the landowner to continue using groundwater for non-agricultural reasons.
- **Type 2 Non-Irrigation Grandfathered Right (Type 2 Rights)** – These rights are held by non-agricultural groundwater users and were issued after passage of the GMA. These rights can be leased, all or in part, or sold in entirety, for use anywhere within the AMA.

The number of IGFRs and Type 2 Rights can only be reduced over time as no new IGFRs, or Type 2 Rights can be created in the AMA. Type 1 Rights could theoretically increase in number but only through the retirement of IGFRs, which are typically awarded a reduced groundwater entitlement for non-agricultural water uses.

The term "Grandfathered Rights" is derived from the fact that water uses in existence for the five years prior to enactment of the GMA (1975 – 1980) were "grandfathered in" and awarded the right to continue pumping and using groundwater. This includes irrigated lands that were converted to a non-irrigation use during a specific qualifying period prior to 1980; these lands were issued Type 1 Rights. Type 1 Rights created after the GMA by retiring IGFRs are still considered grandfathered rights since their origin is from irrigation grandfathered rights. These groundwater right provisions will become particularly important to the City as it extends its service further into Rainbow Valley.

3.2.4 Central Arizona Groundwater Replenishment District

In 1990, the State Legislature authorized legislation to establish Groundwater Replenishment Districts. The CAGRD, which is a division of the Central Arizona Water Conservation District (CAWCD), was established in 1993 with voluntary membership. The purpose of the CAGRD is to provide a mechanism for landowners and water providers to demonstrate an AWS under the AWS rules. The CAGRD recharges unused CAP water, or other renewable water supplies, to offset groundwater pumping by its members. CAWCD owns

and operates several underground water storage facilities including the Agua Fria, Hieroglyphic Mountains, Tonopah Desert, and Superstition Mountains projects in which CAGRDR can store water. The CAGRDR can also store water in Groundwater Savings Facilities (GSFs).

The City has membership in CAGRDR as a Member Service Area (MSA) with a replenishment agreement for a maximum of 15,940 AFY. This agreement provides the City with a mechanism to prove consistency with the management goal of the AMA. The CAGRDR is not currently required to replenish groundwater in the same physical location where it was extracted. It can replace groundwater pumping anywhere within the AMA.

3.2.5 Recharge, Underground Storage and Recovery, and Replenishment

In 1986, the State promulgated the Underground Water Storage and Recovery Act (UWSRA) to regulate the recharge, storage, and recovery of all classes of water. The UWSRA allows renewable supplies to be recharged and stored underground to meet future demands, and encourages the use of excess renewable supplies, such as CAP water and reclaimed water, which would otherwise remain unused.

The distinction between recharge and underground storage and recovery (US&R) is simple. Water can be recharged by any party without the intent to later recover the recharged water for its use (considered to be a "donation" to the AMA). US&R is the practice of storing water underground for recovery and future use. The statutes also include regulations for replenishment. This is the practice of replacing groundwater previously pumped from the aquifer by a specific party.

Underground storage projects involve two types of permits, namely the Underground Storage Facility (USF) Permit and the Water Storage (WS) Permit. The USF permit regulates the process of underground storage, and the WS Permit is issued for the purposes of accruing credits. The USF has two types of physical facilities, namely constructed and managed. Constructed facilities include facilities that are specifically built to facilitate storage such as spreading basins, injection wells, and vadose zone wells. The managed facility permit governs when water is discharged to a natural stream and water is allowed to infiltrate through natural processes.

The UWSRA was amended in 1990 to include provisions for a third type of recharge identified as "indirect" or "in lieu" through a GSF. Using a GSF is an indirect recharging method which allows a water provider to deliver reclaimed water or CAP water for use by another party, such as an agricultural irrigation district, in lieu of pumped groundwater. The water provider gains storage credits for the amount of water delivered, with the same legal identity (CAP water, reclaimed water, etc.) equal to the amount not pumped by the irrigation district minus a 5 percent cut for the aquifer. Reclaimed water is exempt from this cut.

At present, only water used by agricultural irrigators in excess of their own CAP allocation can be counted as credits. This point is virtually moot today, however, since most irrigation districts have relinquished their allocations to CAP water or will in the near future. It is possible under the statutes that water could be delivered to a groundwater-using, non-agricultural water user (i.e., a golf course) to accomplish the same thing.

An amendment to the UWSRA was added which established annual storage and recovery (AS&R) accounts. This addition allows for the use of USFs and wells to store and recover water annually without having to build costly treatment and conveyance facilities. Water stored under an AS&R permit must be recovered in the same calendar year as it was stored. This is one approach to using reclaimed water (indirect potable reuse [IPR]) without the expense of DPR, along with long-term storage and recovery.

To recover stored water credits, a recovery well permit is required. An existing well may be permitted as a recovery well if it is demonstrated that other wells in the vicinity will not be harmed by the recovery of the stored water. The water recovered from the well retains the identity of the water (as previously discussed) when it was stored.

3.3 Water Resources Portfolio

The City has developed a water resources portfolio that includes surface water supplies from the Colorado River, groundwater, and reclaimed water. The City owns twelve potable groundwater production wells and receives bulk groundwater deliveries from the Adaman Mutual Water Company through three wells. The City currently utilizes its reclaimed water supply for direct non-potable reuse and recharge (at the SAT site) and recovery via the City's production wells.

The following water resources are the major components of the City's existing water resources portfolio, each of which is discussed in subsequent sections:

1. Colorado River Supplies consisting of the CAP Municipal and Industrial (M&I) allocation, and the Gila River Indian Community (GRIC) lease.
2. Groundwater, which:
 - a. Can be pumped without replenishment including the phase-in and incidental recharge allowances as determined by the ADWR.
 - b. Is available through a bulk water delivery agreement with Adaman.
 - c. Is produced as remediated groundwater through the PGAN and PGAS Superfund projects, which is exempted from replenishment requirements through 2050.
3. Reclaimed water.
4. Long-term storage credits derived from recharge and storage of reclaimed water and CAP water.

The yield and delivery capability of each of the City's water resources is impacted by the following:

1. Hydrologic/climatologic effects (i.e., drought impacts and climate change).
2. Institutional restrictions on the location of use.
3. The location of service area demand.
4. Impacts from groundwater contamination and remediation activities at the PGAN and PGAS Superfund sites.
5. Capacity of the water transmission and distribution infrastructure to deliver water to customers.

The following sections discuss each of the City's water resources from the perspective of resource evaluation, drought yield implications, and operational considerations.

Locations of the City's water resources planning area and major water resources features including the SAT site, City groundwater wells, and GSFs near the City's service area are shown in Figure 3.1.

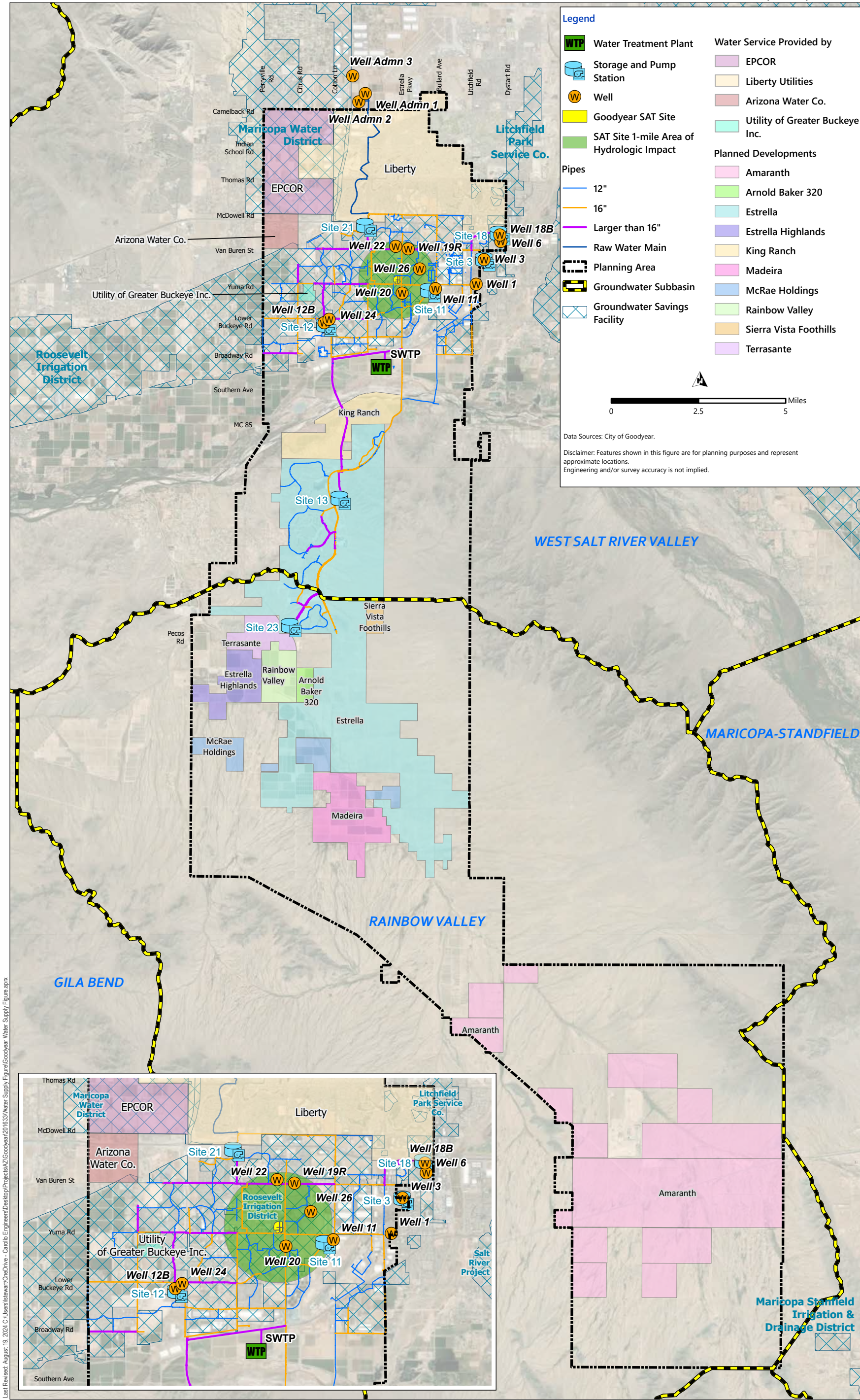


Figure 3.1 City of Goodyear Service Area
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

3.3.1 Colorado River Supplies

The CAP is designed to deliver approximately 1.5 million acre-feet (MAF) of Colorado River water annually to central and southern Arizona. The estimated annual water supply available for delivery from the CAP in normal water years is 1.415 MAF. A total of 620,678 acre-feet (ac-ft) has been contracted by M&I entities, including the City. The remainder includes CAP Indian and other contracted water and uncontracted Non-Indian Agricultural (NIA) priority water.

3.3.1.1 Resource Evaluation

The City currently has a subcontract for 10,742 AFY of M&I priority CAP water and a GRIC lease for 7,000 AFY of CAP water (also M&I priority). These supplies may be used anywhere within the City's service area. In the City's 2016 Designation, the use of CAP water was limited to recharge and recovery because the City did not have a means to treat and deliver CAP water directly to its customers at the time.

The City's SWTP began operating in 2022. This facility has a rated capacity of 8 mgd (8,960 AFY) and is used to treat a portion of the City's CAP water. Currently, the City's SWTP can reliably treat a maximum of 6.5 mgd (7,280 AFY). In February 2017, the City entered into an agreement with the Salt River Valley Water Users' Association (SRVWUA) and the SRP Agricultural Improvement and Power District. The current agreement term is through the year 2066 and allows the City to wheel its CAP water allocation through the CAP/SRP Interconnection Facility (CSIF) located adjacent to the Granite Reef Diversion Dam and through the SRVWUA Water Delivery System. The agreement states that the City can lease a volume of 25,000 AFY of capacity in the CSIF. The infrastructure and agreements put in place after the City's 2016 Designation significantly increased the City's ability to use CAP water to meet demands.

The City can also store CAP water based on its permitted recharge volumes for several USFs and GSFs. The City's total permitted annual storage volume is 112,500 AFY. The annual volume of CAP water that can be recovered is limited by the maximum recovery well permit volume of the City's recovery wells. All the City's wells are permitted as recovery wells.

3.3.1.2 Drought Yield Implications

The Colorado River is experiencing a nearly 23-year drought. Drought, climate aridification, and over-allocation of the Colorado River's resources has led to alarming declines in Lake Mead's water levels. Lake Mead serves as the governing reservoir for delivering Colorado River water to the Lower Basin States (California, Nevada, and Arizona) and Mexico. This "structural deficit" in Lake Mead has been recognized for many years.

In 2007, interim shortage guidelines were established to reduce water deliveries to Arizona and Nevada once Lake Mead elevations dropped below 1075 feet. These reduced deliveries were agreed upon by the Lower Basin States to develop an intentionally created surplus (ICS) to prevent the water level in Lake Mead from dropping below 1025 feet, which is the lowest practical operational level for maintaining water deliveries.

The 2007 interim guidelines are temporary and remain in effect until December 31, 2025. In 2019, the United States Bureau of Reclamation (USBR) recognized the need for additional mitigation measures to address declining water levels in Lake Mead. The USBR then facilitated the development of the Drought Contingency Plan (DCP) with separate agreements for the Upper and Lower Basin states. The DCP went into effect on May 20, 2019, and effectively builds on the 2007 interim guidelines by establishing additional voluntary reductions for all the lower basin states as well as reduced water deliveries to Mexico through the Binational Water Scarcity Contingency Plan.

Under the DCP, Colorado River resources delivered annually to Arizona could be reduced between 192,000 acre-feet and 720,000 acre-feet (between 7 and 23 percent of the total Colorado River apportionment to the State). Cuts to specific subcontractors will be based on water right priority. All of the City's CAP water is M&I/Indian Priority, which is at a lower risk of being cut until the higher DCP tiers are reached.

Arizona continues to work with the other Colorado River Basin states to develop operational concepts for a sustainable river system. In March 2024, Arizona, California, and Nevada presented a post-2026 Operations Plan to the USBR. Within the state, the Arizona Reconsultation Committee (ARC) is working on details of how this proposed plan will be implemented in Arizona's and identifying potential impacts to Arizona water users. The City is represented and actively engaged in the ARC.

For the IWMP, the approach taken to evaluate the City's susceptibility to long-term drought was to assume a 30 to 65 percent total cut of CAP water as a potential condition for each IWMP planning period (refer to Section 3.4).

Arizonan Water Banking Authority

In 1996, the Arizona Water Banking Authority (AWBA) was created to store unused portions of Arizona's share of the Colorado River water underground. The AWBA is in the process of storing 4.28 MAF of LTSCs, which includes 2.67 MAF for Arizona's use. These credits can be recovered (pumped) during a shortage period to provide back-up water supplies for Arizona water users. This process is known as "firming," and the water reserved in store through the process is referred to as "firmed water." The unused CAP water serves the following purposes:

- Firming a percentage of subcontracted amounts in times of shortages or disruption of the CAP system.
- Meeting the management plan objectives of the Arizona Groundwater Code.
- Assisting in the settlement of Native American water right claims.
- Exchanging water supplies to assist Colorado River communities.

In January 2014, a draft report by the AWBA, ADWR, and the CAP was released entitled "Recovery of Water Stored by the Arizona Water Banking Authority." This report outlined strategies for firming M&I subcontractors which included direct recovery, indirect recovery, and credit exchange methods for providing the firming coverage. Shortage amounts and timing of these shortage conditions are also discussed based on Colorado River modeling studies.

In 2021, a joint update was released by the AWBA, ADWR, CAWCD, and the Recovery Planning Advisory Group (RPAG) that includes an updated analysis of projected AWBA firming volumes, estimated recovery capacity needs, and an updated operational timeline to further refine the procedural steps for recovery implementation. Firmed water is intended to be recovered for delivery to M&I sub-contractors if and when Tier 3 reductions begin.

For shortages to the M&I priority pool, the AWBA will distribute credits provided the following conditions exist:

- AWBA has credits available to firm the supply.
- CAP's recovery schedule is consistent with statutes, rules and policies.
- Credits will be used to benefit the county for which they were accrued.
- The shortage to the M&I priority pool is less than 20 percent.

The City's GRIC lease water supply is federally firmed by the United States, and therefore the City should order their GRIC lease water prior to ordering their CAP subcontract water to the extent possible. This ensures that if there are declared shortages on the CAP any portion of the GRIC lease would not be reduced and could be used fully before the City would need to use other reduced supplies, supplemented with LTSCs.

3.3.1.3 Operational Considerations

CAP water can be ordered year-round, although the CAWCD has a policy that limits a subcontractor to 11 percent of their total CAP supply delivered per month. Since the CAP is not operating at full capacity, this peak delivery rate has not been strictly enforced. While it is not known if and when the peak limit will be enforced, it is prudent for the City to be aware of this and assume that it potentially could be. Based on the City's total CAP entitlement of 17,742 AFY, this would be equivalent to 1,951 acre-feet in a month ($17,742 \times 11 \text{ percent} = 1,951 \text{ acre-feet per month}$ or $65 \text{ acre-feet per day}$), which is equivalent to 21.2 mgd ($65 \text{ acre-feet per day} \times 0.325733 \text{ gallons per acre-foot} = 21,172,638 \text{ gallons per day [gpd]}$).

The CAP canal is not taken out of service for routine maintenance. Provisions are in place to allow water deliveries to continue during maintenance. Although the CAP canal has not been shut down in the past, there are potential catastrophic risks that may result in failures or outages.

The SRP canal system, through which the City's CAP water is supplied, is subject to seasonal outages for canal cleaning and maintenance, which is typically performed in the winter months when demands are lower. The City's water deliveries through the SRP system are subject to curtailments or interruptions due to emergencies, canal dry-up, operational constraints, and necessary maintenance and repairs.

We recommended that the City continue to diversify and develop its supply sources, including groundwater production and expanding both groundwater and surface water treatment. This will allow the City to adapt to changing water supply conditions, including the potential for permanent reductions in the City's CAP allocation and long-term groundwater physical availability.

3.3.2 Groundwater

The AWS rules adopted by ADWR require that for a groundwater resource to be considered physically available, it must not cause the static water level to drop below 1000 feet below ground surface (ft bgs) over a 100-year pumping period. On May 31, 2016, the City received its re-designation of AWS effective until December 31, 2028.

The City's legal availability of groundwater is limited by the GMA, which includes the volume of groundwater in the City's AWS Groundwater Allowance Account. The account includes groundwater in the following categories:

- Groundwater allowance.
- Accrued incidental recharge.
- Annual and long-term storage credits.

Annual and long-term storage credits are accrued by recharging renewable supplies (CAP, and reclaimed water), which can be used to offset groundwater pumping which must be replenished.

3.3.2.1 Water Resource Evaluation

The City has a one-time allocation of groundwater that may be pumped as part of the "phase-in" to safe yield in the Phoenix AMA. This quantity was established in 1995 by the AWS rules. Per the 2016 AWS designation, the Phase-In Allowance was computed to be 948.05 AFY for a 100-year period. The Phase in allowance, which if used, would not incur a replenishment obligation.

Under the AWS rules and as approved by ADWR in the 2016 Designation, the City is allowed an Incidental Recharge allocation of 5.1 percent of its total annual water demand (refer to the City's 2016 Decision and Order). The formula was based upon the estimated volume of water recharged to the groundwater aquifer from the City's water distribution system through leaks and delivery to end users. The amount of incidental recharge will increase as water use increases in the City in the future. In the 2016 Decision and Order, the City's incidental recharge volume was calculated to be 936.32 AFY, which was based on the projected year 2027 annual water demands. Incidental recharge is important in that it is not counted against the City as a CAGRDR replenishment obligation when reported to ADWR in the annual water use reporting.

The AWS Groundwater Allowance Account is the amount of groundwater pumping available to the City that does not have to be replenished. In 2022, the City's Groundwater Allowance Account totaled approximately 101,018 ac-ft (or 1,010 AFY for 100 years), which can be used for drought protection or for emergency purposes.

The City has been using a portion of its CAP water supply for AS&R to offset groundwater pumping that would otherwise need to be replenished. In 2023, the City stored and recovered 9,579 acre-feet of CAP water. As of 2022, the City has accrued 90,293.66 acre-feet of LTSCs, which include both CAP and reclaimed water.

In the future, the City may elect to continue to expand the SWTP to provide capacity to treat and deliver more CAP water to the service area and/or continue to recharge/recover CAP water for AS&R to offset groundwater pumping or accrue LTSCs. Decisions regarding expanding surface water treatment capacity should consider the realistic long-term yield of the City's CAP water as well as other water supplies that may be conveyed to the SWTP for treatment. Expanding AS&R within the area of hydrologic impact (AOHI) can only happen if the City can demonstrate sufficient recharge capacity is available to meet the City's needs without causing unreasonable harm to others.

As the City evaluates options for recharge and recovery of CAP water, the following are recommended:

- **Recharge and recover CAP water within the AOHI whenever possible.** The AOHI for a USF is defined as one mile from the facility while the AOHI for a GSF is defined as anywhere within the GSF boundary. Water recovered within the AOHI of a USF or in a GSF is not counted against the groundwater physical availability established in City's Designation.
- **Make certain USF and GSF permits are renewed on time to preserve recharge options.** USF permits typically have a 20-year limit and must be renewed through an ADWR re-permitting process. The current re-permitting timeline for USFs the City has capacity ownership in ranges from year 2025 through 2040 as shown in Table 3.1. Information on applicable GSF re-permitting timelines is shown in Table 3.2. The City should be proactive and work with recharge facility owners to re-permit them in a timely fashion.
- **Consider leasing USF capacity to other (or potential) Designated Municipal Providers.** As the City is more certain how its CAP water will ultimately be deployed, there will be less of a need to maintain capacity in CAWCD recharge facilities. There may be opportunities to lease capacity to other utilities, particularly those that have recovery wells within the AOHI of those facilities.

Table 3.1 Underground Storage Facility Recharge Capacity

Underground Storage Facility	USF Number	Start Date	End Date	Total Facility Storage Capacity (ac-ft)	Goodyear's Annual Capacity (ac-ft)	Total Recharged in 2023 (ac-ft)	USF Operator	Type of Water
Agua Fria Managed	71-569775.0009	12/22/2020	12/22/2040	540,000	13,000	4,588.0	CAWCD	CAP
Agua Fria Constructed	71-569776.0010	12/22/2020	12/22/2040	540,000	13,000	2,752.0	CAWCD	CAP
Hieroglyphic Mountain Recharge Project	71-584466.0005	10/31/2022	10/31/2042	35,000	13,000	-	CAWCD	CAP
Tonopah Desert Recharge Project	71-593305.0003	11/7/2017	9/1/2025	2,000,000	17,000	-	CAWCD	CAP
Superstition Mountains Recharge Project	71-207702.0004	9/28/2021	1/15/2028	56,500	56,500	8.0	CAWCD	CAP
City of Goodyear (SAT)	71-226310.0001	9/18/2020	9/18/2040		6,570	1,879.7	Goodyear	Reclaimed

Table 3.2 Groundwater Storage Facility Recharge Capacity

Groundwater Savings Facility	GSF Number	Start Date	End Date	Annual Recharge Capacity (ac-ft)	Goodyear's Total Storage Capacity (ac-ft)	Goodyear's Total Recharged in 2023 (ac-ft)	GSF Operator	Type of Water
Maricopa Water District GSF	72-558246.0007	6/19/2015	6/19/2025	40,000	10,000	-	Maricopa Water District	CAP
Tonopah Irrigation District GSF	72-534439.0006	3/6/2023	3/6/2028	17,059	10,000	2.0	Tonopah Irrigation District	CAP
Roosevelt Irrigation District GSF	72-572386.0006	2/3/2021	2/3/2026	133,000	N/A	5,376.1	Roosevelt Irrigation District	CAP
Maricopa-Stanfield Irrigation & Drainage District GSF	72-531381.0006	9/22/2020	9/22/2025	168,114		-	Maricopa-Stanfield Irrigation District	CAP

Groundwater Physical Availability

The 2016 Decision and Order includes a tabulation of the groundwater physically available by groundwater basin within the City's service area. The total groundwater determined to be physically available to the City is 13,328 AFY in the West Salt River Valley (WSRV) groundwater subbasin and 9,349 AFY in the Rainbow Valley groundwater subbasin. However, the ADWR approved groundwater to meet annual demands is defined as 5,025 AFY for the WSRV and 274 AFY for Rainbow Valley groundwater subbasin.

Table 3.3 shows the approved groundwater volumes from the City's 2016 Designation and amount of groundwater physical availability approved by the ADWR for other developments in Rainbow Valley. These developers have an approved Analysis of Assured Supply (AAWS). The total amount of approved groundwater supply for these other developers amounts to 55,403 AFY. The City is currently working with several developers within Rainbow Valley to define service agreements and infrastructure plans. Under current ADWR rules, there is not an established mechanism in place to govern the transfer of groundwater physical availability associated with either a Certificate of Assured Water Supply (CAWS) or AAWS to a Designated Municipal Provider. See Table 3.3 for more details on Rainbow Valley groundwater physical availability.

Table 3.3 Groundwater Physical Availability Summary

Source of Supply	DAWS Approved Volume (AFY)
City Groundwater WSRV ⁽¹⁾	5,025
West Salt River Valley Total	5,025
City Groundwater Rainbow Valley ⁽¹⁾	274
Estrella Highlands Development ⁽²⁾	3,414
Rainbow Valley 320 ⁽²⁾	682
Madeira North ⁽²⁾	22,099
Madeira Developments ⁽²⁾	4,454
Rainbow Valley Developments ⁽²⁾	1,682
Amaranth Developments ⁽²⁾	23,072
Rainbow Valley Total	55,677

Notes:

(1) Volume approved in the 2016 Decision & Order.

(2) ADWR Issued AWS Demands in Rainbow Valley modeled for 2024 Modified Designation of Assured Water Supply (MDAWS) Application.

The groundwater storage volumes shown in Table 3.3 have been demonstrated to be physically available based on groundwater modeling completed by the City or by developers. The groundwater model simulates existing and projected demands over a 100-year period and is subject to specific criteria required by ADWR. These criteria include demonstrating that the water is of adequate quality as well as demonstrating that water levels will not exceed 1,000 feet below ground surface after 100 years of simulated groundwater pumping. Near-term changes in demands or groundwater pumping intensity by the City or others may change future groundwater modeling results. Demands in Table 3.3 were modeled when determining the groundwater available for the City within Rainbow Valley in support of the City's 2024 MDAWS Application.

The City has a bulk water sale and treatment agreement with Adaman to provide groundwater from outside of the City's service area. The term of this agreement is 80 years with an option for three 10-year extensions. The agreement with Adaman is to provide up to 11,200 AFY (10 mgd) of groundwater. However, in the City's current Designation, ADWR only approved 4,467 AFY of groundwater to be available to the City. This limit is due to groundwater physical availability.

Groundwater pumped and treated at the PGAN and PGAS Superfund treatment facilities is available to the City as remediated groundwater in accordance with Arizona Law. Per the City's 2016 AWS Designation, the City can pump 373.59 AFY of remediated groundwater without incurring a replenishment obligation through year 2025. In 2021, the Arizona State Legislature passed a statute to extend the remediated groundwater pumping exemption sunset date to year 2050.

The PGAN and PGAS superfund sites have a significant impact on the City's water system operation. The City has had to abandon wells that were impacted by this contaminated groundwater. The operation of Wells 1 and 3 is anticipated to be impacted by the groundwater plumes. Recharge facilities also cannot be located in a manner that affects movement of the groundwater plume.

3.3.2.2 Drought Yield Implications

Groundwater pumping is essentially drought proof and is an excellent physical source during periods of reduced surface water yields. However, there are concerns related to sustainability of physical groundwater supplies in the WSRV and RV aquifers.

After the City receives reduced surface water it will be important to maintain sufficient well capacity to pump groundwater to replace surface water shortages during droughts and emergencies. The criteria and pumping capability needs are discussed in Chapter 4. The implications of increased well pumping for certain drought scenarios are discussed in detail in Section 3.4.

3.3.2.3 Operational Considerations

The City has developed and continues to develop a number of groundwater production wells throughout its service area. Groundwater pumping is not subject to canal delivery limitations, seasonal dry-ups, or drought impacts in the same manner as surface water supplies, making groundwater production wells ideal for purposes of meeting peaking, standby, drought, and emergency needs.

Wells are permitted according to ADWR rules and regulations, which include annual withdrawal rate/volume limitations. ADWR's well rules, approved in 2006, allow for 100 percent of the original duty cycle of a well to be available to replacement wells used for municipal purposes. Groundwater quality, including levels of total dissolved solids (TDS), nitrates, fluoride, and arsenic is of major concern to the City. Most of the City's wells need treatment, which significantly increases water supply costs. The City has two reverse osmosis treatment facilities that serve multiple wells. The City also has a treatment facility for the Adaman well supplies. Water treatment is assumed to be required for any new well site.

3.3.3 Reclaimed Water

The City has been treating wastewater to produce a reclaimed water supply that is either delivered directly to customers or made available for recharge to offset future groundwater withdrawals that require replenishment. The City uses the reclaimed water produced at the Goodyear 157th Ave Water Reclamation Facility (WRF). The reclaimed water produced at the Corgett and Rainbow Valley WRFs is

returned to the Estrella development community for non-potable uses or discharged into a nearby wash. In the future when the Rainbow Valley WRF treats wastewater that does not originate in Estrella then the City will have the opportunity to beneficially use the reclaimed water from these additional developments.

3.3.3.1 Resource Evaluation

The goal of the City's reclaimed water management program is to beneficially use all the reclaimed water the City produces, either through reuse or recharge. Effluent generated at the 157th Ave WRF is delivered to the Goodyear SAT site, which is permitted to recharge 6,570 AFY of reclaimed water. The City has an agreement to deliver up to 7.5 mgd (8,400 AFY) of effluent to the Buckeye Water Conservation Drainage District (BWCCD) via the BWCCD Canal for irrigation. They can also discharge reclaimed water to the Gila River in an emergency. Water delivered to BWCCD does not provide a direct water resources benefit to the City (i.e., in-lieu recharge or long-term storage credits).

Effluent generated at the Corgett WRF is delivered to the Estrella development through a distribution system that was built by the developer to provide non-potable water for landscape irrigation and filling lakes that are then used to irrigate the Estrella Golf Club. Currently 99 percent of effluent from the Corgett WRF is delivered to the Estrella development. Effluent from Corgett WRF can also be discharged to the Corgett Wash in an emergency.

Effluent generated at the Rainbow Valley WRF is delivered to the Estrella development and used by this development to provide non-potable water for landscape irrigation and filling lakes that are then used to irrigate the Estrella Golf Club. Currently 70 percent of the effluent from the Rainbow Valley WRF is delivered to the Estrella development. Approximately 25 percent of the effluent from the Rainbow Valley WRF goes to CantaMia, an Estrella development, for landscape irrigation, and the remaining 5 percent of effluent goes to the Waterman Wash.

Irrigation water demands vary seasonally, with peak demands occurring during the summer months, and low demands during the winter or during precipitation events. Since the reclaimed water produced from the water reclamation facilities is relatively constant, storage and recovery facilities are needed to manage supplies in response to seasonal demands. It is recommended that additional reclaimed water generated from new growth be used for aquifer storage and recovery to the highest extent possible.

3.3.3.2 Drought Yield Implications

Like groundwater, reclaimed water is not affected by drought and remains relatively constant throughout the year. When the City must impose its Water Conservation and Curtailment Plan, which cuts back on water use, some reductions in reclaimed water supply may also be experienced.

3.3.3.3 Operational Considerations

Current reclaimed water utilization is based on executed agreements between the City and the end users. These agreements specify a certain reclaimed water delivery amount or committed capacity. Because of the importance of reclaimed water in the City's water resource portfolio, the City should structure development agreements so that the City retains the reclaimed water for recharge. This helps to provide the water resource that is needed for continued growth. The City should also seek opportunities to restructure existing agreements with developers to increase the amount of recharge that is available to the City.

Reclaimed water will be stored underground in recharge facilities that are or will be constructed by the City, for later recovery or to remain in storage as LTSCs. The City should continue to pursue maximizing its reclaimed water recharge capability to offset groundwater pumping. Expanding direct, non-potable reuse systems is recommended only when needed to serve an industrial or commercial customer that returns a high percentage of the reclaimed water through the collection system. The City already has the ability to recover reclaimed water through wells in its potable water system. This gives the City flexibility to determine where the reclaimed water will be used.

3.4 Water Supply and Demand Balance

Available water supplies were compared to the projected average annual demands for both normal and drought conditions anticipated for each planning period. This analysis was undertaken to meet the following objectives:

1. Identify the renewable supply surplus (or shortfall) for each condition to confirm the City's portfolio aligns with the safe yield management goal of the Phoenix AMA.
2. Identify triggers for water supply, treatment, or reclaimed water management infrastructure that are needed for a water resource to be used to meet a projected demand (thereby confirming physical and continuous availability of supplies).

As discussed in Chapter 2 of the IWMP, water demands, and reclaimed water production projections were developed for five-year planning periods from 2023 through 2038. The following sections compare the water supply versus demand balances for each of these planning horizons and discuss potential impacts from drought conditions and potential mitigation strategies.

3.4.1 Normal Water Year Supply and Demand Balance

Table 3.4 presents a summary of renewable water supply availability versus demands for years 2023 through 2038. The renewable water supplies include CAP water, renewable groundwater, and reclaimed water. Renewable groundwater is defined as water that does not need to be replenished. For the purposes of this analysis, LTSCs are also included. However, they can only be used once. This includes the total potable, and reclaimed water demands for WPA 2 through WPA 5. WPA 1 is not included as this area is served by EPCOR and Liberty Utilities. The portion of WPA 2 served by the Arizona Water Company is also not included. The service area demand growth versus available supplies through the year 2038 is graphically depicted in Figure 3.2.

The Normal Year water supply and demand balance shows:

- The City has sufficient renewable supplies in the water portfolio to meet the total potable and non-potable projected demands through year 2038, with surpluses between nearly 7,300 AFY to approximately 12,400 AFY across the planning horizon. This assumes there are no changes to the City's CAP allocation and that its full CAP allocation and the other renewable resources in the City's water portfolio continue to be recognized by ADWR.
- Full utilization of CAP water to meet demands requires either an expansion of the SWTP or continued AS&R through a USF or GSF and recovery via recovery wells. Currently, the City's SWTP can treat 6.5 mgd (7,280 AFY) and the City's firm groundwater production capacity is currently 21 mgd (23,520 AFY) (reference Table 4.1 in Chapter 4). The City's combined potable water production capacity is 30,800 AFY (current SWTP capacity plus current firm groundwater production capacity). This exceeds the year 2038 potable demand projections of 22,780 AFY by 8,020 AFY.

- Reclaimed water produced that exceeds the projected reclaimed water non-potable demands is estimated to be 6,348 AFY by 2028 (7,614 AFY reclaimed water produced less 1,266 AFY of non-potable demand = 6,348 AFY). The annual recharge capacity of the SAT site is 6,570 AFY, which cannot currently be utilized because of a reclaimed water transmission main restriction that limits water deliveries. It is recommended that the City take immediate action to install the needed transmission capacity to fully utilize the SAT site recharge capacity.
- Beyond 2028 through 2038, the City will need an additional 2,500 AFY of recharge capacity to accommodate the estimated reclaimed water produced in excess of non-potable demands, assuming 6,570 AFY of reclaimed water continues to be sent to the SAT site (10,361 AFY reclaimed water produced – 1,266 AFY non-potable demand – 6,570 AFY SAT site capacity = 2,525 AFY).

Table 3.4 Renewable Water Resources Supplies and Demands - Normal Year

	Annual Demand (AFY)			
	2023	2028	2033	2038
Potable Demands ⁽¹⁾	13,660	15,920	19,080	22,780
Reclaimed Demands ⁽¹⁾	1,266	1,266	1,266	1,266
Total Water Demand	14,926	17,186	20,346	24,046
Supply (AFY)				
Surface Water				
CAP M&I	10,742	10,742	10,742	10,742
CAP GRIC Lease	7,000	7,000	7,000	7,000
Total CAP Surface Water	17,742	17,742	17,742	17,742
Groundwater				
Annual Credit for Incidental Recharge ⁽²⁾	697	812	973	1,162
Groundwater Allowance	948	948	948	948
Remediated Groundwater Pumping Allowance	374	374	374	374
CAGRD ⁽³⁾	0	0	0	0
Long Term Storage Account	786	786	786	786
Total Renewable Groundwater	2,805	2,920	3,081	3,270
Reclaimed Water				
Reclaimed Water Produced ⁽⁴⁾	6,823	7,614	9,003	10,361
Total Reclaimed Water	6,823	7,614	9,003	10,361
Total Renewable Supplies	27,370	28,276	29,826	31,373
Surplus/(Deficit)	12,444	11,090	9,480	7,327

Notes:

- Includes demands for WPA 2, WPA 3, and part of WPA 4.
- Per the City's 2016 Designation, Incidental Recharge is calculated as 5.1 percent of the average annual daily demand.
- The City has the option to replenish up to 15,940 AFY through CAGRD.
- The amount of reclaimed water available to be stored and recovered is the total amount of reclaimed water produced minus the volume used for direct, non-potable reuse.

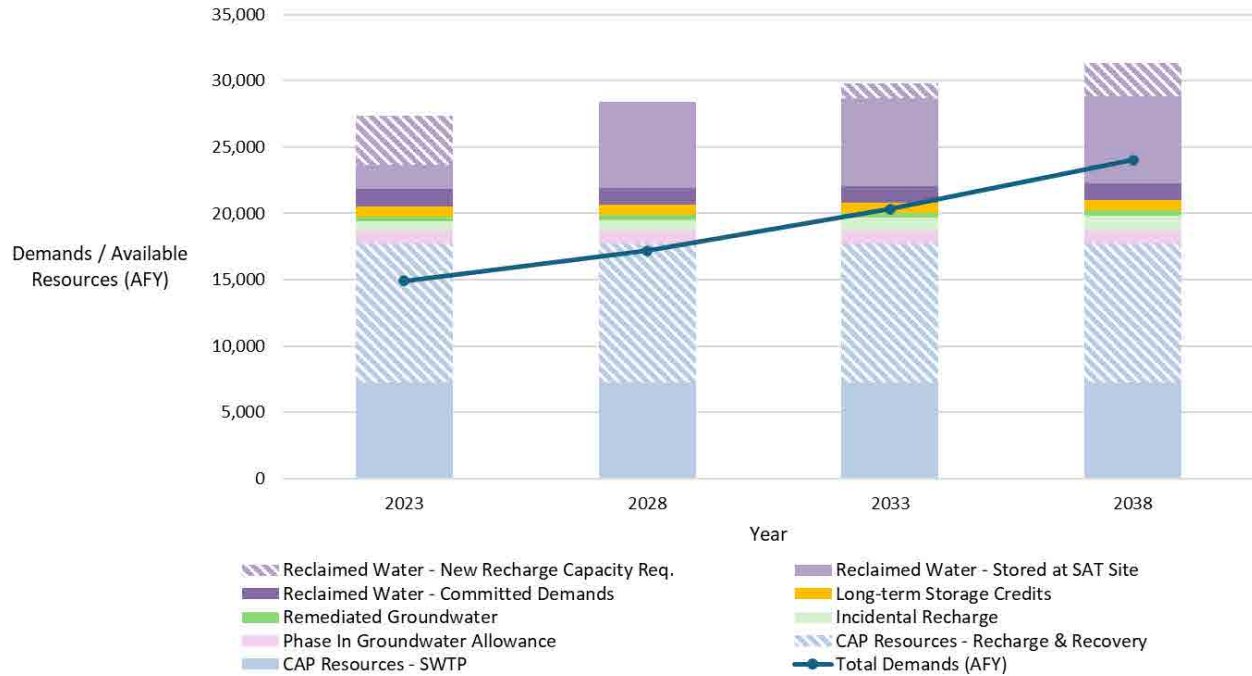


Figure 3.2 Renewable Supplies Versus Demands - Normal Year

3.4.2 Dry Water Year Supply and Demand Balance

Renewable supplies were compared to demands for three drought conditions, defined as a CAP water reduction of 30 percent, 50 percent, and 65 percent. The City's existing surface water supplies that could be affected by these drought shortages are the 10,742 AFY M&I sub-contract and the 7,000 AFY GRIC lease, totaling 17,742 AFY. Accordingly, the City's surface water supply would theoretically be reduced to 12,419 AFY, 8,871 AFY, and 6,210 AFY for the 30 percent, 50 percent, and 65 percent drought scenarios, respectively. Table 3.5 summarizes the City's estimated available CAP water resources under normal and drought conditions.

Table 3.5 Potential CAP Drought Reductions

Water Resource	Availability (AFY)			
	Normal Year	30% Drought	50% Drought	65% Drought
M&I Sub-contract	10,742	7,519	5,371	3,760
GRIC Lease	7,000	4,900	3,500	2,450
Total	17,742	12,419	8,871	6,210

Although these were drought analyses, to be conservative for the IWMP, no reductions to total water demands (i.e., potential impacts from water conservation) were assumed.

3.4.2.1 30 Percent CAP Supply Reduction

Table 3.6 shows the demand growth versus available supplies through the year 2038 assuming a 30 percent reduction in available CAP water. This supply versus demand comparison is shown graphically in Figure 3.3. Table 3.6 displays the total potable and reclaimed demands which include demands from WPA 2 – WPA 5.

The 30 percent CAP supply reduction supply and demand balance shows:

- Even with reduced CAP supplies, the City has sufficient renewable supplies in the water portfolio to meet the total potable and non-potable projected demands through year 2038, with surpluses ranging from approximately 2,000 AFY to 7,100 AFY across the planning horizon.
- Full utilization of CAP water to meet demands requires either an expansion of the SWTP or continued AS&R through a USF or GSF and recovery via recovery wells.

Table 3.6 Renewable Water Resources Supplies and Demands - 30 Percent CAP Reduction

	Annual Demand (AFY)			
	2023	2028	2033	2038
Potable Water Demand ⁽¹⁾	13,660	15,920	19,080	22,780
Reclaimed Demands ⁽¹⁾	1,266	1,266	1,266	1,266
Total Water Demand	14,926	17,186	20,346	24,046
Supply (AFY)				
Surface Water				
CAP M&I	7,519	7,519	7,519	7,519
CAP GRIC Lease	4,900	4,900	4,900	4,900
Total CAP Surface Water	12,419	12,419	12,419	12,419
Groundwater				
Annual Credit for Incidental Recharge ⁽²⁾	697	812	973	1,162
Groundwater Allowance	948	948	948	948
Remediated Groundwater Pumping Allowance	374	374	374	374
CAGRD ⁽³⁾	0	0	0	0
Long Term Storage Account	786	786	786	786
Total Renewable Groundwater	2,805	2,920	3,081	3,270
Reclaimed Water				
Reclaimed Water Produced ⁽⁴⁾	6,823	7,614	9,003	10,361
Total Reclaimed Water	6,823	7,614	9,003	10,361
Total Renewable Supplies	22,047	22,953	24,503	26,050
Surplus/(Deficit)	7,121	5,767	4,157	2,004

Notes:

- (1) Includes demands for WPA 2, WPA 3 and part of WPA 4.
- (2) Per the City's Designation, Incidental Recharge is calculated as 5.1 percent of the average annual daily demand.
- (3) The City has the option to replenish up to 15,940 AFY through CAGRD.
- (4) The amount of effluent water available to be stored and recovered is the total amount of effluent water minus the amount of effluent water used for direct treatment and delivery.

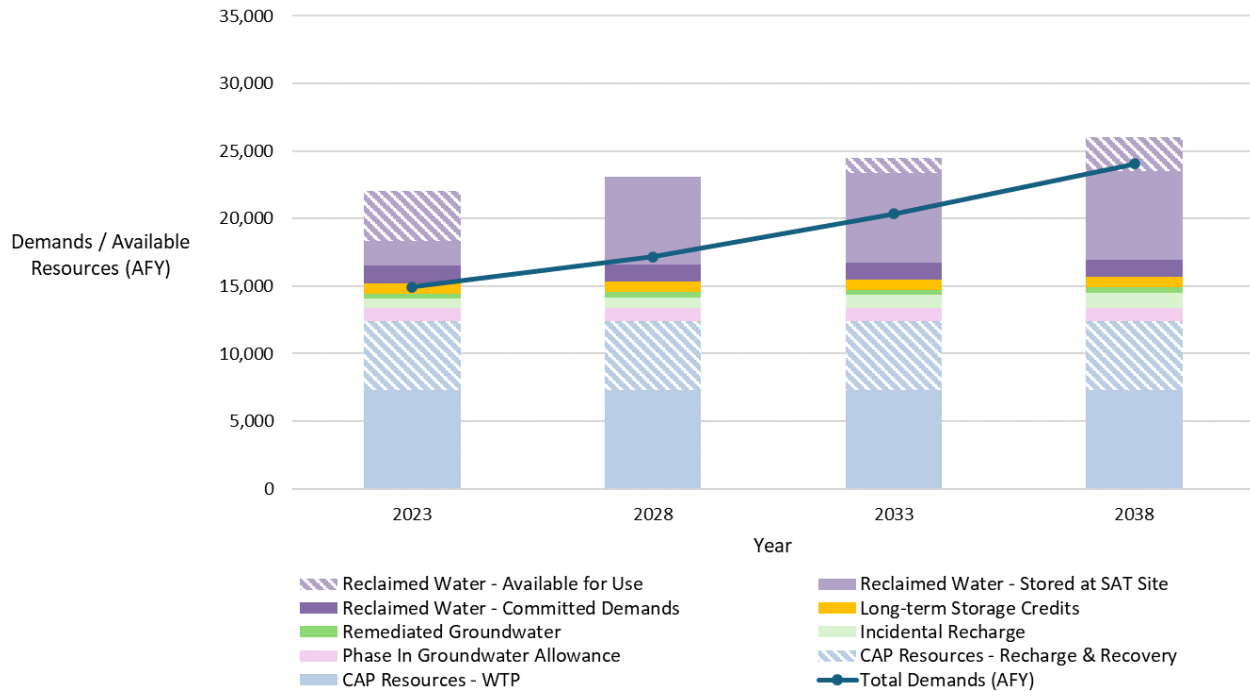


Figure 3.3 Renewable Supplies Versus Demands - 30 Percent CAP Reduction

3.4.2.2 50 Percent CAP Supply Reduction

Table 3.7 shows the demand growth versus available supplies through the year 2038 assuming a 50 percent reduction in available CAP water. This supply versus demand comparison is shown graphically in Figure 3.4.

The 50 percent CAP supply reduction supply and demand balance shows:

- With more significant CAP supply reductions, the City has sufficient renewable supplies in the water portfolio to meet the total potable and non-potable projected demands through year 2033, with a shortfall of approximately 1,500 AFY predicted in year 2038.
- Full utilization of CAP water to meet demands requires either an expansion of the SWTP or continued AS&R through a USF or GSF and recovery via recovery wells.
- In 2038, the City will need an additional approximately 2,500 AFY of recharge capacity to accommodate the estimated reclaimed water produced that exceeds non-potable demands.

Table 3.7 Renewable Water Resources Supplies and Demands - 50 Percent CAP Reduction

	Annual Demand (AFY)			
	2023	2028	2033	2038
Potable Water Demand ⁽¹⁾	13,660	15,920	19,080	22,780
Reclaimed Demands ⁽¹⁾	1,266	1,266	1,266	1,266
Total Water Demand	14,926	17,186	20,346	24,046
Supply (AFY)				
Surface Water				
CAP M&I	5,371	5,371	5,371	5,371
CAP GRIC Lease	3,500	3,500	3,500	3,500
Total CAP Surface Water	8,871	8,871	8,871	8,871
Groundwater				
Annual Credit for Incidental Recharge ⁽²⁾	697	812	973	1,162
Groundwater Allowance	948	948	948	948
Remediated Groundwater Pumping Allowance	374	374	374	374
CAGRD ⁽³⁾	0	0	0	0
Long Term Storage Account	786	786	786	786
Total Renewable Groundwater	2,805	2,920	3,081	3,270
Reclaimed Water				
Reclaimed Water Produced ⁽⁴⁾	6,823	7,614	9,003	10,361
Total Reclaimed Water	6,823	7,614	9,003	10,361
Total Renewable Supplies	18,499	19,405	20,955	22,502
Surplus/(Deficit)	3,573	2,219	609	(1,544)

Notes:

- (1) Includes demands for WPA 2, WPA 3 and part of WPA 4.
- (2) Per the City's Designation, Incidental Recharge is calculated as 5.1 percent of the average annual daily demand.
- (3) The City has the option to replenish up to 15,940 AFY through CAGRD.
- (4) The amount of effluent water available to be stored and recovered is the total amount of effluent water minus the amount of effluent water used for direct treatment and delivery.

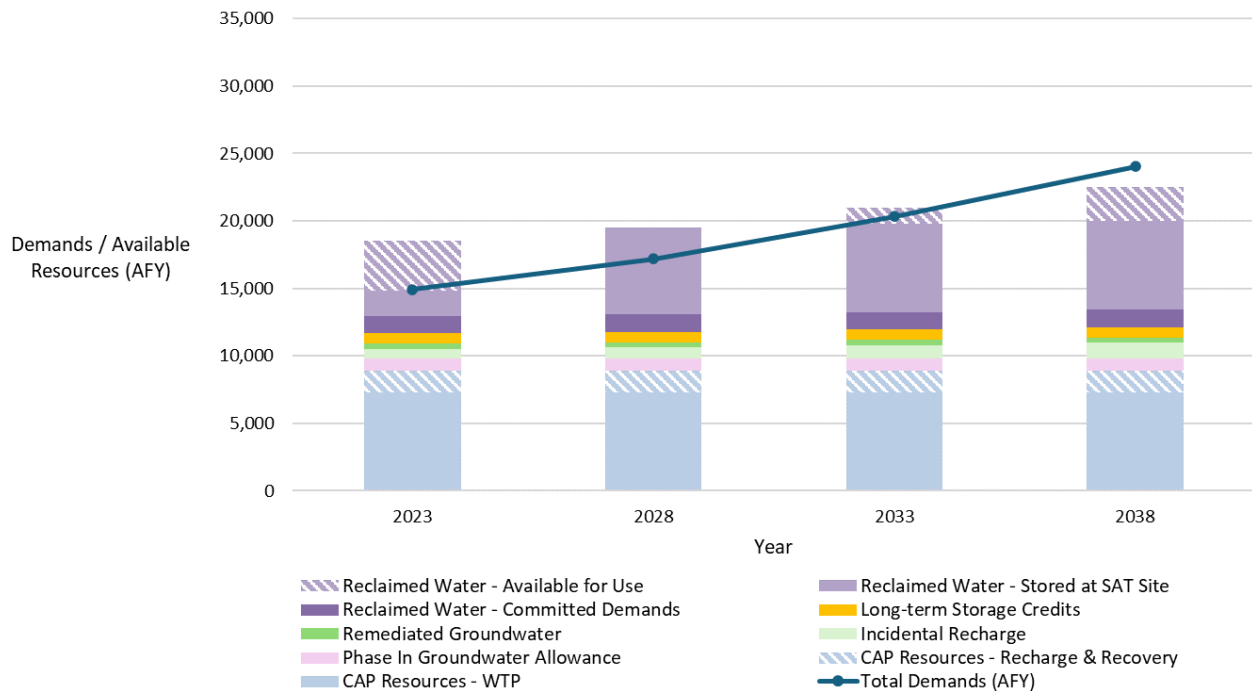


Figure 3.4 Renewable Supplies Versus Demands - 50 Percent CAP Reduction

3.4.2.3 65 Percent CAP Supply Reduction

Table 3.8 shows the demand growth versus available supplies through the year 2038 assuming a 65 percent reduction in available CAP water. This supply versus demand comparison is shown graphically in Figure 3.5.

The 65 percent CAP supply reduction supply and demand balance shows:

- With severe CAP supply reductions, the City does not have sufficient renewable supplies in the water portfolio to meet the total potable and non-potable projected demands beginning in year 2028. The projected renewable supply shortfalls in years 2028 through 2038 range from approximately 400 to 4,200 AFY.
- With severe CAP reductions, the available CAP water (6,210 AFY = 5.5 mgd) is less than the existing capacity of the SWTP. Under this scenario, the existing capacity at the SWTP allows for the full utilization of available CAP water to meet demands without the need for continued AS&R.
- Full utilization of available reclaimed water supplies would be required under this scenario, and additional recharge capacity (approximately 2,500 AFY) would be required in year 2033 and beyond to utilize available resources.

Table 3.8 Renewable Water Resources Supplies and Demands - 65 Percent CAP Reduction

	Annual Demand (AFY)			
	2023	2028	2033	2038
Potable Water Demand ⁽¹⁾	13,660	15,920	19,080	22,780
Reclaimed Demands ⁽¹⁾	1,266	1,266	1,266	1,266
Total Water Demand	14,926	17,186	20,346	24,046
Supply (AFY)				
Surface Water				
CAP M&I	3,760	3,760	3,760	3,760
CAP GRIC Lease	2,450	2,450	2,450	2,450
Total CAP Surface Water	6,210	6,210	6,210	6,210
Groundwater				
Annual Credit for Incidental Recharge ⁽²⁾	697	812	973	1,162
Groundwater Allowance	948	948	948	948
Remediated Groundwater Pumping Allowance	374	374	374	374
CAGRD ⁽³⁾	0	0	0	0
Long Term Storage Account	786	786	786	786
Total Renewable Groundwater	2,805	2,920	3,081	3,270
Reclaimed Water				
Reclaimed Water Produced ⁽⁴⁾	6,823	7,614	9,003	10,361
Total Reclaimed Water	6,823	7,614	9,003	10,361
Total Renewable Supplies	15,838	16,744	18,294	19,841
Surplus/(Deficit)	912	(442)	(2,052)	(4,205)

Notes:

- (1) Includes demands for WPA 2, WPA 3 and part of WPA 4.
- (2) Per the City's Designation, Incidental Recharge is calculated as 5.1 percent of the average annual daily demand.
- (3) The City has the option to replenish up to 15,940 AFY through CAGRD.
- (4) The amount of effluent water available to be stored and recovered is the total amount of effluent water minus the amount of effluent water used for direct treatment and delivery.

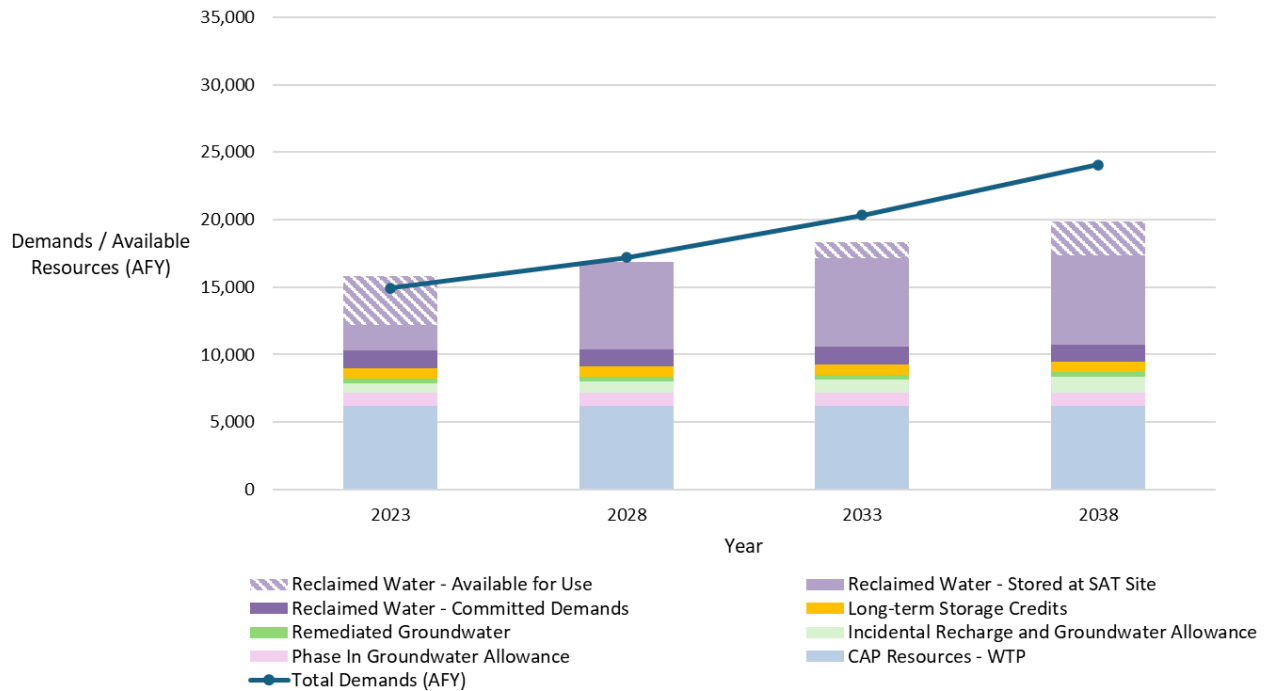


Figure 3.5 Renewable Supplies Versus Demands - 65 Percent CAP Reduction

3.4.3 Drought Mitigation Strategies

There are several options available to the City for mitigating the impact of these potential shortfalls. These include:

1. ADWR's drought exemption which can be authorized by the Director of ADWR. This exemption allows 80 percent of a surface water shortfall to be made up from groundwater (drought pumping) without incurring a replenishment obligation. This applies to the City's groundwater replenishment obligation and can only be implemented if there is physical groundwater available to pump to replace the surface water shortage. This implies that if additional drought groundwater pumping is allowed, additional wells will be required to pump the increased supply.
2. A second measure of protection is provided by the AWBA. The AWBA has the obligation to provide "firming" water supplies for a 20 percent cutback in CAP M&I water supplies. The AWBA has developed scenarios and an operating plan for replacement as described in Section 3.3.1.2.
3. A third opportunity for the City to mitigate the shortfall is for the City to implement its demand management program. This program is embodied in Section 14-5-6 of the City's Code of Ordinances: Water Use Restrictions. This section states that the City Manager is authorized to declare a water shortage and the implementation of water use and conservation restrictions and employ the City's Drought Preparedness Plan. Any declaration of water shortage will identify the water use restrictions stage and water use restrictions and measures to be implemented as defined in the City's Drought Preparedness Plan. This program could be implemented to help the City mitigate its surface water shortfalls during a drought.

ADWR allows 80 percent of the surface water shortfall to be made up from groundwater pumping (drought pumping) without a replenishment obligation. Under the 65 percent CAP supply reduction scenario, the City's surface water shortfall would be 11,532 AFY (normal year CAP supply volume of 17,742 AFY – 6,210 AFY available under 65 percent CAP supply reduction scenario). With the drought pumping exemption, the City could pump approximately 9,200 AFY (11,532 AFY * 80 percent) of groundwater without a replenishment obligation. This drought pumping volume is greater than the 4,205 AFY deficit predicted in year 2038 as discussed in Section 3.4.2.3.

A short-term severe reduction in CAP supplies over several years was also considered. Assuming the 65 percent CAP supply reductions were seen over 5 years, a total of 21,025 ac-ft (4,205 AFY * 5 years) of additional groundwater would need to be pumped to cover the shortfall of renewable supplies. This volume of groundwater is within the drought pumping volume allowed (9,225 AFY * 5 years = 46,128 ac-ft).

If drought pumping exemption is not granted by ADWR, the City could use LTSCs to meet the shortfall (replenishment obligation) predicted in year 2038 of the 65 percent CAP supply reduction scenario. As of 2022, the City has accrued 90,293.66 ac-ft of LTSCs. In evaluating a short-term severe reduction in CAP supplies over 5 years and assuming a drought pumping exemption was not granted, and a total of 21,025 ac-ft of LTSCs would be needed to meet the shortfall under this scenario. This use of LTSCs would reduce the City's total accrued LTSCs to 69,268.66 ac-ft (90,293.66 ac-ft - 21,025 ac-ft). This reduction is approximately 23 percent of the City's total LTSCs as of year 2022. Based on this, and assuming the City is able to fully utilize the renewable resources discussed in Section 3.4 through AS&R, significant banking of additional LTSCs is recommended to meet potential short-term future drought conditions. It is further recommended that the City focus on meeting demands with renewable resources to reduce its use of supplies with replenishment obligations.

Regardless of whether drought pumping or LTSCs are used to meet a potential future renewable supply deficit during drought conditions, adequate groundwater physical availability and groundwater production capacity are still needed to meet that demand. As discussed in Section 3.4.1, the City's current groundwater production capacity is greater than the demands predicted in year 2038. The City's groundwater physical availability, discussed in Section 3.3.2, is also greater than the 4,205 AFY deficit seen under this scenario.

3.5 Future Water Supply Opportunities

The following sections describe future water supply opportunities for the City to consider in developing long-term strategies for mitigating water supply shortages and increasing water supply resilience.

3.5.1 Bartlett Dam New Conservation Storage

Bartlett Dam is the lower of two dams on the Verde River system. Accumulation of sedimentation behind the upper dam, Horseshoe Dam, has reduced storage capacity, which is currently approximately one third of its 132,000 ac-ft design capacity. In 2021, SRP announced its intention to evaluate options to raise Bartlett Dam to restore and/or increase capacity in the Verde system. The Bureau of Reclamation (BOR), in partnership with SRP, undertook an appraisal study to collect data and stakeholder input. The purpose of this task was to evaluate the needs and perspectives regarding the loss of storage capacity on the Verde system. As a result of the appraisal process, the BOR, SRP, and a number of stakeholders started a feasibility study and launched a steering committee to evaluate options to raise Bartlett Dam to restore and/or increase capacity. The City is engaged in this process, which could potentially result in additional renewable water resources available to the City.

SRP in conjunction with 22 tribal, agricultural, and municipalities parties, including the City, are working with BOR to complete a feasibility study evaluating the proposed expansion to Bartlett Dam. After the completion of this feasibility study, a finalized plan will be presented to Congress for consideration and approval. Design and construction could take 10-15 years beyond the completion of the feasibility study. There is potential for the City to be a participating party and gain access to a portion of the additional storage and supply in this project. With significant interest in this project, negotiations for specific amounts of water may be challenging. It is recommended that the City remain engaged in this process and open to developing this supply option.

3.5.2 Priority 3 or 4 Colorado River Contract Water

Colorado River water rights could be obtained by purchasing land adjacent to the river that has historically been used for agriculture and conveying it through the CAP canal to the City. This could include Priority 3 and 4 contracts. Water contracts executed prior to September 30, 1968 are Priority 3 and have a higher delivery priority than the CAP. Water contracts executed after this date (including CAP water) are Priority 4.

This type of water purchase and conveyance through the CAP canal would require review and approval from the Secretary of the Interior, ADWR and CAWCD. These supplies could be used immediately by the City for either treatment and delivery to customers or for recharge for long-term storage credits. Priority 3 water would be less susceptible to drought than the City's CAP M&I sub-contract due to its higher priority on the Colorado River.

Acquiring these supplies could be challenging due to potential local opposition to following farmland and severing water rights in historically agricultural communities, potentially competing with CAWCD as well as other water providers for potential acquisitions, and gaining institutional approval from local, state, and federal entities. An additional challenge could include establishing agreements with CAWCD for conveyance capacity in the CAP canal when CAGRD/CAWCD could be a competing party in potential acquisition purchases.

3.5.3 Imported Groundwater

Another approach could include developing the groundwater supply outside of the Phoenix AMA and transporting the supply to the City. This could include groundwater from the Harquahala Irrigation Non-Expansion Area (INA), the McMullen Valley or Butler Valley areas. These supplies would require treatment prior to distribution. This concept would require IGAs and the development of wells outside the AMA along with pumping, transmission, storage, water treatment, and delivery infrastructure required to convey this water to the City's potable water system. Imported groundwater supplies will likely be expensive to acquire and significant infrastructure would be needed to access this water. There may be a potential to develop a partnered project with other communities that may improve the economic viability of this project.

3.5.4 Water from the Buckeye Canal

The Buckeye Canal passes through the City and serves BWCDD irrigation lands that someday are expected to develop. This could free up canal water for other uses that perhaps includes increasing the City's potable water supply. Water from this canal is attractive as a water supply because these canals convey a substantial amount of water through the City and would likely be much less expensive than importing water from afar. There are a number of issues that need to be investigated to determine the viability of this canal as a water source. These issues include:

1. What is the volume of water potentially available and what portion of the water is surface water, groundwater, and reclaimed water?
2. What are the legal issues that would need to be addressed in using this water?
3. Since reclaimed water is comingled in the canals with other water, would ADWR allow the reclaimed and surface water portions of this water to be recharged?

There may also be opportunities to exchange reclaimed water with BWCDD for other surface water. It is recommended that the City continue to work with BWCDD and ADWR to vet options for beneficial use of water supplied through the Buckeye Canal.

3.5.5 Regional Partnerships

The City could partner with other West Valley communities to develop a regional water supply solution. These partnerships could identify new water resources, or water sources that could be developed from water that is not currently being used to its full potential. These potential buildout supply alternatives can be further studied independently to determine their feasibility, project requirements, and costs to develop the required water supply.

3.5.6 Advanced Water Purification

The Arizona Department of Environmental Quality (ADEQ) is currently developing rules for the Advanced Water Purification (AWP) Program. On July 9, 2024, ADEQ published the draft AWP rules, and the final rules are anticipated by December 31, 2024. If pursued, AWP would provide an additional reliable, locally controlled, and drought-proof supplemental water supply for the City. Opportunities may arise for partnering with other cities on a regional AWP program. It is recommended that the City remain engaged in regional discussions on AWP. Beyond the possibility for regional AWP, the City could engage in a study to evaluate the feasibility of AWP locally at existing City facilities. Key elements of this study would include a flow balance to determine flows potentially available for AWP and an evaluation of water quality conditions at existing City facilities to inform the development of treatment train options.

3.6 Water Supply Development Strategies for Rainbow Valley

Within the Phoenix AMA, the City is unique in that its service area includes the Rainbow Valley groundwater sub-basin which is not within the Phoenix AMA groundwater model. Current rules allow developers in Rainbow Valley to continue to obtain CAWS with groundwater as the sole source of supply, which is not currently allowed elsewhere in the Phoenix AMA. With the announcement that no new CAWS would be issued using groundwater as a source within the Phoenix AMA, there has been more development interest in Rainbow Valley. The City currently serves water to customers in Rainbow Valley and anticipates continued growth there over the next several decades.

In support of its 2024 MDAWS application, the City conducted a hydrologic study for the Rainbow Valley portion of the City's service area. The hydrologic study was based on existing AWS demands from developer projects plus a new amount of City pumping. These pumping demands were simulated in the hydrologic modeling analysis in a manner so as not to violate the AWS rule requirement of not creating aquifer drawdowns exceeding 1000 feet below ground surface over a 100-year period. The simulated modeling results for the three pumping wells produced estimated depths to groundwater of 480.20, 544.90, and 649.00 feet below ground surface, respectively. The results of the study demonstrated that the City could pump 1,160 AFY for the 100-year period in addition to the developer committed pumping. As a conservative assumption, no recharge of reclaimed water was assumed within the model.

Current development plans do not provide any new water sources to recharge the aquifer or to offset the groundwater pumping. Over time, the available aquifer storage will decline. When the City and other water users seek renewal of their designation of assured water supply in the future, the available physical supply determination of groundwater will decline due to dewatering. This means that future allowable pumping out of this aquifer will be reduced. A water supply based on groundwater pumping that dewateres the aquifer is not sustainable. New supplies will need to be developed and delivered to Rainbow Valley. If no other supplies are provided, the long-term sustainable supply will be reduced, and development will not be able to continue. ADWR is currently looking for ways to streamline the process for modifying existing DAWS to include new supplies or other limited changes. These potential policy changes could be beneficial to the City as new supplies are developed and delivered to Rainbow Valley.

In addition to supply sustainability considerations, the City faces challenges in expanding its systems in Rainbow Valley as a number of developers there have an approved AAWS. Under current ADWR rules there is not an established mechanism in place to govern the transfer of groundwater physical availability associated with a CAWS or AAWS to a Designated Provider. This creates an additional challenge for the City, as a Designated Provider, working to serve developments with an approved AAWS or CAWS to provide assurances that the City's Designation can support their developments. The City is currently working with several developers within Rainbow Valley to define service agreements and infrastructure plans. Achieving these agreements will take time and effort coordinating with ADWR, attorneys, and development representatives to establish a process that does not currently exist. Guidance from ADWR on new approaches consistent with Assured Water Supply rules that consider mutually beneficial approaches to transferring groundwater physical availability from an AAWS to a Designated Provider, will also be necessary as the City continues discussions with developers within Rainbow Valley.

Given these conditions in the Rainbow Valley sub-basin, the following guiding principles are recommended as the City constructs water conveyance, treatment, and delivery infrastructure. Further discussion of these principles is described in Chapters 4, 5, and 6.

- Emphasis local recharge and recovery within the AOHI as recharge facilities and recovery wells are built.
- As the City enters into development agreements, the City should seek to retain as much reclaimed water as possible for groundwater replenishment.
- As ADWR continues to evaluate the process for modifying the DAWS, it is recommended that the City remain engaged with this process so the City is aware of any policy changes and can take advantage of those as new supplies are brought to Rainbow Valley.
- A portion of the City's CAP water allocation could eventually be a water supply for Rainbow Valley, but additional infrastructure may be needed.

3.7 Drought Response and Water Conservation

3.7.1 Drought Preparedness Plan

The City has a Drought Preparedness Plan (DPP), completed in 2022, that outlines proactive measures to respond to local water concerns and denotes clear triggers for implementing demand reduction measures. Within the DPP, four water use restriction stages are defined:

1. **Stage 1: Water Watch** – Enacted in response to direct impacts to the City's water portfolio, no mandatory water reduction measures are implemented at this stage. Outreach and messaging will be employed to emphasize the need for voluntary water use reductions.
2. **Stage 2: Water Alert** – This stage may be triggered when demand reaches/exceeds 85 percent of the daily available water production capacity and there is no expected recovery of service for the next seven days. Under this stage, the City can implement a combination of voluntary and mandatory water reductions from users.
3. **Stage 3: Water Warning** – This stage may be triggered when demand reaches/exceeds 90 percent of the daily available water production capacity and there is no expected recovery of service for the next seven days. The City can implement mandatory water restrictions for some or all users.
4. **Stage 4: Water Emergency** – Triggered when demands exceed 95 percent of the daily available water production supply, the City can invoke the most severe water use restrictions for all users at this stage.

Additionally, the DPP established a Water Emergency Response Team (WERT) that will assess current and projected water supplies, demands, and shortages and provide recommendations to the City Manager. Assembly of this group will occur when one of the water use restriction stages is triggered.

The DPP includes a drought matrix that provides a list of water reduction measures the City could implement during shortages. This matrix includes qualitative estimated water savings and the difficulty of implementing each of the recommended response actions. The DPP does not include any quantitative water conservation targets for any of the water use restriction stages. Neighboring Cities have quantitative water conservation targets ranging from 5 to 20 percent reduction goals depending on the stage of drought. It is recommended that the City work to establish quantitative water conservation targets for each of the water use restriction stages defined in the DPP.

3.7.2 Goodyear's Current Conservation Program

As a designated municipal water provider, the City has a legal obligation to reduce per capita groundwater reuse as a part of the 1980 Groundwater Management Act. The City currently implements a variety of water conservation practices that raise awareness of water conservation, help customers adopt good water management and irrigation practices, and help high water users learn to reduce water consumption. The City provides a number of rebates and incentives for residential customers including free home water checks and free home water conservation kits and brochures. Several rebates and incentives are also available to Homeowners Associations (HOA), multi-family residences, and businesses. The City supports several educational and outreach programs that range from providing free brochures and water guides to providing hands-on science, technology, engineering, and math (STEM) activities and classes for Grades 4-12. Additionally, the City has several ordinances focusing on water conservation.

3.8 Recommended Strategies to Manage Water Supplies and Demands

The City has sufficient renewable supplies in the water portfolio to meet the total potable and non-potable projected demands through year 2038 with a surplus of nearly 10,000 AFY in 2038. While the City has adequate renewable supplies to meet demands, additional capacity for CAP water and additional recharge capacity would be required to fully utilize these resources.

The following are recommended to help the City as it continues to develop and maintain a sustainable water supply to meet the needs of City residents and businesses:

1. The City has significant volumes of reclaimed water produced that exceed the projected reclaimed water non-potable demands. The annual recharge capacity of the SAT site cannot currently be utilized because of a reclaimed water transmission main restriction that limits water deliveries. It is recommended that the City take immediate action to install the needed transmission capacity to fully utilize the SAT site recharge capacity.
2. Beginning in 2033, the City is anticipated to have reclaimed water produced in excess of non-potable demands and the permitted recharge capacity of the SAT site (assuming action is taken to allow for the full permitted capacity of the SAT site to be used). To utilize this additional reclaimed water produced it is recommended that the City construct additional recharge capacity (2,500 AFY). Hydrogeologic studies will be required to identify favorable places for recharge.
3. Because of the importance of reclaimed water in the City's water resource portfolio, the City should structure any future development agreements and establish policies so that the City retains the reclaimed water for recharge. Additionally, the City should also seek opportunities to restructure existing agreements with developers to increase the amount of recharge that is available to the City.
4. The City should continue to pursue maximizing its reclaimed water recharge capability to offset groundwater pumping.
5. Annually, purchase the City's full allotment of CAP water to recharge until this water is required to supply current demands. The City should consider expanding the capacity at the SWTP prior to 2030 to allow for the utilization of the City's full CAP allotment.
6. The City should recharge and recover CAP water within the AOHI whenever possible as water recovered within the AOHI of a USF or within the boundaries of a GSF is not counted against the groundwater physical availability established in City's Designation.
7. As the City is more certain how its CAP water will ultimately be deployed, there will be less of a need to maintain capacity in CAWCD recharge facilities. There may be opportunities to lease capacity to other utilities, particularly those that have recovery wells within the AOHI of those facilities.
8. Seek opportunities to bank additional LTSCs to provide a mechanism to replenish groundwater pumped in response to reductions of CAP water allocations during drought. This protects the City if ADWR does not grant groundwater pumping exemptions to cover the City's groundwater replenishment obligations during extended periods of drought.
9. Seek opportunities to work with ADWR to establish guidance on new approaches that consider approaches to transferring groundwater physical availability from an AAWS to a Designated Provider, as the City continues discussions with developers within Rainbow Valley.

10. Develop quantitative water conservation targets for each of the water use restriction stages defined in the City's DPP.
11. Continue to engage with SRP in discussions regarding Bartlett Dam surface water.
12. Pursue opportunities to purchase or lease water that currently flows in the Buckeye irrigation canal. This potential water source is physically located in the City and therefore is more accessible than other water sources. As development occurs, this water supply might be purchased. The City should undertake a study to determine the legal issues that would need to be overcome before obtaining a right to this water. Negotiations should ascertain supply availability, canal operations, bulk water delivery potential, and recharge opportunities for LTSCs.

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CHAPTER 4 WATER INFRASTRUCTURE MASTER PLAN

4.1 Introduction

Chapter 4 presents the water system evaluation for the City as part of the 2024 IWMP. The purpose of this water master plan is to identify the water system improvements and timing to serve the City's needs through the 2030, 2035, and 2040 infrastructure planning periods. To develop the master plan, a hydraulic model was prepared to evaluate the capacity of the distribution system in each infrastructure planning period. Proposed future infrastructure was evaluated, the timing of the future water treatment facility expansion was determined, and a plan for future water system expansion was developed.

This chapter of the IWMP contains the following sections:

- 2024 Water Distribution System.
- Water Model Update.
- Calibrate model based on 2023 pressure monitoring data.
- Water system evaluations based on performance criteria and condition assessment.
- Future Water Distribution System Plan.
- Buildout Water System Hydraulic Evaluation.
- Water System Capital Improvement Projects.
- Conclusions and Recommendations.

4.2 2024 Water Distribution System

The City's water service area is divided into five water planning areas. The City's water planning areas are shown in Figure 4.1. WPA 2 contains the Goodyear SWTP and the wells that are currently in service. A one square mile area north of Van Buren St and west of Citrus Rd is served by the Arizona Water Company. A one-quarter square mile area south of Yuma Rd and East of Citrus Rd is served by Utility of Greater Buckeye Inc. WPA 3 includes Estrella and King Ranch, which is expected to start developing in the next five years. WPA 4 is currently undeveloped. The developments Terrasante, Rainbow Valley, and Estrella Highlands in WPA 4 are expected to start developing in the next five years. Some or all of these three developments may be served by a private water provider, however, this report assumes that all three areas will be served by the City. Planning infrastructure for these areas is one of the objectives of this report. WPA 5 is undeveloped. WPA 5 is not expected to start developing during the planning periods of this master plan and the area may be served by a private utility, so it is not included in this master plan.

4.2.1 Pressure Zones

The City's water distribution system is split into two major areas: WPA 2 which includes Central Goodyear and WPA 3 which includes Estrella. WPA 2 is located north of the Gila River and contains a mix of residential, commercial, and industrial developments. WPA 3 is located south of the Gila River and consists of relatively new residential developments with some community commercial development.

Figure 4.2 shows the City's existing (2023) water distribution system and pressure zones. The City's water distribution system consists of three primary pressure zones and two sub-pressure zones: Central, Zone 1 South, Zone 1 Reduced, and Zone 2 South. Central Goodyear (WPA 2) is served by the Central Zone. WPA 3 is served by the Zone 1 South and Zone 2 South pressure zones. Zone 1 South has a reduced pressure zones at lower elevations (Zone 1 Reduced). Pressure zones are shown in Figure 4.2. A pressure zone schematic of the distribution system is provided in Figure 4.3 to illustrate the elevation ranges of each pressure zone and how the pressure zones are supplied.

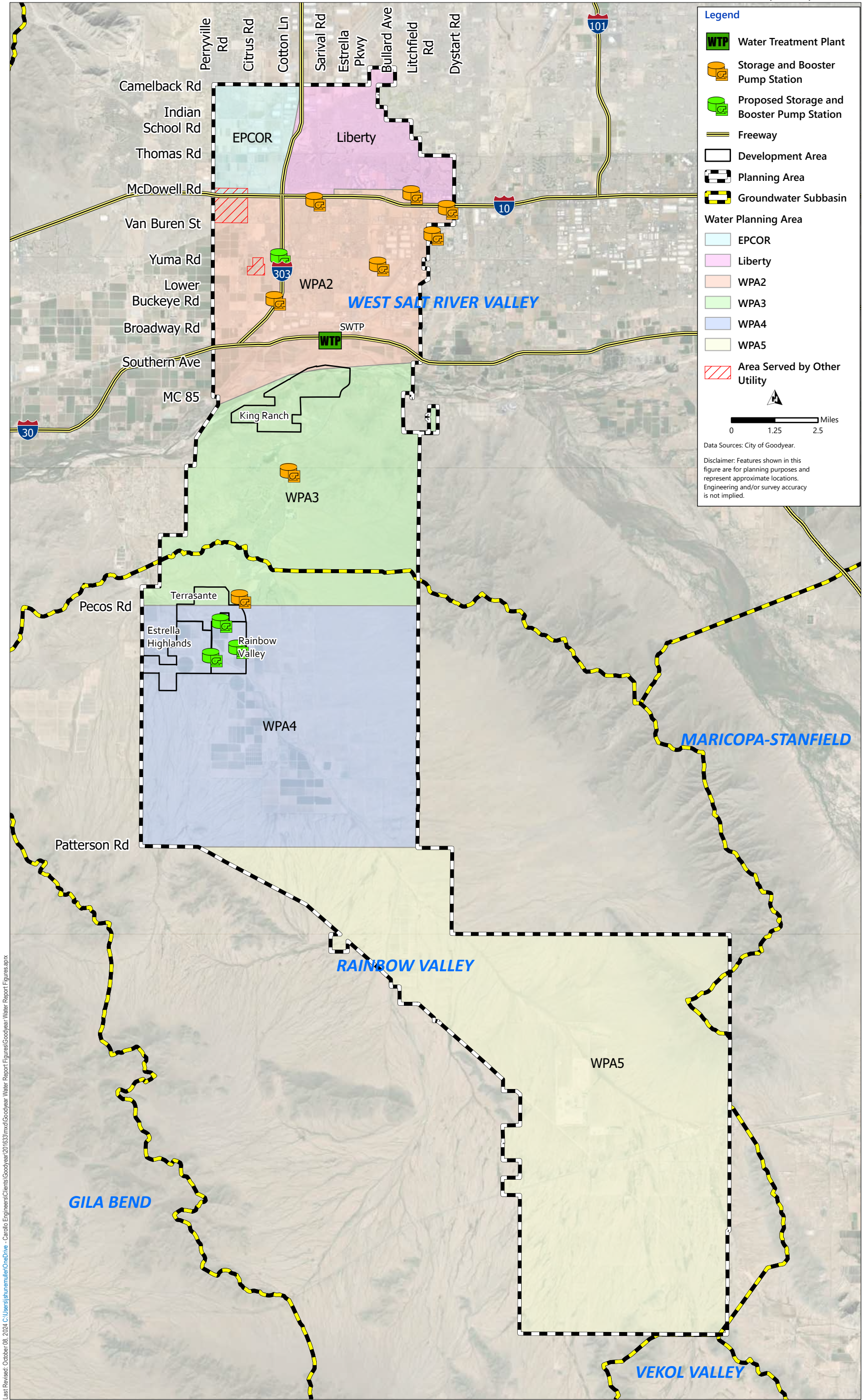


Figure 4.1 City of Goodyear Water Planning Areas and Supply Facilities
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

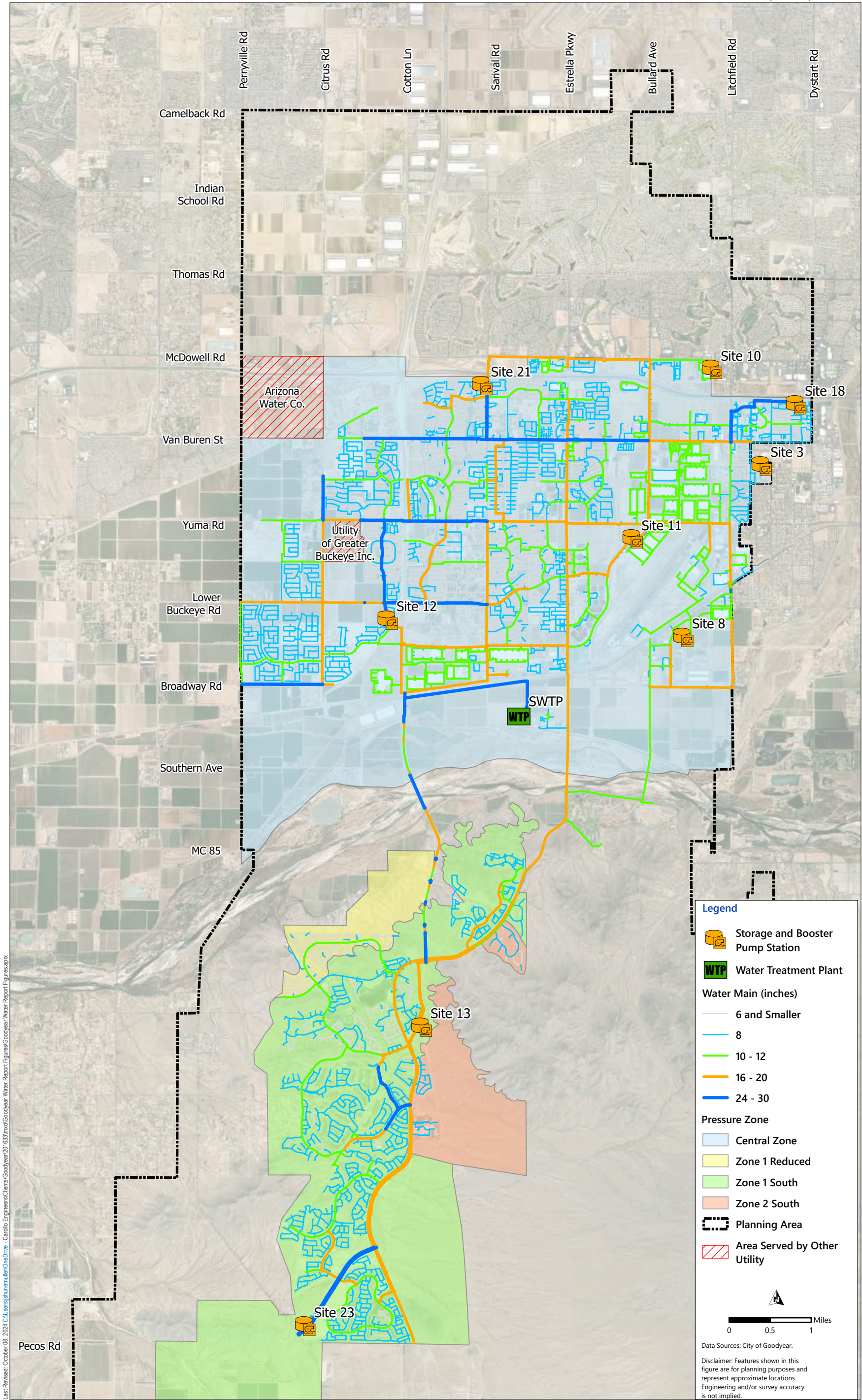
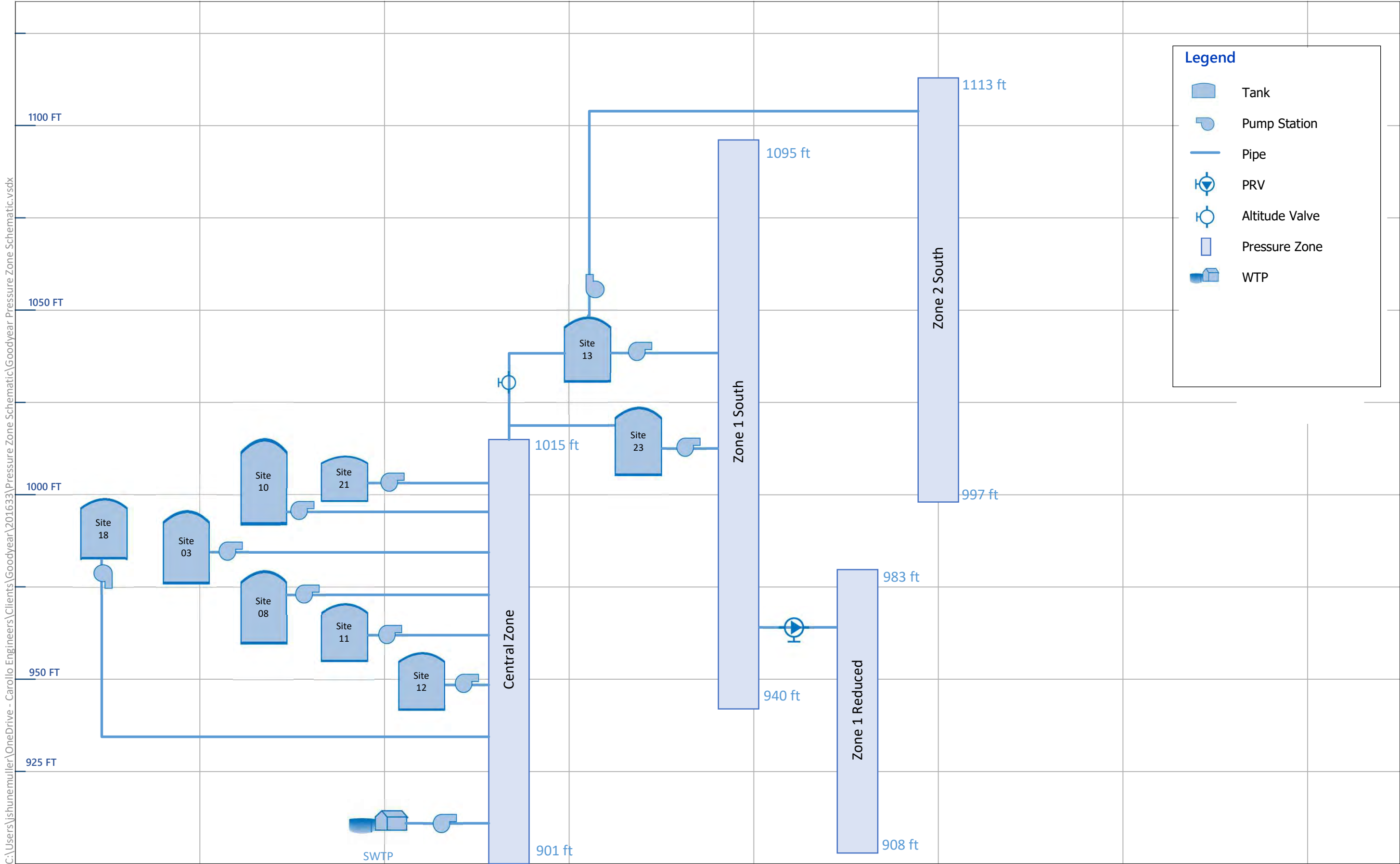


Figure 4.2 2023 Water Distribution System
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN



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4.2.2 Water Supply Facilities

4.2.2.1 Wells

The City has 15 wells that are in WPA 2, of which 13 are active. The location of each well is shown in Figure 4.4 and pumping flow rates are summarized in Table 4.1. Well 3 is the only well that does not require treatment or that is not used in a blending program to help other wells meet water quality requirements. Water from wells that require treatment is pumped to a storage and pumping site that is also equipped with a treatment facility.

The City's well treatment sites are listed below with a description of treatment activity:

- **Site 11 (Bullard Water Campus)** – RO treatment is provided to Wells 19, 22, and 26. Wells 1, 11, and 20 are blended with the RO product water in the finished water reservoir. Blending schemes are important to maintain capacity at the Bullard Water Campus and the loss of one well may impact the ability of the City to use another well.
- **Site 12** – RO treatment is provided for Well 12 and Well 24.
- **Site 21** – Arsenic treatment is provided for Adaman Wells 1 and 2.
- **Site 18** – Before the well failed, arsenic treatment was provided for Well 18B, which was blended with water from Wells 6 and 18A in the finished water reservoir.

Table 4.1 City of Goodyear Wells

Well	Pumping Flow Rate (gpm) ⁽¹⁾	Point of Entry into the Water Distribution System
Well 1	500	Site 11
Well 3	425	Well 3
Well 6	485	Site 18
Well 11	620	Site 11
Well 12	850	Site 12
Well 18A	850	Site 18
Well 18B ⁽²⁾	0	Site 18
Well 19	750	Site 11
Well 20 ⁽³⁾	1,600	Site 11
Well 22 ⁽³⁾	1,950	Site 11
Well 24	2,300	Site 11
Well 26	1,900	Site 12
Adaman Well 1	1,340	Site 21
Adaman Well 2	500	Site 21
Adaman Well 3 ⁽⁴⁾	1,200	Site 21
Total	15,270	
Toal (mgd)	22.0	

Notes:

- (1) Production capacities for each well were provided by the City.
- (2) Well 18B has failed and needs replacement.
- (3) Well 20 requires blending with Well 22 to manage arsenic levels.
- (4) Adaman Well 3 is currently offline but expected to be brought online in the future. Therefore, it is listed as out of service for calculating the City's current "Firm" capacity.

4.2.2.2 Surface Water Treatment Plant

The City's surface water is a CAP allocation that is wheeled through the interconnect at the Granite Reef Dam and wheeled through SRP canals to a location in Avondale where a pump station delivers through a 24-inch pipeline and treated at the City's SWTP.

The City's SWTP reliable production capacity is 4,500 gpm. A future expansion is planned to increase the water production to 10,500 gpm. The SWTP is co-located with the 157th Avenue WRP so that in the future, the City could implement DPR if it chose to do so. The SWTP is also shown in Figure 4.4.

4.2.3 Pump Stations

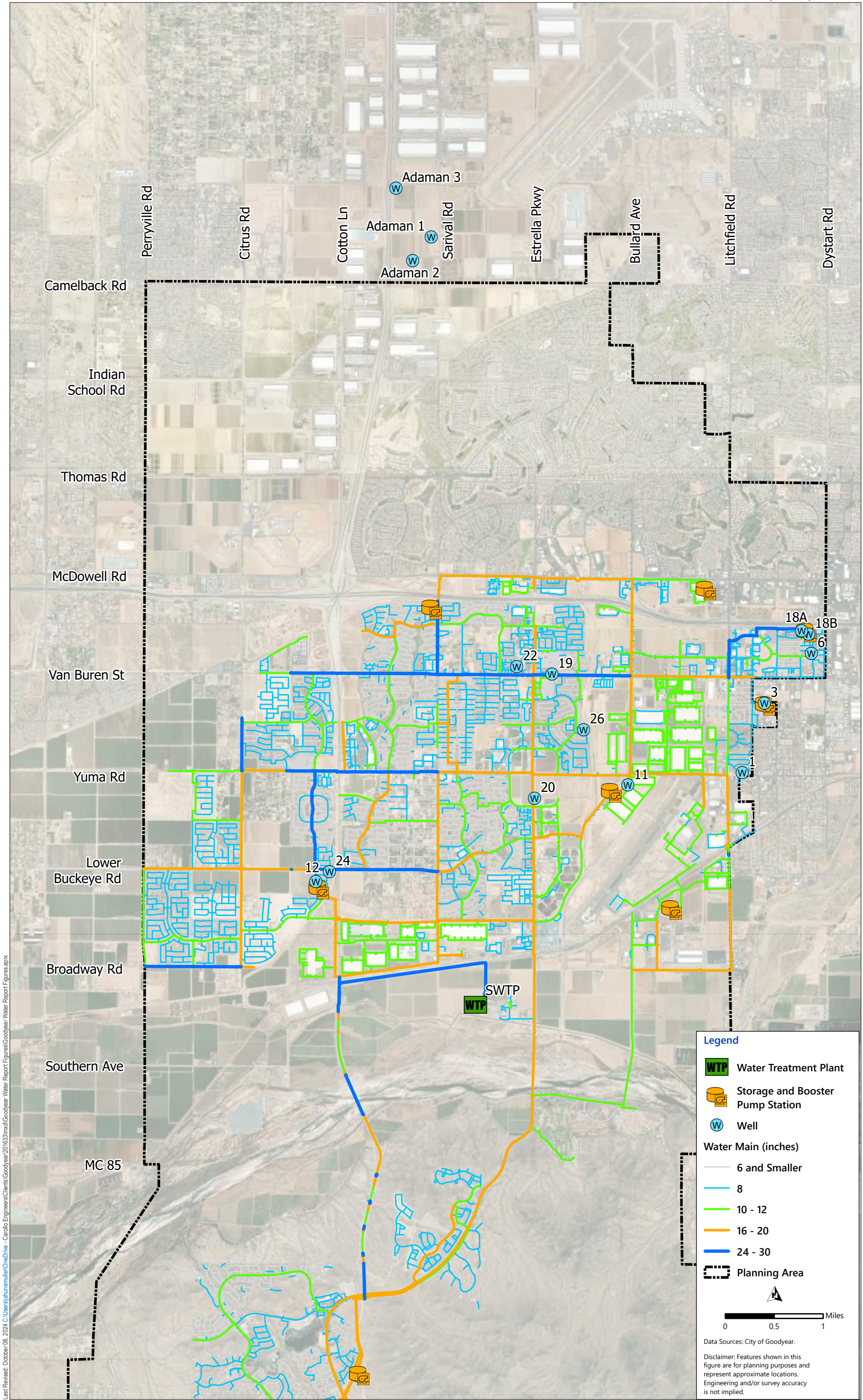
The City currently has 10 storage and booster pump station sites, not counting the pump station at the SWTP. Eight of the booster stations are in the Central Zone and two are in Zone 1 South. Five of the pump stations in the Central Zone are supplied by wells (Sites 3, 11, 12, 18, and 21). Three of the pump station sites (7, 8, 10) store distribution system water during low demand times and then pump the water out to help supply peak hour demands. Of these three, Site 7 has been taken out of service. Site 8 is outdated and was being considered for abandonment but may be kept to help provide fire flows for nearby data centers or be replaced with a newer facility. The City is planning to construct a new 1.5-million-gallon (MG) tank at Site 18 to offset the retirement of storage at Sites 7 and 8.

Site 13 has two sets of booster stations, one to deliver water to Zone 1 South and the other to deliver water to Zone 2 South. Site 13 (Zone 2) station has three pumps but currently, only two pumps can be run at a time due to power restrictions. The Site 23 booster pump station takes water from the Central Zone and pressurizes the southern part of Zone 1 South. Site 23 is also located where it can provide a water supply to future development in WPA 4.

Table 4.2 summarizes the booster pump stations in the water distribution system.

Table 4.2 Goodyear Pump Station Summary

Site Name	Elevation (ft)	Pressure Zone(s)	Number of Pumps	Total Capacity (gpm)	Firm Capacity (gpm)
Site 3	977.9	Central	2	1,000	500
Site 7	907.6	Central	3	1,500	0
Site 8	959.2	Central	2	1,000	500
Site 10	990.4	Central	2	1,000	500
Site 11	954.7	Central	6	5,600	4,800
Site 12	943.3	Central	6	6,500	6,500
Site 13 (Zone 1)	1031.9	Zone 1 South	5	6,400	3,400
Site 13 (Zone 2)	1031.9	Zone 2 South	3	1,000	500
Site 18	985.7	Central	3	2,800	1,840
Site 21	998.6	Central	5	7,040	5,200
Site 23	1008.0	Zone 1 South	5	11,070	7,710



4.2.4 Storage

The City currently has a storage reservoir located at each of the ten booster pump station sites, and Site 12 has two storage reservoirs, for a total of 11 reservoirs, as well as additional storage available at the SWTP. The City has a total of 14.28 MG of available storage capacity: 8.98 MG in the Central Zone and 5.30 MG in Zone 1 South. Table 4.3 summarizes the capacity of the City's storage reservoirs.

Table 4.3 Goodyear Existing Storage Reservoir Summary

Site Name	Pressure Zone	Total Capacity (MG)	Available Capacity (MG) ⁽¹⁾
Site 3	Central	0.18	0.16
Site 7	Central	0.75	0.00
Site 8	Central	0.75	0.65
Site 10	Central	0.75	0.67
Site 11	Central	2.00	1.70
Site 12	Central	2 @ 2.00	3.20
Site 18	Central	1.00	0.80
Site 21	Central	2.00	1.60
SWTP	Central	0.20	0.20
Central Zone Total		11.63	8.98
Site 13	Zone 1 South	1.5	1.3
Site 23	Zone 1 South	5.0	4.0
Zone 1 South Total		6.5	5.3

Notes:

(1) Less than the actual rated capacity of the reservoir. Indicates estimate of usable capacity after accounting for the reservoir overflow elevation and the space needed to keep pumps from running dry.

4.2.5 Pipelines

The City's water distribution system consists of 451 miles of water distribution mains ranging from 4 to 30 inches in diameter. Table 4.4 presents a summary of the water mains by diameter, based on the City's GIS geodatabase. As shown in Table 4.4, approximately 63 percent of the City's water mains are 6 or 8 inches in diameter and approximately 30 percent of water mains are 10 to 16 inches in diameter.

Table 4.5 summarizes the City's water mains by pipe material. Over 90 percent of the water mains are ductile iron and most of the remaining pipes are asbestos cement.

Table 4.6 summarizes the City's water mains by decade of installation. Over 70 percent of the City's water mains have been installed since the year 2000. Only 3.6 percent of the City's water mains are 50 years or older. Therefore, most of the Goodyear water system is relatively new.

The data for Table 4.4, Table 4.5, and Table 4.6 was obtained from the City's GIS data. Pipes in the GIS that are smaller than 4 inches in diameter were assumed to be privately owned service mains and were excluded from these tables.

Table 4.4 Water Main Lengths by Diameter

Diameter (in)	Length (mi)	Percent of System
4	5.1	1.1%
6	139.0	30.8%
8	146.8	32.5%
10	7.9	1.8%
12	66.3	14.7%
16	61.8	13.7%
18	0.3	0.1%
20	3.8	0.9%
24	16.2	3.6%
30	3.9	0.9%
Total	451.1	

in - inch(es); mi - mile(s)

Table 4.5 Water Mains by Material

Pipe Material	Total Length (mi)	Percent
Asbestos Cement	37.0	8.2%
Ductile Iron	410.2	90.9%
Polyvinyl Chloride (PVC)	3.9	0.9%
Unknown	0.005	0.0%
Total	451.1	

Table 4.6 Water Mains by Age

Pipe Install Decade	Total Length (mi)	Percent
1950s	2.2	0.5%
1960s	2.4	0.5%
1970s	11.7	2.6%
1980s	65.8	14.6%
1990s	48.0	10.6%
2000s	293.5	65.1%
2010s	26.2	5.8%
2020s	1.3	0.3%
Unknown	0.02	0.0%
Total	451.1	

4.3 Water Distribution System Hydraulic Model Update

The City's previous water system model used the Infowater modeling software. However, the companion sewer modeling software is no longer commercially available, and it is useful to have the water and sewer models provided by the same company and with a common user interface. Therefore, in this project, a hydraulic model of the City's water system was developed and calibrated using the Aquanuity Water software that is very similar to the Infowater software. The model was created from the City's GIS data and facilities information provided by the City. The hydraulic model was used to evaluate the existing and future capacity of the water distribution system, to identify system deficiencies and CIP to address the system deficiencies.

4.3.1 Water Demand Allocation

Water demands were calculated based on customer billing data that was geocoded to the property parcel, and land use data based on zoning information. Demands were set to align with water production data, including non-revenue water. Demands were allocated spatially to the nearest node in the model.

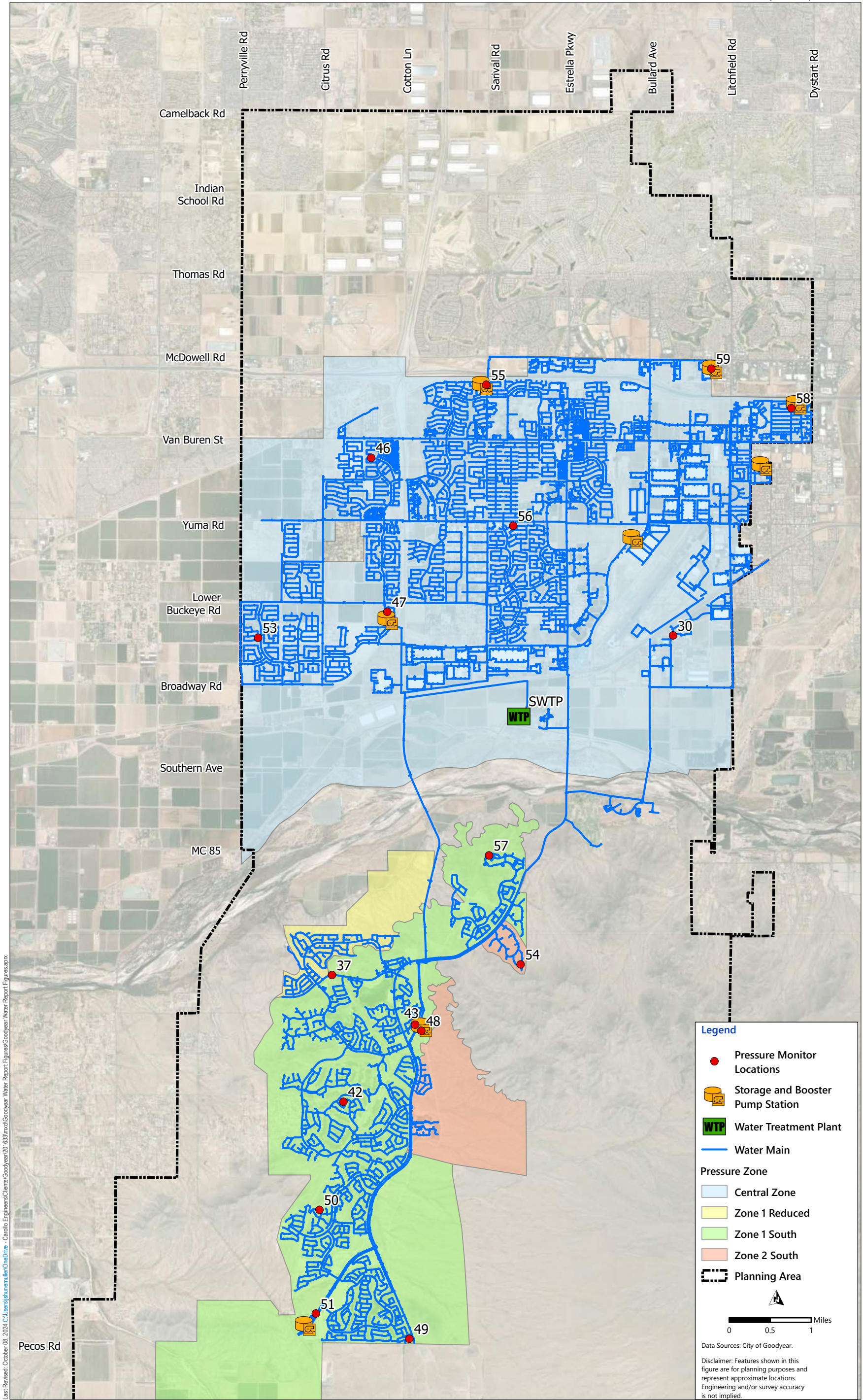
4.4 Hydraulic Model Calibration

Hydraulic model calibration is a crucial component of the hydraulic modeling effort because it is used to validate model accuracy and to establish a level of confidence in the model. Once the model was developed, field testing was performed to collect pressure data to calibrate the model. Calibrating the model improves the accuracy of the model in predicting system performance, which is used to identify system deficiencies, and improvement recommendations to address identified deficiencies. This section summarizes the overall methodology employed to calibrate the City's water distribution system hydraulic model and the calibration results.

4.4.1 Pressure Monitoring Field Test

A pressure monitoring field test was performed from August 29, 2023, to September 12, 2023. Pressure data was collected in 15-minute intervals at 17 locations throughout the City's water distribution system. These locations shown in Figure 4.5 were chosen through collaboration between the City and Carollo to obtain pressure data near booster pump station discharges and at vital points of the system (such as high elevation areas, areas where the City has noted pressure issues in the past, and areas in residential developments that do not have any nearby pump stations).

Supervisory control and data acquisition (SCADA) data from 7 pump stations for the same time period were also provided by the City. The pressure monitoring and SCADA data are essential for multiple reasons. First, the data provides accurate insight into the typical operating pressures and hydraulic grade lines (HGL) in each pressure zone. The HGLs of different test locations within a pressure zone should align relatively closely and can be used as an indicator of reliable test data. Second, the water distribution system hydraulic model can be calibrated so that pressure results in the model match those observed in the field test. Figure 4.6, Figure 4.7, and Figure 4.8 show the HGLs from the pressure monitoring field test and SCADA data in the City's three pressure zones. One observation from the field test results is that the pressures do not drop significantly during peak demand hours of the day. This is an indication that the water distribution system does not appear to be stressed while delivering peak demands. At any given time the head loss across the distribution system is about 20 feet, which is relatively small, except for Zone 2 South, which is small and not well networked.



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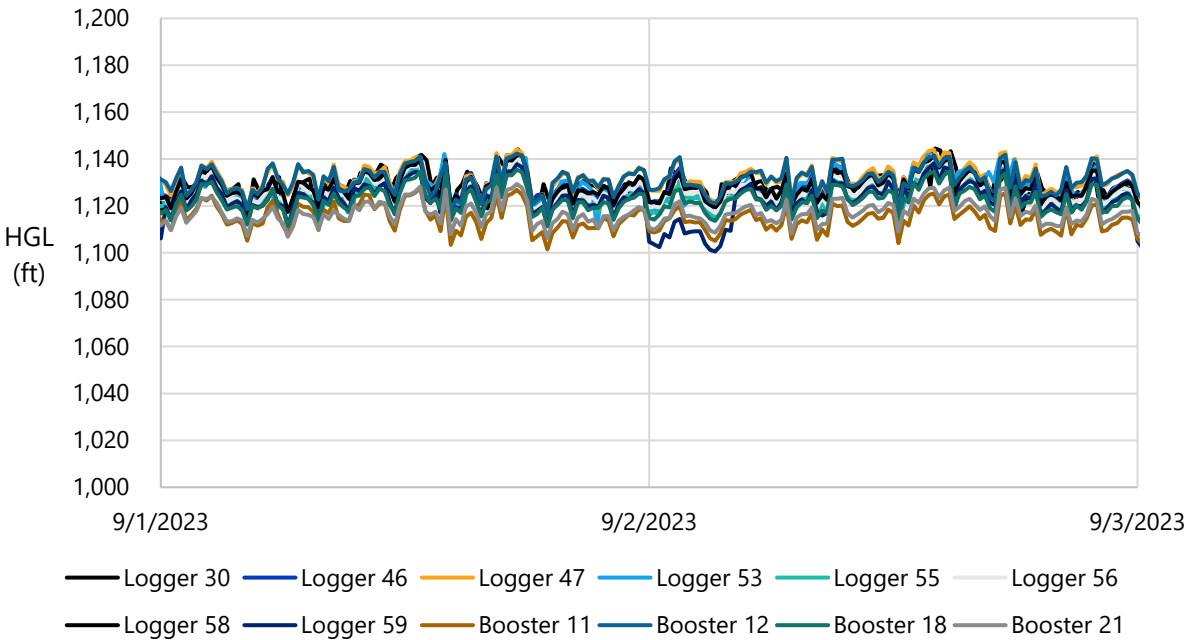


Figure 4.6 Central Zone Field Test and SCADA Data Hydraulic Grade Lines

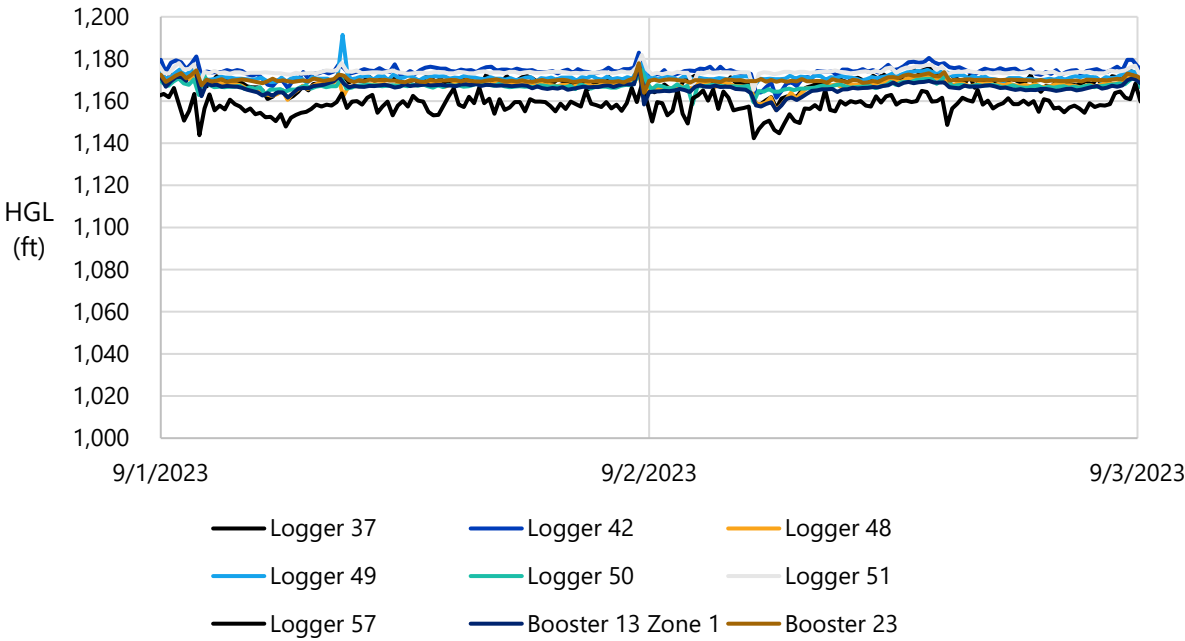


Figure 4.7 South Zone 1 Field Test and SCADA Data Hydraulic Grade Lines

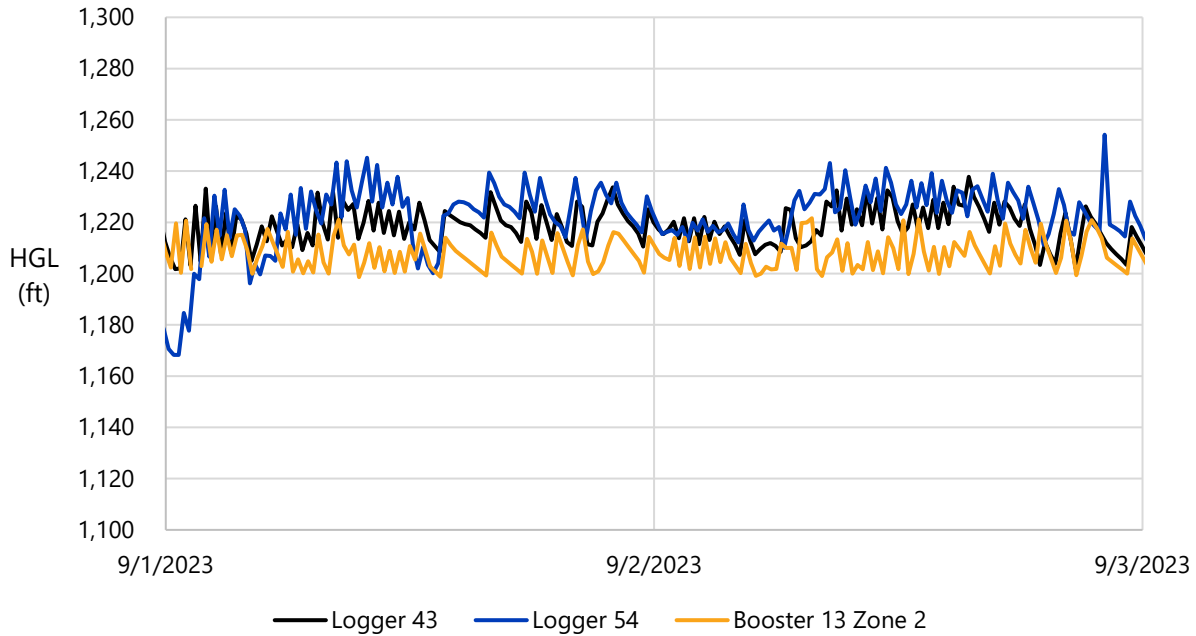


Figure 4.8 South Zone 2 Field Test and SCADA Data Hydraulic Grade Lines

Calibrating the model pressure results is performed by adjusting pump discharge pressure settings, adjusting pipe roughness factors, and verifying the accuracy of model facility data (such as pipe diameters and junction elevations). Because the pressure monitors used in the field test have a margin of error of ± 1 pounds per square inch (psi), a calibrated model pressure that is within 5 percent of the field test pressure is determined to be sufficiently accurate. Table 4.7 summarizes the pressure monitoring and model calibration results which are less than ± 5 percent.

Table 4.7 Pressure Monitoring Field Test and Model Calibration Results

Pressure Monitor Number	Average Field Data Pressure (psi)	Model Pressure (psi)	Percent Difference
30	70.7	68.1	3.7%
37	98.3	96.7	1.6%
42	74.7	71.3	4.5%
43	83.6	82.3	1.5%
46	58.5	56.4	3.6%
47	81.5	79.5	2.4%
48	57.1	56.7	0.8%
49	46.3	45.6	1.6%
50	41.8	42.6	-1.9%
51	69.5	67.8	2.4%
53	84.2	81.8	2.9%
54	54.9	56.4	-2.7%
55	52.6	50.0	4.9%
56	64.4	62.8	2.6%
57	79.3	82.9	-4.5%
58	59.1	56.6	4.2%
59	55.8	54.1	3.1%

4.5 Water Distribution System Performance Criteria

Performance criteria are the standards of measurement used to evaluate the adequacy of water distribution system infrastructure. Performance criteria are based on legal requirements and engineering best practices.

4.5.1 Overview

Performance criteria address water supply redundancy, water system reliability, and system operational requirements. Performance criteria are more general than design criteria, which provide specific requirements that must be incorporated into new infrastructure.

Performance criteria are based on legal requirements and engineering best practices. According to the Arizona Administrative Code (A.A.C.), public water systems shall be designed using good engineering practice (R-18-5-502). The water system performance criteria for the IWMP include standards from the A.A.C., Engineering Bulletin No. 10 (issued by the Arizona Department of Health Services, May 1978), water industry best practices, and performance criteria established in the City's previous Integrated Water Master Plans. These "standards of measurement" are considered good engineering practice and provide the City acceptable levels of water system performance and reliability.

4.5.1.1 Water Supply Redundancy

Water supply redundancy refers to the degree to which water can still be supplied to the City if one or more of the water supply sources is unavailable. Decisions concerning the extent of redundancy are often policy decisions influenced by the price a utility is willing to pay for the redundancy compared with the risk of having to implement water use restrictions or provide a lower level of service to the customer. Under some conditions, it may be more economical for the City to implement water use restrictions than to build infrastructure that will be used only on infrequent occasions when a particular water source may be unavailable. Water supply redundancy needs depend on the unique water supplies of each city. Most communities in central Arizona that rely on surface water seek to provide redundant or backup water supplies for outages of canals that deliver SRP or CAP water supplies under average day demand conditions. For communities that rely on groundwater, holding one or more production wells in reserve (firm capacity) is a common way to provide water supply redundancy.

4.5.1.2 Water System Reliability

The City's water system reliability is dependent on the reliability of all the components within the system as well as the reliability of support systems and services outside of the City's control (Adaman wells and power supply). The level of reliability provided is usually based on historic operational experience and judgment, which results in confidence that the system can deliver water under a variety of normal and emergency conditions. Consequently, professional judgment must be used when specifying system components and the number and location of components needed to meet reliability criteria.

The level of reliability provided by the system is a function of the reliability of the major system components:

- Raw water sources.
- Treatment processes and/or facilities.
- Major transmission mains.
- Power sources.
- Booster stations.
- Storage tanks.

Reliability of the City's water system is provided by a combination of the following factors:

- Sufficient groundwater production to meet maximum-day demand.
- Reserve system storage to meet emergency conditions, in addition to fire and normal operational needs.
- Transmission capability to deliver water to the distribution system.
- Looped transmission and distribution system network to provide multiple pathways for water to reach customers.
- Sufficient booster pumping capabilities with a pump station or the largest pump in a station out of service.

4.5.1.3 Water System Operational Requirements

Water system operational requirements refer to the level of service provided by a utility to the customer. Levels of service include many parameters, such as minimum and maximum pressures, maximum flow velocities, storage, redundancy, and provisions for emergency conditions. Adequate pressure is usually defined in terms of a minimum pressure under certain demand conditions, such as peak hour or fire flow. Adequate fire protection refers to providing adequate storage volume and flow to meet firefighting demands. The water system is adequate when system demand conditions are satisfied while meeting system performance criteria, such as system pressure, velocity, and head loss.

4.5.2 Water Production Facilities

Production facilities for the water system should have sufficient capacity to meet the demands of the maximum day of the year. For systems served with groundwater wells, it is standard practice to evaluate production capabilities based on "firm" capacity, or the capacity with the largest well out of service in each pressure zone.

For Goodyear, the largest production well is Well 24. However, treated water from Well 22 is blended with water from the City's second largest well, Well 20 to meet water quality requirements. Because of this, when Well 22 is removed from service, Well 20 cannot be used. Therefore, Goodyear's "firm" capacity results in Wells 20 and 22 being removed from service instead of Well 24.

4.5.3 Fire Flow

The City of Goodyear's Fire Department has adopted the 2006 International Fire Code (IFC 2006) as documented in Chapter 5 of Goodyear's City Code. Depending on the type of use, construction, fire area, the required fire flow and duration ranges from 1,500 gpm for 2 hours to 8,000 gpm for 4 hours as shown in IFC 2006 Appendix B, Table B105.1. The IFC 2006 allows reductions in fire flow requirements for structures with approved automatic sprinkler systems and installation practices, which can be granted at the discretion of Goodyear's Fire Marshall.

For the purposes of the water system master plan system evaluations and future system planning, master planning fire flow requirements were developed that are general and based on land use. For single-family residential land uses the master planning fire flow requirement is 1,500 gpm for 2 hours. For commercial and industrial land uses the master planning fire flow requirement is 3,500 gpm for 4 hours.

The actual fire flow requirements for future, individual structures shall be determined in accordance with the IFC 2006 (or the City's currently adopted standard) as documented in the Goodyear City Code.

It is assumed that a major fire will not occur during the peak hour demand condition since the chance of this happening is minimal. Rather, it is more likely that a fire could occur under maximum day demand conditions. Therefore, in the system evaluations, fire demand will be applied under maximum day demand conditions.

4.5.4 Pump Stations

Usually pumping stations are the most critical components in a distribution system with respect to meeting reliability/redundancy criteria, because these facilities are subject to disruption by the following conditions:

- Power outage.
- Mechanical failure.
- Line breaks.
- Table 4.8 summarizes these conditions and the criteria to be employed for reliability in this master plan update.

Table 4.8 Pump Station Reliability Criteria

Condition	Result	Mitigating Criteria
Power Outage	Creates loss of pumping capacity at one or more pumping facilities.	Provide emergency backup power supply generation or dual power feed to critical facilities.
Mechanical Failure	Creates loss of pumping capacity due to one or more pumps at a facility being out of service.	Provide sufficient pumping capacity at each booster pumping station to meet maximum day demands with any one pump or the largest pump out of service (referred to as "firm capacity" of the station). This allows for pumps to be out of service due to mechanical failure or unscheduled maintenance.
Line Break	Occurs at or near the booster station, creating a loss of all or a portion of the pumping capacity at the facility.	A line break at or near a booster station disrupting supply is usually mitigated through multiple pumping facilities, storage, and pressure reducing valves (PRV) facilities (where available).

For line breaks affecting critical pumping facilities, reliability/redundancy criteria are established so that average day demand conditions can be met for each pressure zone.

A pump station pumping to a closed system, with no other water sources or elevated storage, should be sized for the larger of peak hour demand or maximum day plus fire flow demand. Diurnal demands (peak hour) and fire demands will be met from ground storage, and the booster stations will need to be able to pump this flow from the reservoirs. Pump stations should be designed based on the capacity that can be consistently provided with the largest pump out of service (firm capacity). In addition, pump stations that deliver water into higher pressure zones must be sized to meet the demands of both zones, the parent and subordinate zones.

The following summarizes pump station criteria:

- When pumping to a closed system, the capacity equals the larger of 120 percent of peak hour demand or maximum day plus fire flow demand.
- The allowance for reliability and uncertainties in demand projections equals 10 percent of the station's firm capacity.
- Pump stations should be sized to meet demands with the largest pump out of service (firm capacity).
- When multiple booster stations supply a zone, average annual water demands should be supplied with the largest booster station out of service.

The firm capacity of booster stations that pump from reservoirs is often set so that half of the reservoir can be emptied in a six-hour period.

4.5.5 Transmission/Distribution Mains

Water system piping serves three basic purposes:

- To transfer water from the source of production to storage.
- To distribute water from the source of storage to the consumer.
- To provide a conduit to supply firefighting water.

Transmission and distribution mains are sized for the greater of the following two demand conditions:

- Maximum day demand plus fire flow.
- 120 percent of Peak hour demand.

The following pressure criteria are recommended to assess the adequacy of the water transmission/distribution system under the two demand conditions:

- **Peak Hour Demand** – Pressures must be greater than 40 psi and less than or equal to 80 psi. Criteria are established to account for distribution system and backflow prevention facility head loss to achieve a minimum service pressure of 40 psi.
- **Maximum Day Demand plus Fire Flow Condition** – A minimum of 20 psi at the point of maximum fire draft.

The water velocity criteria under maximum day demand conditions are as follows:

- Velocity $\leq$ 5 feet per second (ft/sec) for pipes < 36 inches diameter.
- Velocity $\leq$ 6 ft/sec for pipes $\geq$ 36 inches diameter.

The water velocity criteria under peak hour demand condition is as follows:

- Velocity $\leq$ 7 ft/sec.

The water velocity criteria under fire demand condition is as follows:

- Velocity $\leq$ 10 ft/sec.

4.5.6 Storage Facilities

Since production facilities are typically designed to operate at a steady rate over an extended period, storage reservoirs are planned to accommodate fluctuating demands. The factors included in designing reservoir capacity are diurnal demand fluctuations, fire demand, and emergency reserve storage. In some situations, it may be prudent to have an additional storage volume to provide operational storage. Storage facilities should be designed and operated to meet these conditions, while achieving storage turnover to minimize water quality degradation.

The City's current water storage capacity standard is to provide an amount equal to the average daily demand during the peak month of the year (maximum month conditions), which is outlined in A.A.C. R18-5-503A. In some cases, such as developing areas, this storage criteria is overly conservative, so a storage criteria of one day of the annual average demand is also used in developing areas.

The City's water system now incorporates a blend of groundwater and surface water. The City needs to be aware of the age of water stored in reservoirs and the potential to form disinfection by-products due to the organic compounds found in surface water. Storage will need to be managed in a way to maintain adequate supplies to meet demands and maintain adequate water quality. An adjustment in the City's storage performance criteria may be warranted due to these recent changes.

4.5.7 Development Factors Affecting Performance Criteria

The previously discussed performance criteria apply to pressure zones that have achieved growth generally greater than 50 percent of the expected build out population, with well-developed infrastructure including looped pipelines and a significant percentage of storage and booster pumping facilities in place.

In growth-oriented communities where new pressure zones are being established and proposed developments are located long distances from existing services, the initial population is low and new infrastructure does not usually achieve the criteria recommended for mature pressure zones while in the early stages of development. This is often referred to as "Satellite" development, where stand-alone water supply and delivery infrastructure must be used initially to serve customers until connections can be made to the City's system. These conditions typically occur for the following types of growth/development:

1. Growth in a new pressure zone that is not yet connected to the City's system.
2. Growth in an existing or new pressure zone that is connected to the City's system by a single feed or "umbilical cord" type infrastructure.

Under these growth and development conditions, water usage patterns can vary significantly from patterns observed in mature pressure zones and can greatly affect peaking factors and required storage and booster pumping. The peaking factors for the City's existing pressure zones were based on the previous master plan. When the City's SCADA system is fully operational, data will be available to more precisely calculate peaking factors.

- $MD/Average\ Day\ (AD) = 1.7.$
- $Peak\ Hour\ (PH)/MD = 1.7.$
- $PH/AD = 2.89.$

For new growth areas or "Satellite" developments, it is not uncommon to experience peaking factors that exceed these values. A typical PH/MD factor for these conditions would be 2.5, or PH/AD factor of 4.0 or higher. The reasons for the higher peaking factor include:

1. A significantly greater proportionate share of construction water use compared to normal per capita usage during the early stages of new development. High construction water usage typically occurs at the same time of peak daily per capita water demand.
2. The character that a satellite development displays is much like a "bedroom" community, where the resident's water use patterns are all similar and are not buffered by other types of non-residential and commercial water use.

Fire flow demands also affect the requirements for booster pumping and storage capacity. Typically for new, small developments, the MD plus fire flow demand condition will control the sizing of booster pumping and storage facilities. While for development in mature pressure zones, the PH demand condition will usually control the sizing of booster pumping and storage facilities.

Therefore, considering these development factors, the performance criteria may be modified at the discretion of the City to account for satellite growth conditions.

4.5.8 Performance Criteria Summary

Table 4.9 summarizes the performance criteria used to evaluate the distribution system. Note Table 4.7 does not include all the performance and design criteria listed above, but just the criteria that was used to evaluate the performance of the existing and proposed distribution system.

Table 4.9 City's Performance Criteria Summary

Description	Criteria
Demand and Production Criteria	
Peaking Factors ⁽¹⁾	
MD/AD	1.7
PH/AD	2.89
Production ⁽²⁾	Supply Maximum Day Demand
Storage Criteria ⁽³⁾	Equal to the average daily demand during the maximum demand month of the year. Where appropriate, the daily average annual demand is also used.
Transmission/Distribution	
Velocity Criteria	
Maximum Day	
Pipe < 36 inches	<5 ft/sec
Pipe ≥ 36 inches	<6 ft/sec
Peak Hour	≤7 ft/sec
Fire Flow Condition	<10 ft/sec, <20 psi
System Pressure Criteria (SPC)	40 psi ≤ SPC ≤ 80 psi
Size Criteria (Minimum Diameter, inches)	
Section Lines/Major Arterial	16
Minor Arterials	12
All Other Lines	8
Booster Pump Station Criteria	
Without Elevated Storage ⁽⁴⁾	The larger of 120 percent of Peak Hour Demand or Maximum Day plus Fire Flow of 3,500 gpm.
Firm Capacity ⁽⁵⁾	Capacity with the largest pump out of service.
Fire Demand Criteria	
Master Planning Fire Flow Requirements ⁽⁶⁾	Residential = 1,500 gpm for 2 hours Commercial/Industrial/Schools = 3,500 gpm for 4 hours

Notes:

- (1) Peaking factors are estimates taken from the 2007 Integrated Water Master Plan. These peaking factors are typical of similarly sized communities in Arizona. Without a SCADA system, it is difficult to precisely measure peaking factors.
- (2) Per industry best practices, production requirements should be met with largest well out of service (Mays, Larry W. Water Distribution Systems Handbook. McGraw Hill, 2000, pp 3.7. For Goodyear, the largest well (Well 22) is required to use Well 20 (blending); therefore, firm capacity results in the two largest wells being out of service.
- (3) Arizona Administrative Code: A.A.C. R18-5-503A.
- (4) 2007 Integrated Water Master Plan criteria & industry best practice.
- (5) Engineering Bulletin No. 10, Chapter 3, Section C(1).
- (6) Master Planning Fire Flow Requirements are general and applied for system planning purposes. The 2018 edition of the International Fire Code allows reductions in fire flow requirements for structures with approved automatic sprinkler systems and installation practices, which can be granted at the discretion of the City Fire Marshall.

4.6 Future Infrastructure

This section defines the improvements planned for the water distribution system by planning period (2030, 2035, 2040). As the City continues to grow, proposed water supply, storage, pumping, and pipelines have been sized for 2040 demand conditions. The infrastructure generally aligns with the City's planning periods. For this master plan, WPA 2 is expected to be fully developed by 2040. WPA 3 will experience significant growth but will not reach buildout. WPA 4 will start developing. WPA 5 may be served by a private utility and does not include improvements in this plan. The infrastructure identified for each planning period was evaluated for capacity requirements using the hydraulic model.

4.6.1 2030 Planning Period

The new facilities proposed for the 2030 planning period include new water mains, a new storage tank, a well replacement, and SWTP expansion. Figure 4.9 shows the proposed 2030 facilities. Most of the proposed new water mains are needed due to new development areas and therefore will be funded by developers. The rest will be funded by the City.

The 2030 facilities funded by the City are summarized as:

- **W-7.1** – A 12-inch transmission main on Broadway Rd From Estrella Pkwy to Bullard Ave. This new main will improve the City's transmission capabilities from the SWTP to the data center sites on Broadway Rd and complete a loop over to Litchfield Rd.
- **W-28** – Expansion of the SWTP's treatment capacity from 6.5 mgd to 16 mgd. Addition of 4 MG storage capacity to the SWTP.
- **W-31** – Replacement of Well 18B. According to the City, all equipment is already in place but the well needs to be re-drilled.
- **W-36** – A 24-inch transmission main from the MC85 north of the SWTP to the MC85 and Estrella Pkwy. This new main will improve transmission capabilities from the SWTP to the eastern Central Planning Area.
- **W-37** – A section of 16-inch main along Litchfield Road from MC85 south to El Cielo Road to complete the 16-inch diameter equivalent loop serving the Microsoft site.
- **W-41** – A new 1.5 MG storage tank at Site 18. This new storage is required to offset the loss of storage capacity due to the retirement of Sites 7 and 8.

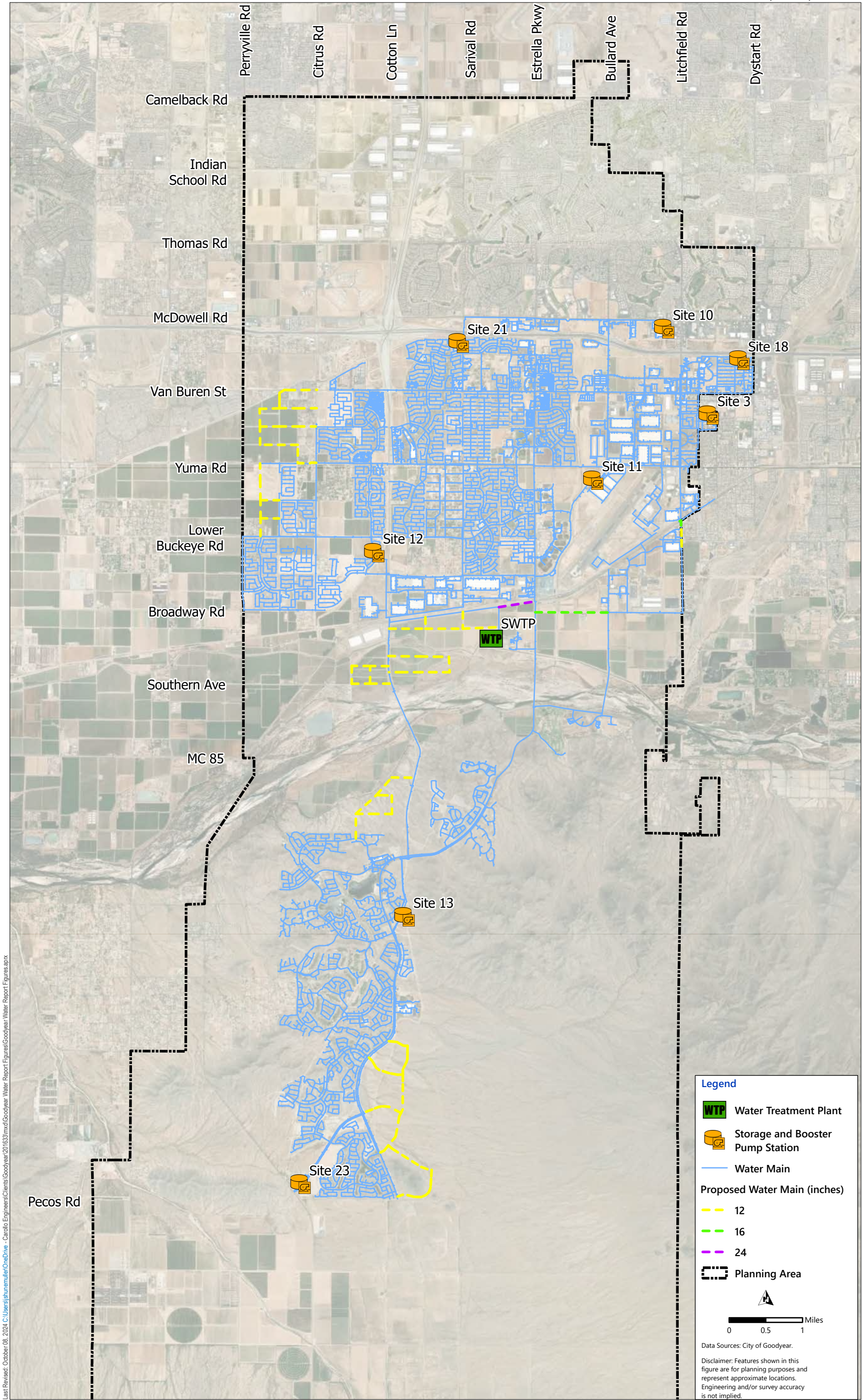


Figure 4.9 2030 Water Distribution System Facilities
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

4.6.2 2035 Planning Period

The new facilities proposed for the 2035 planning period include new water mains, new pressure reducing valves, well water treatment, a new well, storage, and booster pump station. Figure 4.10 shows the proposed 2030 facilities. The proposed City-funded projects are summarized in the list below:

- **W-21** – The West Goodyear Storage and Booster Pump Station. This station will have two 1.5 MG storage tanks and 5.75 mgd pumping capacity. This station will serve Central Zone 2 and will receive water from the Central Zone 1. This site is also proposed to have a well with 1,500 gpm of capacity
- **W-21.3** – A 24-inch transmission main from Citrus Rd and Harrison St. to Van Buren St and 175th Dr. This new water main will improve the City's transmission capabilities to northern and western areas of the Central Zone.
- **W-21.4** – A 24-inch water main from Citrus Rd and Yuma Rd to Yuma Rd and 175th Dr. This new water main will improve the City's transmission capabilities to northern and western areas of the Central Zone.
- **W-22, 23, 24, 25, 26, 27, 38, 39** – Eight PRVs primarily located along Yuma Rd from west of Cotton Ln to Litchfield Rd. to split the Central Zone into Central Zone 1 and Central Zone 2 pressure zones. The sizing and locations of these PRVs can be found in Section 4.2.1.
- **W-32** – Ion exchange treatment for water from the Adaman wells. This treatment will be located at Site 21 and remove nitrate and is sized to treat half of the total combined capacity of the three Adaman wells.
- **W-33** – A 24-inch transmission main from Citrus Rd and Broadway Rd to Cotton Ln and South of MC 85. This new water main will improve the City's transmission capabilities from the SWTP to the western Central Zone.
- **W-35** – Upsizing 3,500 feet of pipe on the Cotton Lane pipeline to Site 13 from the Central Zone. Most of this pipeline is currently 20 inches in diameter but has smaller diameter pipes interspersed throughout the pipeline. These smaller diameter pipes are bottlenecks that cause head loss and high velocities in the pipeline. These issues will become worse over time as future developments in Estrella require higher water deliveries to Site 13.
- **W-42** – Groundwater treatment to remove PFAS from Wells 6, 18 and 18B. 2040 Planning Period

The new facilities proposed for the 2040 planning period include new water mains, one storage tank and booster pump station, and one expansion of an existing pump station. Figure 4.11 shows the proposed 2040 facilities. The Waterman Storage and Booster Pump Station is expected to be developer paid. Most of proposed water mains in this phase are also expected to be developer-funded. The proposed City-funded projects are summarized in the list below:

- **W-30** – Expansion of the Site 13 (Zone 2) Pump Station. This expansion is required to meet fire flow requirements in the South Zone 2 pressure zone.
- **W-34** – A 16-inch transmission main from Site 12 to Cotton Lane and the MC 85. This main will run parallel to an existing 16-inch main to give the equivalent transmission capacity to a 24-inch main. This main will improve the City's transmission capacity between the SWTP and Site 12.

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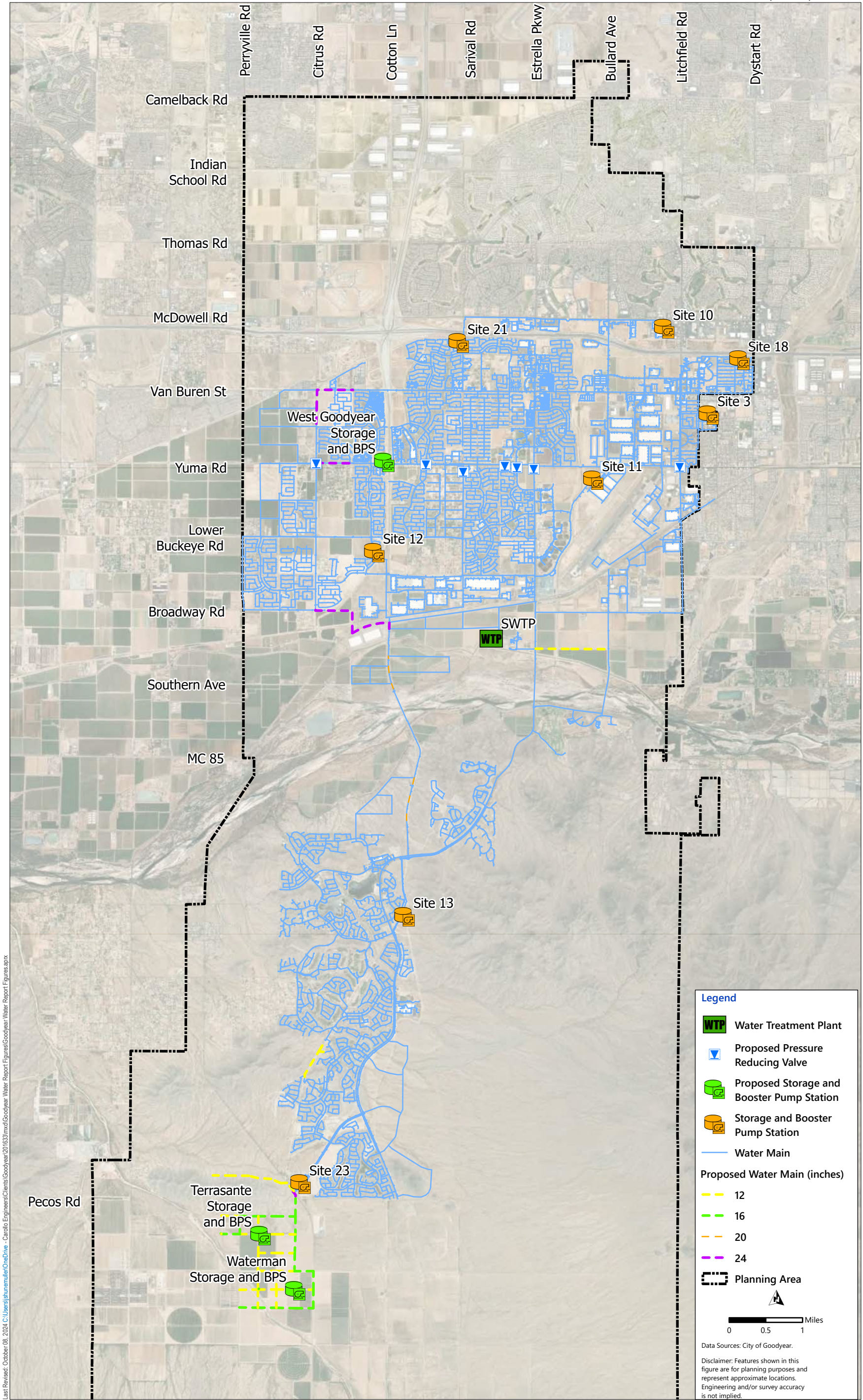


Figure 4.10 2035 Water Distribution System Facilities
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

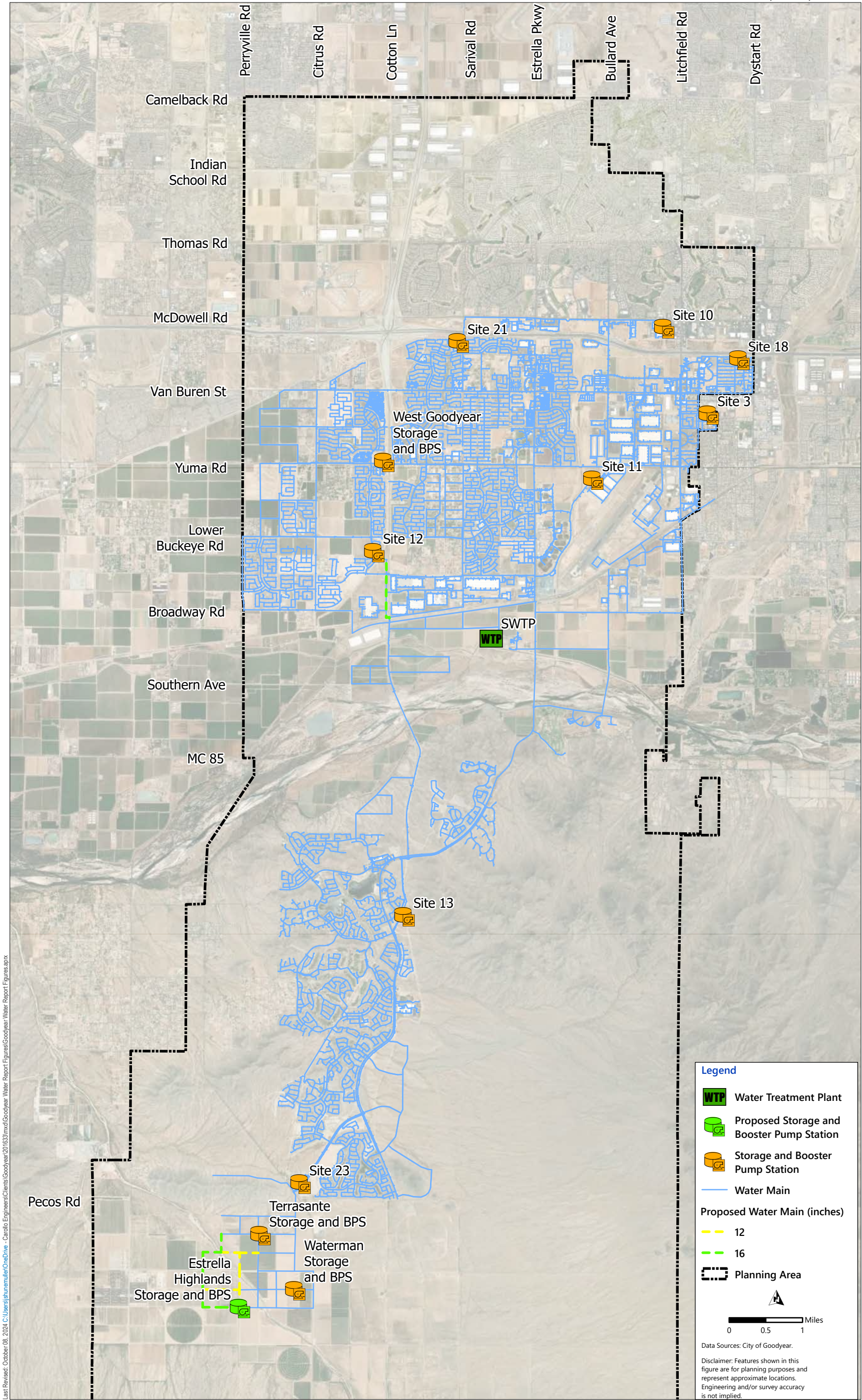


Figure 4.11 2040 Water Distribution System Facilities
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

4.7 Water Distribution System Evaluations

The water distribution system and planned infrastructure was evaluated to identify deficiencies under existing system conditions and year 2040 planning horizon conditions. The water system was evaluated to identify any deficiencies in performance, as well as issues that restrict effective water system operation.

4.7.1 Future Demand Projection Summary

The infrastructure to be added in each future planning period is intended to serve the demands that are projected to occur in the future. Chapter 2 of this report details shows the projected future water demands. The demand projections in Chapter 2 are based on a 15-year planning period to align with the MDAWS application (2030, 2035, 2040). Table 4.10, Table 4.11, and Table 4.12 summarize the total projected water demands in each pressure zone after pressure zone changes. These demand projections will be used for the infrastructure planning periods (2030, 2035, and 2040).

Table 4.10 Projected Average Day Demands by Pressure Zone (mgd)

Zone	2023	2030	2035	2040
Central Zone	7.0	-	-	-
Central Zone 1	-	3.8	4.0	4.1
Central Zone 2	-	4	4.4	4.6
Zone 1 South Including Rainbow Valley	2.9	3.9	6	8.7
Zone 2 South	0.2	0.3	0.3	0.4
Total	10.1	12.0	14.7	17.8

Table 4.11 Projected Maximum Day Demands by Pressure Zone (mgd) (avg x 1.7)

Zone	2023	2030	2035	2040
Central Zone	12.0	-	-	-
Central Zone 1	-	6.5	6.8	7.0
Central Zone 2	-	6.8	7.5	7.8
Zone 1 South	4.93	6.6	10.2	14.8
Zone 2 South	0.34	0.5	0.5	0.7
Total	17.2	20.5	25.0	30.3

Table 4.12 Projected Peak Hour Demands by Pressure Zone (mgd) (avg x 2.9)

Zone	2023	2030	2035	2040
Central Zone	20.4	-	-	-
Central Zone 1	-	11.1	11.6	11.9
Central Zone 2	-	11.6	12.8	13.3
Zone 1 South	8.4	11.3	17.4	25.2
Zone 2 South	0.6	0.9	0.9	1.2
Total	29.4	34.9	42.6	51.6

4.7.2 Water Supply Capacity Evaluation

The City's future water supply requirements were estimated based on projected demands. Design criteria require that the City's redundant water supply facilities (largest well offline) exceed the maximum day demand. Table 4.13 contains an evaluation of the City's projected water supply facilities for each planning period without a Central Zone split, indicating that three new water supply sources are required to meet the supply requirements for future planning years. An expansion of the SWTP has already been planned to double the supply capacity of the plant. The expansion is planned for the 2030 planning period. The other two proposed supply sources are three new wells to be located in the Terrasante, Rainbow Valley, and Estrella Highlands developments. These wells will provide water to the new developments that are also located in Zone 1 South. These developments will also be able to take water from Site 23.

Table 4.13 Water Supply Capacity Evaluation

Well/Plant	Total Capacity (gpm)	Reliable Production (gpm)			
		2023	2030	2035	2040
Well 1	500	500	0	0	0
Well 3	425	425	0	0	0
Well 6	485	0	500	500	500
Well 11	620	620	620	620	620
Well 12	850	850	900	900	900
Well 18A	850	0	850	850	850
Well 18B ⁽¹⁾	0	0	850	850	850
Well 19	750	750	750	750	750
Well 20 ⁽³⁾	1,600	0	0	0	0
Well 22 ⁽³⁾	1,950	1,950	0	0	0
Well 24	2,300	2,300	2,300	2,300	2,300
Well 26	1,900	1,900	1,900	1,900	1,900
Adaman Well 1	1,340	1,340	1,340	1,340	1,340
Adaman Well 2	500	500	500	500	500
Adaman Well 3 ⁽²⁾	1,200	0	1,200	1,200	1,200
SWTP (Existing)	5,250	4,500	4,500	4,500	4,500
SWTP (Expansion)	5,250	0	6,000	6,000	6,000
West Goodyear Well	1,500	0	1,500	1,500	1,500
Terrasante Well	1,500	0	1,500	1,500	1,500
Waterman Well	1,500	0	0	1,500	1,500
Estrella Highlands Well	1,500	0	0	0	1,500
Firm Supply	–	15,635	25,210	26,710	28,210
Maximum Daily Required Production	–	14,544	16,968	20,341	24,240
Surplus/(Deficit)	–	1,091	8,242	6,369	3,970

Notes:

- (1) Well 18B failed and needs replacement. Estimated replaced capacity is 850 gpm. Well 18A and Well 6 cannot operate without blending from Well 18B.
- (2) Adaman Well 3 currently offline, assumed online in future.
- (3) Well 22 taken offline for redundancy. Well 20 taken offline as it is blended with Well 22.

In Table 4.13, several wells are shown as offline for calculating the total firm capacity for each planning period. Well 18B has failed and will need to be replaced to contribute to the City's total water supply capacity. Wells 6 and 18A cannot operate without Well 18B due to blending requirements and the nitrate treatment at the site does not work well. Well 18B is recommended to be back in service by 2030. When calculating the firm water supply capacity, the largest capacity well is assumed to be offline to account for a mechanical failure. Well 24, with a capacity of 2,500 gpm, is the City's largest well. However, due to water quality requirements, water from Well 20 needs to be blended with water from Well 22. Therefore, if Well 22 fails then Well 20 must be taken offline as well. Combined, Wells 20 and 22 have a larger capacity than Well 24 and, therefore these two wells provide the redundancy. Well 22 is kept online in the 2023 calculations due to Wells 6, 18A, 18B, and Adaman 3 being offline. Although there is enough water supply capacity in 2023, there is not sufficient redundancy because the Site 18 wells are off.

Figure 4.12 shows the City's available water supply and projected required water supply in each planning phase. As in Table 4.13, this chart assumes Wells 20 and 22 are offline for redundancy. Adaman Well 3, which is currently offline but planned to be online by 2030. Well 18B is considered offline until 2035. Figure 4.12 is helpful in assessing the timeline for when the SWTP expansion will be necessary to meet the City's water supply requirements. The SWTP expansion should be completed in the 2030 planning period to provide the supply and operational flexibility to serve the City.

Well 12 is in poor condition and will need to be rehabilitated or re-drilled. The timing of this rehabilitation will need to be considered along with the development of additional water supplies to make sure that the City has adequate water production capabilities.

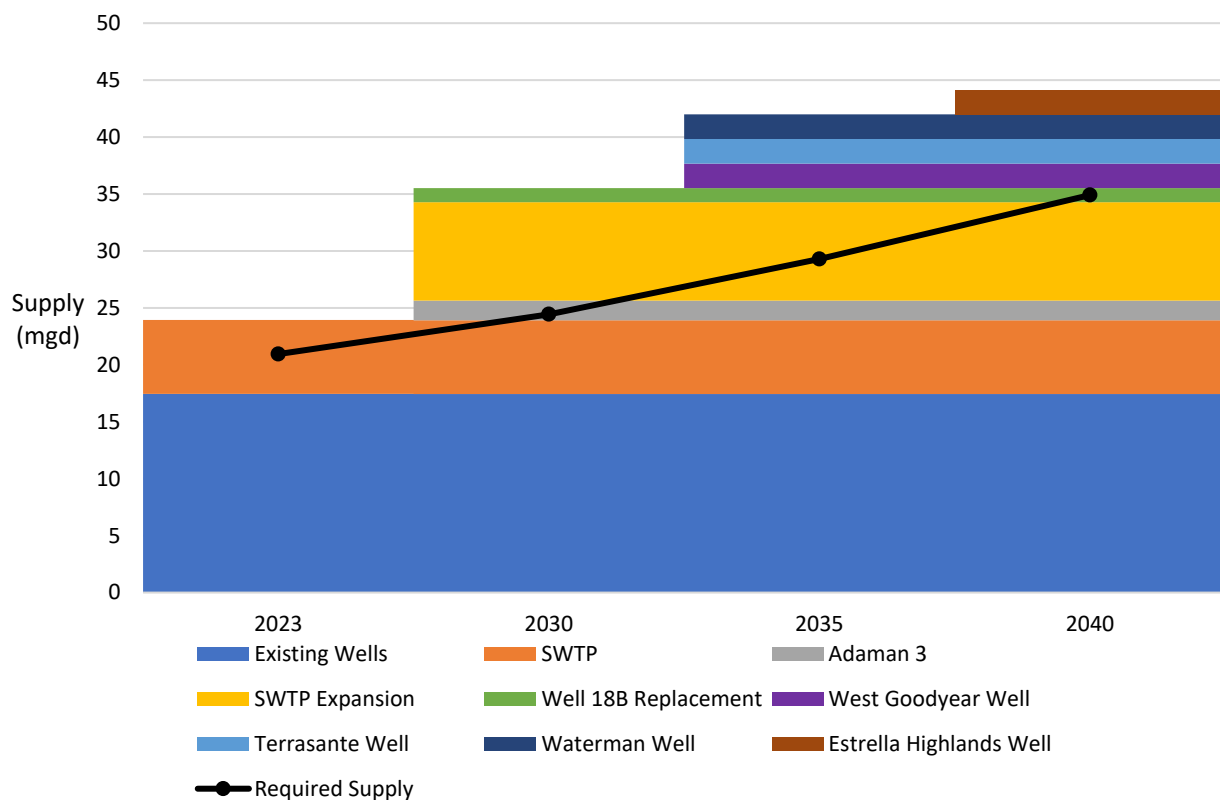


Figure 4.12 Water Supplies Needed to Deliver Maximum Day Demands

4.7.2.1 Groundwater Treatment

Multiple ground water supply sites, both existing and proposed future sites, were identified as likely needing treatment for arsenic or polyfluoroalkyl substances (PFAS). The identified sites and the required treatments are detailed below:

- **Site 18** – City has expressed concerns about rising arsenic and PFAS levels at Site 18. Therefore, the City should plan to add a treatment process that will treat both arsenic and PFAS at Site 18.
- **Site 21** – Nitrate removal via ion exchange treatment will be needed to treat water from Adaman Wells 1, 2, and 3. Currently Adaman Well 3 is not equipped and operating but once all three wells are producing, increased nitrate treatment capacity will be required. An ion exchange treatment capacity of 2.25 mgd would treat half of the water produced by the Adaman wells when all three wells are producing at their full capacity. Arsenic treatment has already been expanded at Site 21 to treat water from the Adaman wells.
- **West Goodyear Well (Proposed)** – Treatment to reduce arsenic levels is anticipated at this site.
- **Rainbow Valley Developments (Proposed Terrasante, Estrella Highlands, and Waterman wells)** – Treatment to reduce arsenic levels is anticipated for these sites. These sites are to be constructed by developers.

4.7.3 Storage Capacity Evaluation

The City's design criteria for distribution system storage is documented in Section 4.5.6. Storage facilities can serve one or more pressure zones if water can be conveyed from the storage tank to the pressure zone through adequately sized pump stations.

The storage requirement is the same in the Central Zone whether the zone is configured as one zone or two zones. Table 4.14 presents the storage analysis for the Central Zone(s). The Central Zone is planned to have three new storage facilities, one 4 MG storage tank with the expanded SWTP, the West Goodyear ground storage tank, and 1.5 MG of storage at Site 18 to replace the retired storage from Sites 7 and 8.

The southern zones share storage facilities, so the storage evaluation is completed for the entire southern area as shown in Table 4.15 includes three future ground storage tanks to serve the Terrasante, Rainbow Valley, and Estrella Highlands developments. By placing a storage and pumping facility in each development, one development is not dependent on another development to start growing. Each of these sites will start with a 1 MG storage tank with space for a second storage tank in the future if needed. An additional 1.5 MG storage tank has previously been recommended to be added to Site 13. An additional storage tank would provide operational flexibility but is not required to meet storage requirements.

Table 4.14 Central Zone(s) Water Storage Capacity Evaluation

Tank	Rated Capacity (MG)	Available Capacity (MG)			
		2023	2030	2035	2040
Site 3	0.18	0.16	0.16	0.16	0.16
Site 7	0.75	0.00	0.00	0.00	0.00
Site 8	0.75	0.65	0.00	0.00	0.00
Site 10	0.75	0.67	0.67	0.67	0.67
Site 11	2.00	1.70	1.70	1.70	1.70
Site 12 ⁽¹⁾	4.00	3.20	3.20	3.20	3.20
Site 18	1.00	0.80	2.30	2.30	2.30
Site 21	2.00	1.60	1.60	1.60	1.60
SWTP	0.20	0.20	0.20	0.20	0.20
SWTP Expansion	4.00	0.00	4.00	4.00	4.00
Future West Goodyear Ground Storage Tank	2.00	0.00	0.00	2.00	2.00
Total Capacity	17.63	8.98	13.83	15.83	15.83
Required Capacity		10.2	11.3	12.16	12.58
Surplus/Deficit		-1.22	2.53	3.67	3.25

Notes:

- (1) Total capacity shown includes the volume from two storage tanks at this site.
(2) Required capacity is calculated as the average day demand of the maximum month.

Table 4.15 Southern Pressure Zones Water Storage Capacity Evaluation

Tank	Rated Capacity (MG)	Available Capacity (MG)			
		2023	2030	2035	2040
Site 13	1.5	1.3	1.3	1.3	1.3
Site 23	5.0	4.0	4.0	4.0	4.0
Terrasante Ground Storage Tank	2.0	0.0	1.0	1.0	2.0
Waterman Ground Storage Tank	2.0	0.0	0.0	1.0	2.0
Estrella Highlands Ground Storage Tank	2.0	0.0	0.0	0.0	1.0
Total Storage Capacity	11.50	5.30	6.30	7.30	9.30
Required Capacity⁽¹⁾		3.49	4.50	6.17	8.28
Surplus/Deficit		1.81	1.80	1.13	1.02

Notes:

- (1) Required capacity is calculated as the average day demand.

4.7.4 Pumping Capacity Evaluation

The City's design criteria state that pumping capacity is summarized in Section 4.5.4.

The Central Zone and Zone 1 South pumping constraint is 120 percent of the peak hour demand. The Zone 2 South maximum pumping constraint is the total maximum day demand plus fire flow. However, because Zone 2 South is a small zone and comprised almost exclusively of residential areas, the fire flow requirement for South Zone 2 has been set to 1,000 gpm because this flow rate is the limit of the pump station.

The southern pressure zones currently receive the entire water supply from the Central Zone delivering water to Sites 13 and 23. Therefore, pumping capacity in the Central Zone must also be high enough to pump to the southern pressure zones.

Table 4.16, Table 4.17, and Table 4.18 summarize the pumping requirements for each pressure zone when Central Zone is not split.

Table 4.16 shows that the Central Zone would require the SWTP expansion and a West Goodyear Future BPS to meet the projected pumping requirements of future planning periods.

Table 4.16 Central Zone Pumping Requirements without a Pressure Zone Split

Booster Pump Station	Number of Pumps	Capacity or Demand (gpm)					
		Total	Firm	2023	2030	2035	2040
Site 3	2	1,000	500	500	500	500	500
Site 7 ⁽²⁾	3	1,500	1,000	0	0	0	0
Site 8	2	1,000	500	500	0	0	0
Site 10	2	1,000	500	500	500	500	500
Site 11	6	5,600	4,800	4,800	4,800	4,800	4,800
Site 12 ⁽³⁾	6	6,500	6,500	0	0	0	0
Site 18	3	2,800	1,840	1,840	1,840	1,840	1,840
Site 21	5	7,040	5,200	5,200	5,200	5,200	5,200
SWTP (Existing)	4	7,000	5,275	5,275	5,275	5,275	5,275
SWTP (Expansion)	5	10,000	8,000	0	8,000	8,000	8,000
West Goodyear Future BPS	4	5,040	4,200	0	4,200	4,200	4,200
Total Capacity		44,755	38,315	18,615	29,815	29,815	29,815
Required Fire Flow				3,500	3,500	3,500	3,500
Required Capacity				13,508	15,922	17,790	20,115
Delivery to Zone 1 South				3,745	4,828	6,617	8,891
Surplus/Deficit				1,362	9,065	5,408	809

Notes:

- (1) Required pumping capacity calculated as the maximum of (a) the peak hour demand to the Central Zone or (b) the maximum day demand to the Central Zone plus 3,500 gpm fire flow, plus maximum day demand to the combined southern zones. The peak hour demand controls.
- (2) Site 7 is offline and not expected to come back online. Site 8 is expected to be retired by 2030.
- (3) Site 12 taken offline for redundancy.

Table 4.17 and Table 4.18 summarize the pumping capacity requirements for the Central Zone 2 and Central Zone 1 if the Central Zone was split.

Table 4.17 shows that a proposed West Goodyear Future booster pump station (BPS) is required to meet pumping requirements starting in 2033. This pump station provides the ability to move water from Central Zone 1 to Central Zone 2 and adds a redundant water supply to Central Zone 2. The required water delivery to the north zone from the south is included in Table 4.18.

Table 4.17 Central Zone 2 Pumping Capacity Evaluation

Booster Pump Station	Number of Pumps	Capacity or Demand (gpm)					
		Total	Firm	2023	2030	2035	2040
Site 3	2	1,000	500	500	500	500	500
Site 10	2	1,000	500	500	500	500	500
Site 18	3	2,800	1,840	1,840	1,840	1,840	1,840
Site 21	5	7,040	5,200	5,200	5,200	5,200	5,200
West Goodyear Future BPS	5	5,040	4,200	0	4,200	4,200	4,200
Total Capacity		14,340	12,240	8,040	12,240	12,240	12,240
Required Fire Flow				3,500	3,500	3,500	3,500
Required Capacity				7,089	7,982	8,777	9,290
Surplus/Deficit				951	4,258	3,463	2,950

Notes:

- (1) Required pumping capacity calculated as the maximum of (a) the peak hour demand to the Central Zone 1 or (b) the maximum day demand to the Central Planning Area Zone plus 3,500 gpm fire flow. The peak hour demand controls.

Table 4.18 shows that the planned SWTP expansion is the only required pumping capacity upgrades needed to meet the pumping capacity requirements of the Central Planning Area (South) split zone.

Table 4.18 Central Zone 1 Pumping Capacity Evaluation

Booster Pump Station	Number of Pumps	Capacity (gpm) or Demand (gpm)					
		Total	Firm	2023	2030	2035	2040
Site 7 ⁽²⁾	3	1,500	1,000	0	0	0	0
Site 8	2	1,000	500	500	0	0	0
Site 11	6	5,600	4,800	4,800	4,800	4,800	4,800
Site 12	6	6,500	5,400	5,400	5,400	5,400	5,400
SWTP (Existing)	4	5,275	5,275	5,275	5,275	5,275	5,275
SWTP (Expansion)	5	8,000	8,000	0	8,000	8,000	8,000
Total Capacity		27,875	24,975	15,975	23,475	23,475	23,475
Required Fire Flow				3,500	3,500	3,500	3,500
Required Capacity				6,664	7,568	9,139	10,383
Delivery to Zone 1 South				3,745	4,828	6,617	8,891
Surplus/Deficit				5,566	11,079	3,519	4,201

Notes:

- (1) Required pumping capacity calculated as the maximum of (a) the peak hour demand to the Central Zone 1 or (b) the maximum day demand to the Central Zone 1 plus 3,500 gpm fire flow, plus maximum day demand to the combined South Zones. The peak hour demand controls.
- (2) Sites 7 and 8 are offline and not expected to come back online.

Table 4.19 shows that three future pump stations are used to meet the projected pumping capacity requirements of South Zone 1. These two proposed pump stations would be in the Terrasante, Rainbow Valley, and Estrella Highlands developments and correspond with the three proposed wells and storage facilities in this zone.

Table 4.19 South Zone 1 Pumping Capacity Evaluation

Booster Pump Station	Number of Pumps	Capacity or Demand (gpm)					
		Total	Firm	2023	2030	2035	2040
Site 13 (Zone 1)	5	6,400	3,400	3,400	3,400	3,400	3,400
Site 23	5	11,070	7,710	7,710	7,710	7,710	7,710
Terrasante BPS	4	4,000	3,000	0	3,000	3,000	3,000
Waterman BPS	4	4,000	3,000	0	0	0	3,000
Estrella Highlands BPS	4	4,000	3,000	0			3,000
Total Capacity		29,470	21,110	11,110	14,110	14,110	20,110
Required Fire Flow				3,500	3,500	3,500	3,500
Required Capacity				6,457	7,801	12,120	17,526
Surplus/Deficit				4,653	6,309	1,990	2,584

Notes:

- (1) Required capacity calculated as the maximum of (a) the peak hour demand of South Zone 1 or (b) the maximum day demand of South Zone 1 plus a 3,500 gpm fire flow. Peak hour controls.

Zone 2 South currently only has pumping capacity at Site 13, with a firm capacity of only 500 gpm. The current pumping capacity is not sufficient to meet fire flow requirements for the zone. Expanding the pumping capacity of the Zone 2 South pump station at Site 13 is recommended to meet future development and fire flow requirements.

Table 4.20 South Zone 2 Pumping Capacity Evaluation

Booster Pump Station	Number of Pumps	Capacity or Demand (gpm)					
		Total	Firm	2023	2030	2035	2040
Site 13 (Zone 2)	2	1,000	500	500	500	500	500
Site 13 (Zone 2) Expansion	3	1,500	1,000	0	1,000	1,000	1,000
Total Capacity		2,500	1,500	500	1,500	1,500	1,500
Required Fire Flow				1,000	1,000	1,000	1,000
Required Capacity				1,288	1,336	1,383	1,430
Surplus/Deficit				(788)	164	117	70

Notes:

- (1) Required capacity calculated as the maximum of (a) the peak hour demand of South Zone 2 or (b) the maximum day demand of South Zone 2 plus a 1,000 gpm fire flow. Maximum day plus fire flow controls.

4.7.5 Distribution System Pressures

4.7.5.1 2023 Water Distribution System

The water model was used to determine if the existing water system meets pressure performance criteria in Peak Hour Demand scenarios. The system pressure criteria states that pressures should remain between 40 to 80 psi where customers are located. Pressures greater than 80 psi can occur but require a service line PRV. Figure 4.13 shows the pressure results throughout the water distribution system in a 2023 peak hour demand scenario without a Central Zone split.

Within the Central Zone, areas south of Dunlap Rd have pressures above 80 psi while pressures at the northern end of the pressure zone are just above 40 psi. Service line PRVs should be used at customer sites that have pressures greater than 70 psi. The pressure range is caused by the large elevation range in the Central Zone. One solution to manage pressures is to split the Central Zone into two zones, Central Zone 1 and Central Zone 2. A pressure zone split would reduce the elevation range of the zone and allow for more freedom in adjusting pump station discharge pressures. One location for a pressure zone split would be the Yuma Rd alignment. A zone boundary along Yuma Rd would result in two new pressure zones of roughly equal size that have several storage, pumping, and water supply facilities.

As an alternative, the City could investigate a pressure zone split boundary that includes the airport and Site 11 in Central Zone 2. Including Site 11 in Central Zone 2 would split the pump station sites that the City must run constantly for on-site reverse osmosis treatment between the two split zones and could make operations easier.

Figure 4.14 shows the facilities required to create a pressure zone boundary. Figure 4.15 shows a pressure zone schematic with the two Central pressure zones.

A 2023 minimum demand scenario (80 percent of average day demand) scenario was modeled and pressures remain within the 40 – 80 psi range.

4.7.5.2 2030 Water Distribution System

The water model was used to evaluate the water distribution system for planning year 2030 with the proposed Central Zone split. Figure 4.16 and Figure 4.17 shows the peak hour and max day plus fire flow pressure results from the 2030 water distribution system with the Central Zone split.

Figure 4.16 shows that the Central Zone split enables model pressures to remain between 40 and 80 psi during peak hour demand conditions. Further, Figure 4.16 shows that the zone split better allows max day demand plus fire flow residual pressures to be kept between 20 and 80 psi throughout the Central Zones 1 and 2.

A 2030 minimum demand scenario (80 percent of average day demand) scenario was modeled and pressures remain in the 40 – 80 psi range.

4.7.5.3 2040 Water Distribution System

The water model was used to evaluate the water distribution system for the 2040 planning period with and without the proposed Central Zone Split. Figure 4.18 and Figure 4.19 shows the pressure results throughout the system in a 2040 Peak Hour Demand Scenario, prior to and after the zone split, respectively. Like 2030 conditions, splitting the Central Zone keeps pressures within the 40 to 80 psi Central Zone 1 and 2.

The City is experiencing higher density residential development in several areas of the City. The demands with the higher density development were evaluated to determine if pressures drop too much where this high-density development is being constructed. Figure 4.20 presents the results of this evaluation. As Figure 4.20 shows, pressures are acceptable even with the higher density development.

A 2040 minimum demand scenario (80 percent of average day demand) scenario was modeled and pressures remain in the 40 – 80 psi range.

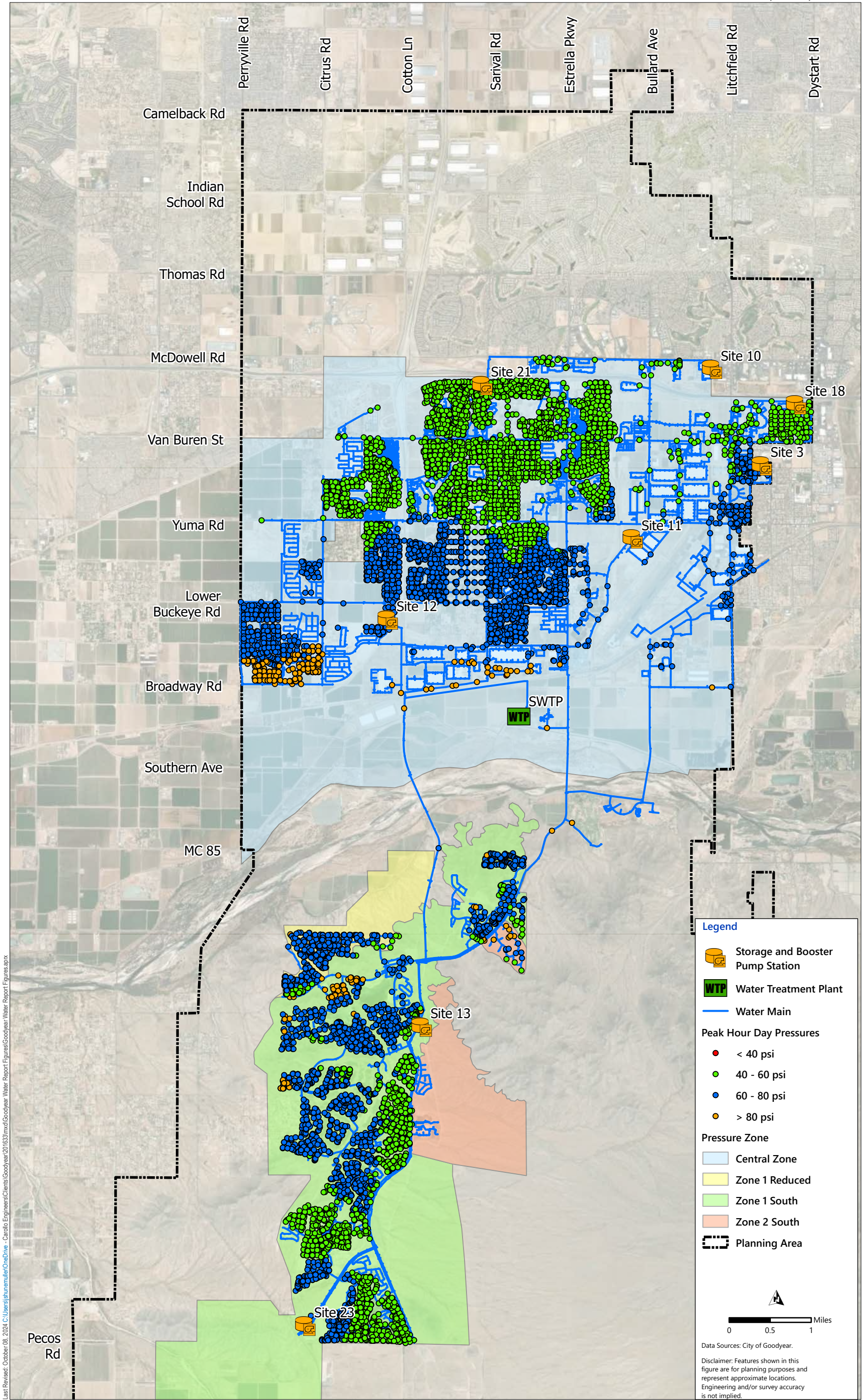


Figure 4.13 2023 Distribution System Pressures, Peak Hour Demand
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

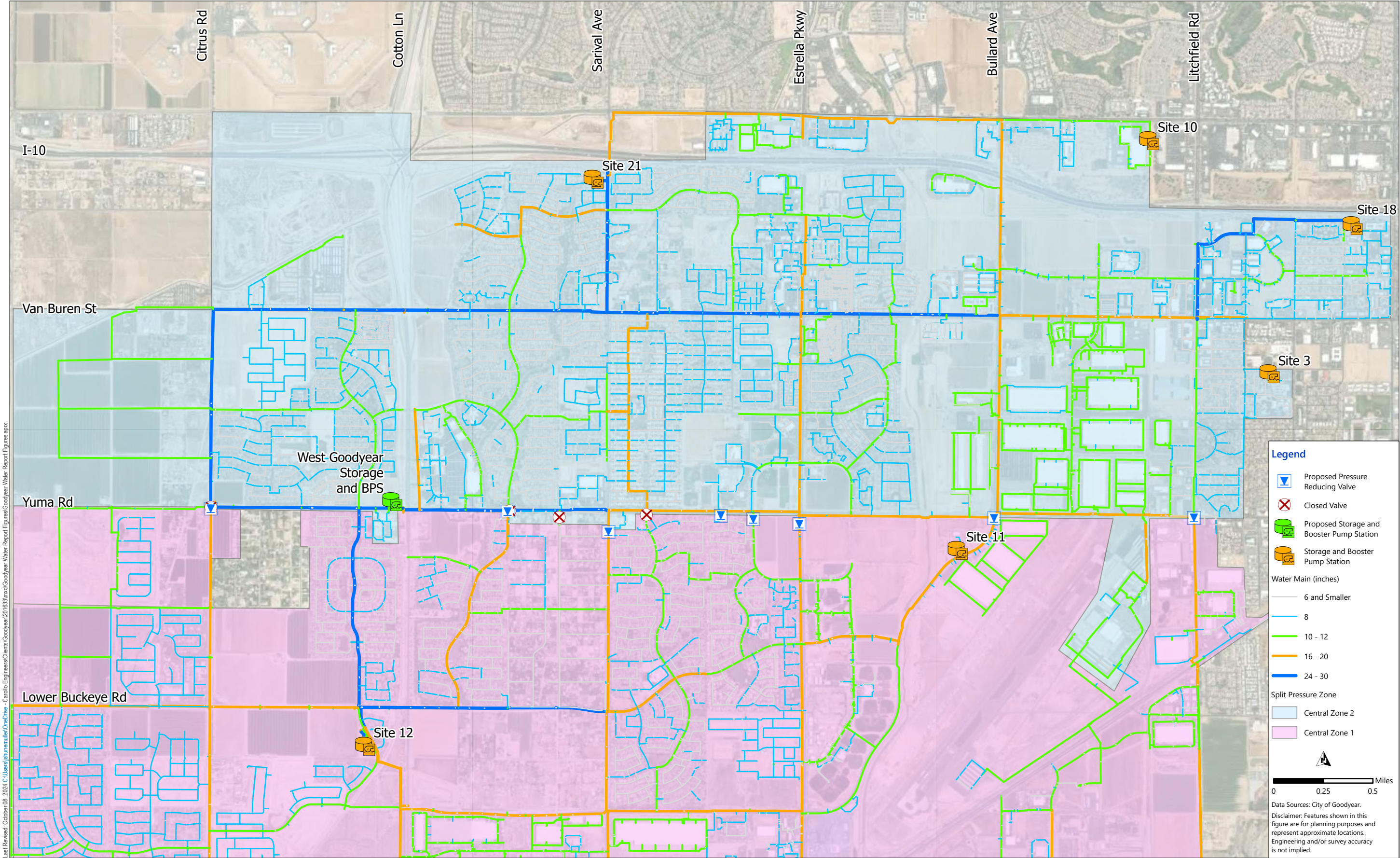


Figure 4.14 Central Zone Split Facilities
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

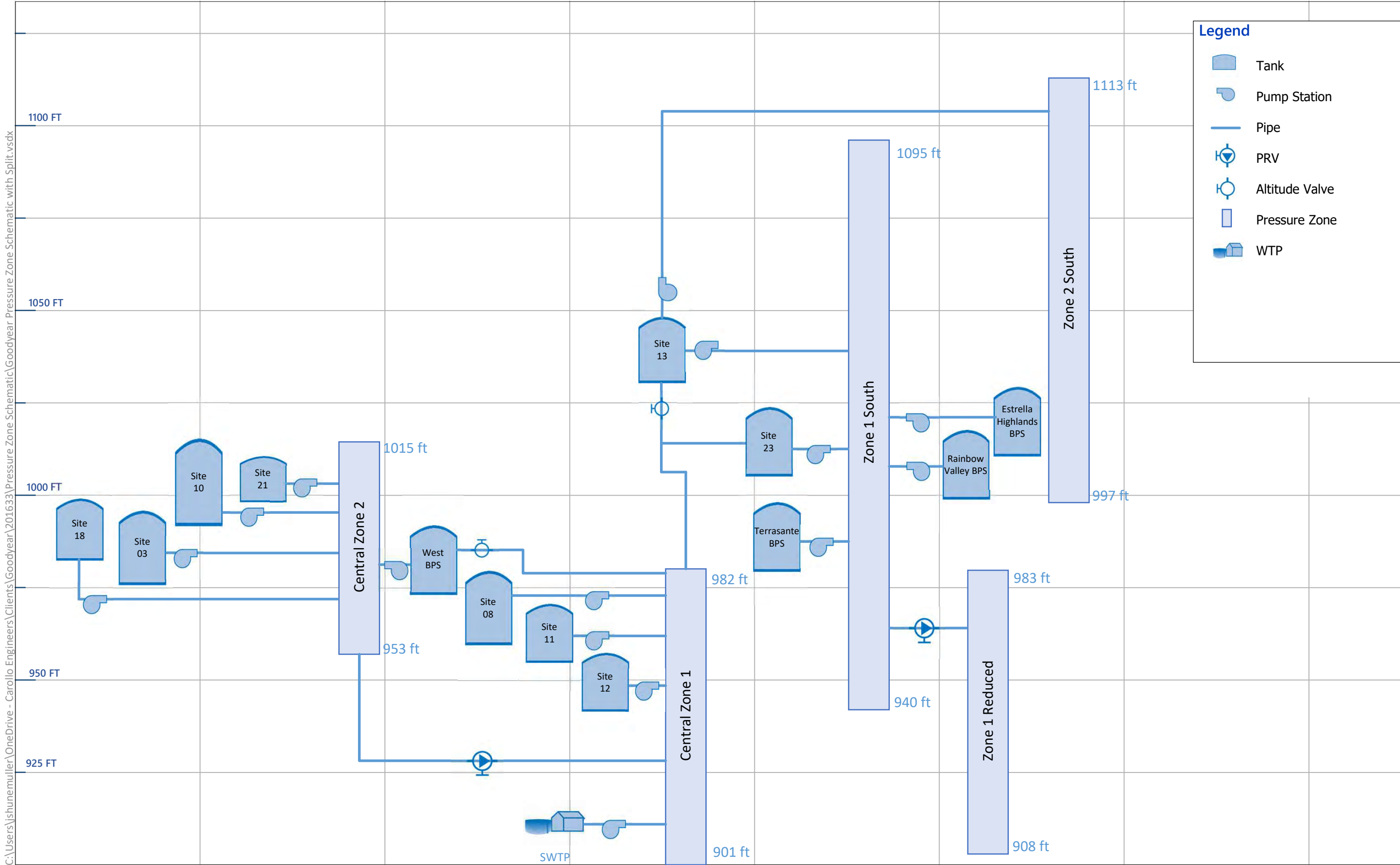


Figure 4.15 Pressure Zone Schematic with Central Zone Split and Rainbow Valley Facilities
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

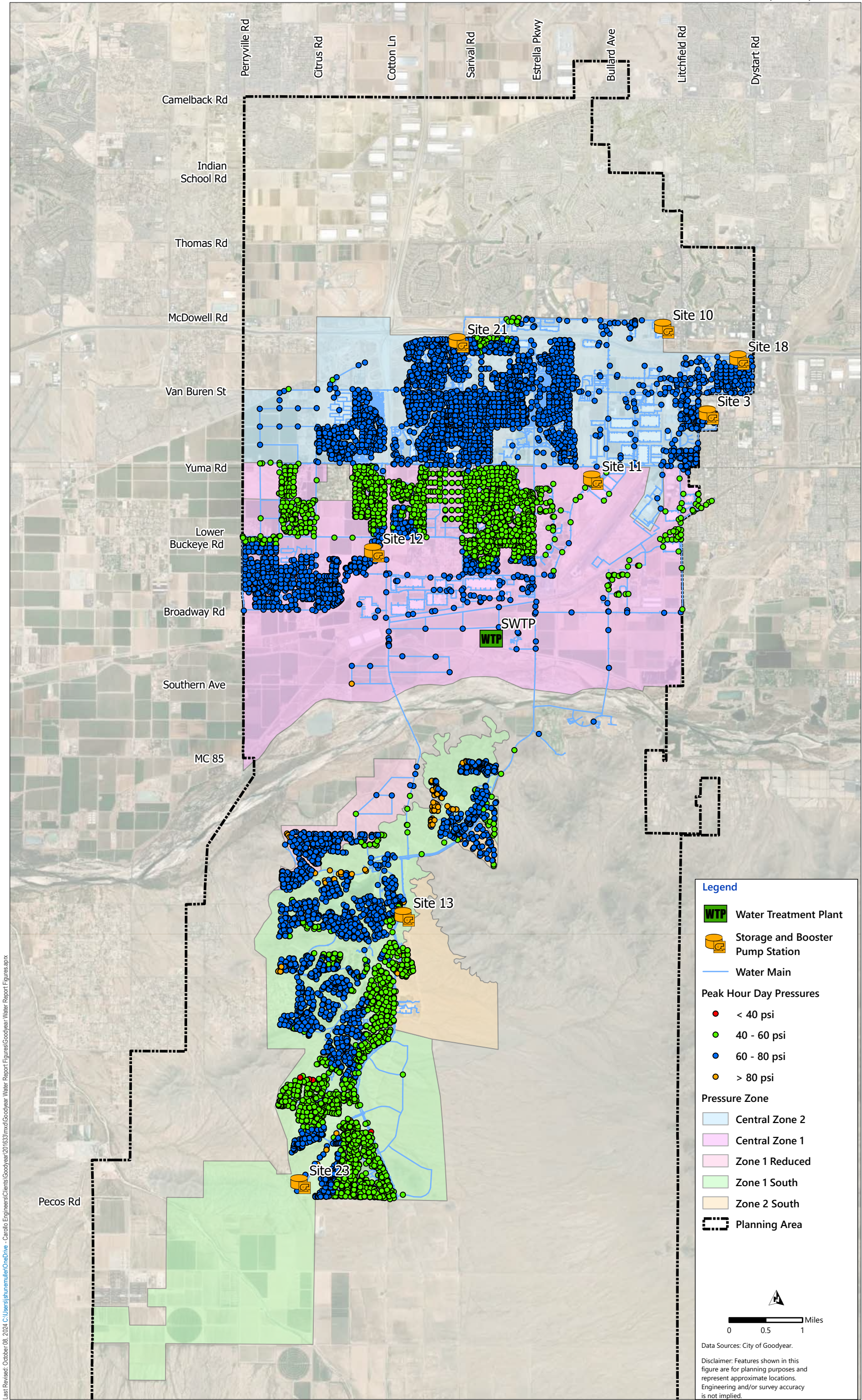


Figure 4.16 2030 Distribution System with Central Zone Split, Peak Hour Demand Pressures
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

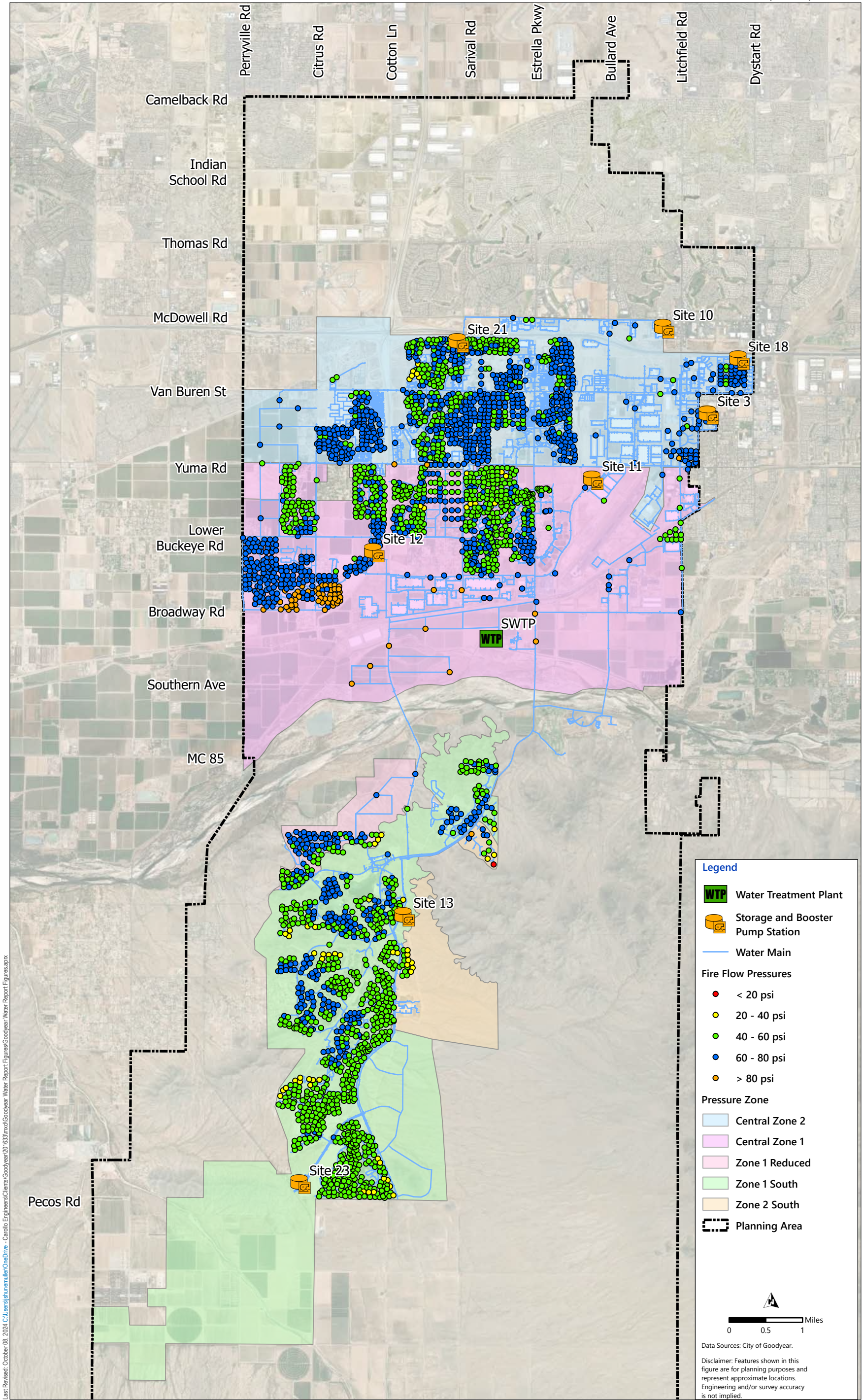


Figure 4.17 2030 Distribution System with Central Zone Split, Max Day Plus Fire Flow Pressures
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

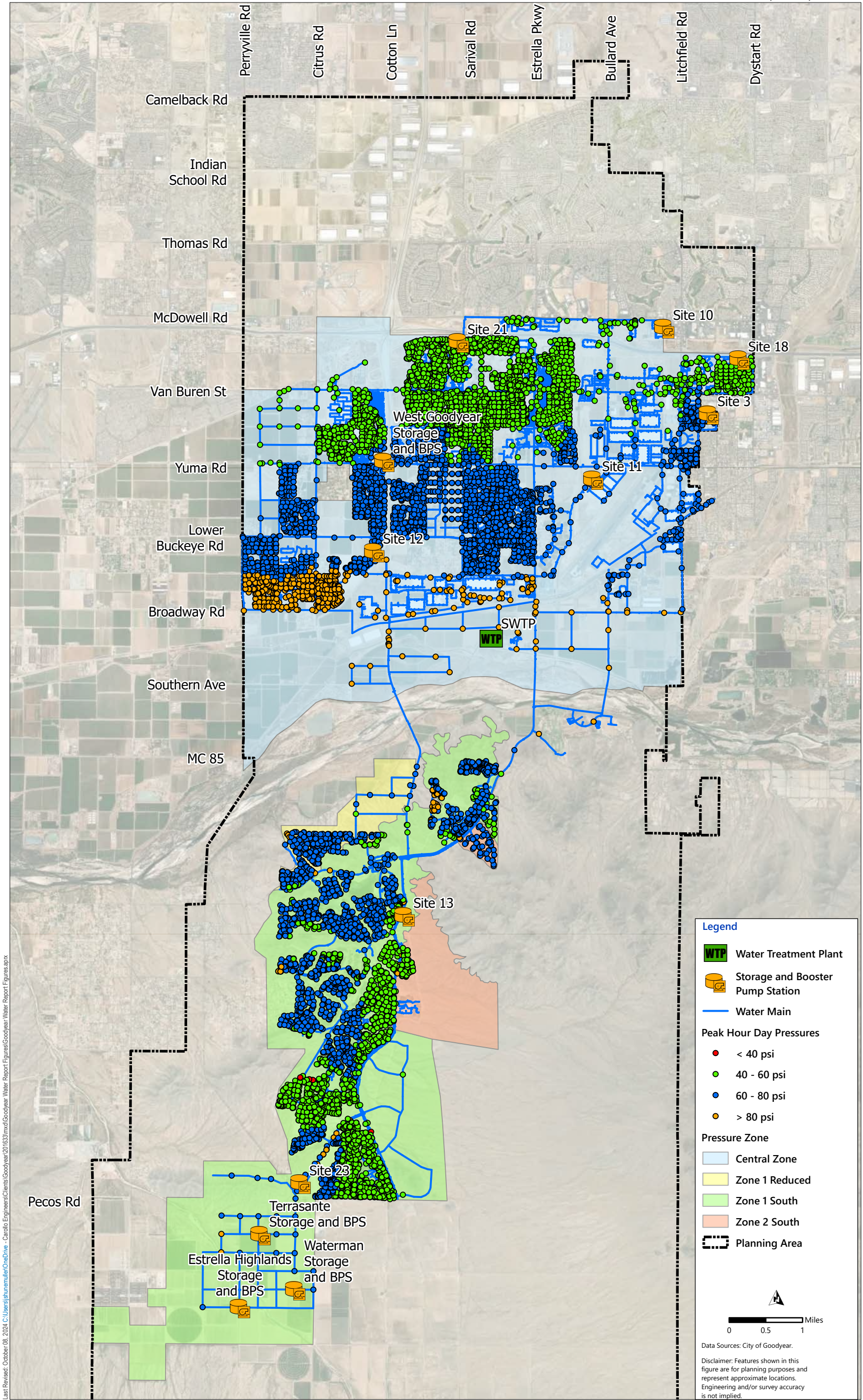


Figure 4.18 2040 Distribution System without a Central Zone Split, Pressures with Peak Hour Demands
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

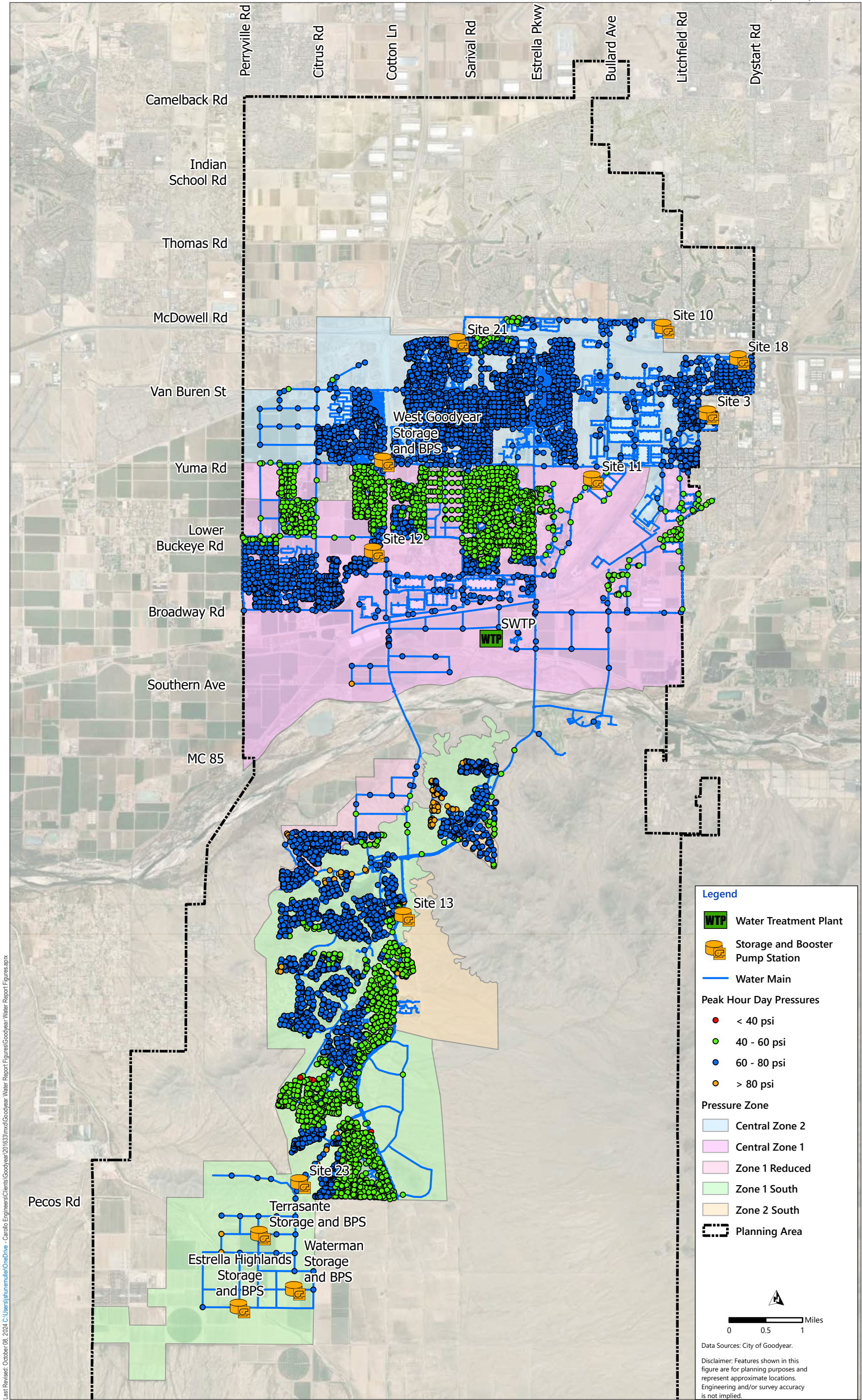


Figure 4.19 2040 Distribution System with a Central Zone Split, Pressures with Peak Hour Demands
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

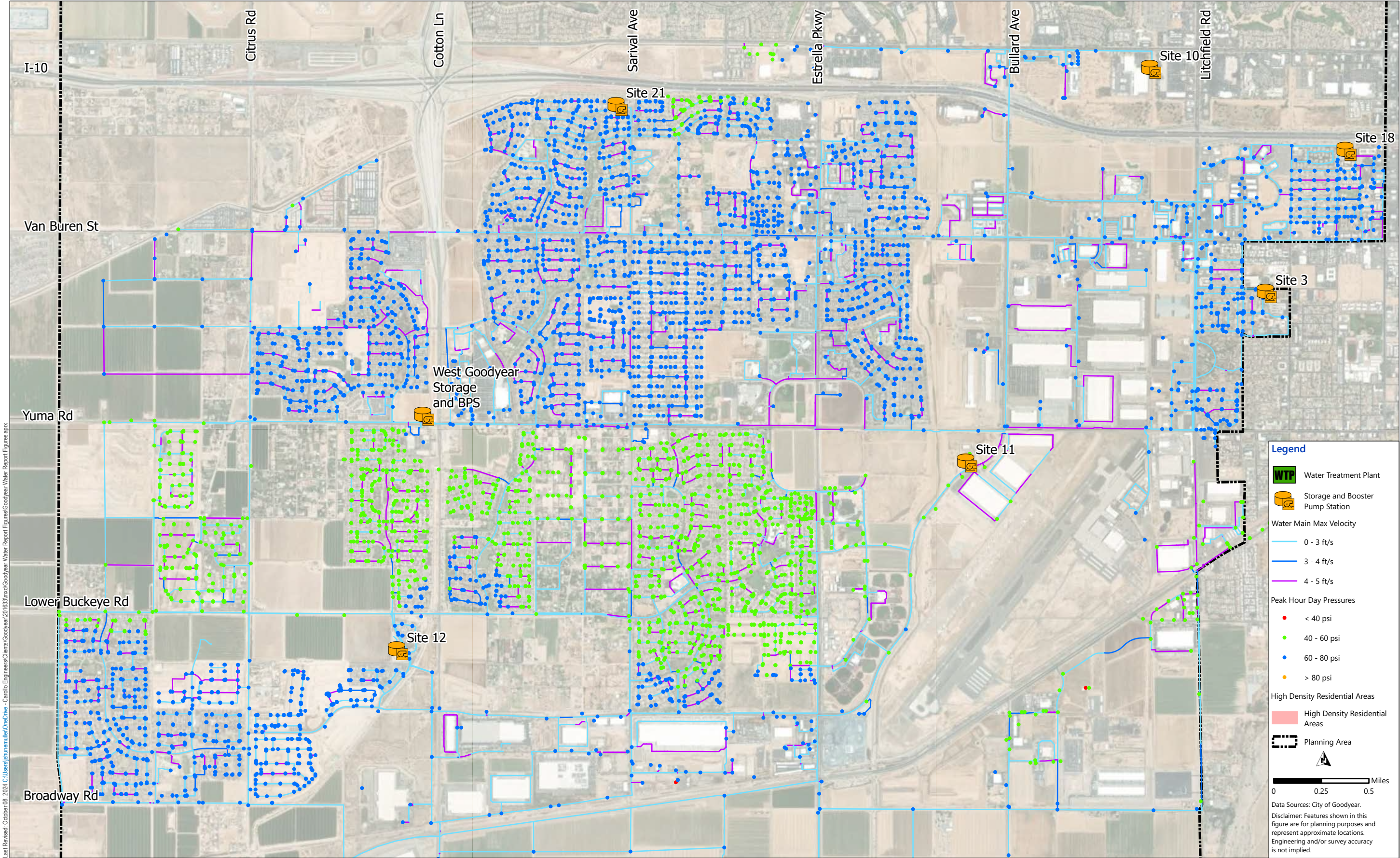


Figure 4.20 2040 Peak Hour Demand Pressures Near High-Density Development
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

4.7.6 Pipe Velocities

The 2023 water system was also evaluated to determine if pipeline velocities with peak hour conditions resulted in flows that were less than 7 ft/sec. This criterion was satisfied for all pipes in the distribution system. Figure 4.21 presents the 2023 water system peak hourly water velocities.

Figure 4.22 presents the maximum pipe velocities for the 2040 peak hourly demand conditions when the Central Zone is split. Maximum pipe velocity results were found to be similar with and without a Central Planning Area zone split.

4.7.7 Fire Flow Evaluation

The hydraulic model was used to evaluate the ability of the 2023 water distribution system to provide maximum day demands plus fire flow demands. The fire flow criterion is 1,500 gpm for residential areas and 3,500 gpm for commercial, industrial, and school areas. For horse properties, a fire flow of 1,000 gpm was applied because the pipes in many of these areas were not designed to deliver 1,500 gpm fire flows. Fire flow demands were applied only to pipes where hydrants exist. Most areas were able to deliver the required fire flow with a residual pressure greater than 20 psi. Areas where fire flows provided were less than the required criteria were primarily on dead end lines and locations where the pipe diameter is 6 inches or smaller. Figure 4.23 presents the 2023 water system fire flow residual pressures.

The hydraulic model was also used to evaluate the water distribution system under 2040 conditions to provide maximum day demands plus fire flow demands. Figure 4.24 and Figure 4.25 show the fire flow residual pressures for the 2040 water distribution system without and with a Central Zone split, respectively.

The development area south of Estrella Pkwy between Santa Elizabeth Dr and Krista Dr W in Zone 2 South does not meet fire flow requirements. This fire flow failure is due to a combination of low pumping capacity in Zone 2 South and high elevations in this development. The addition of pumps at Site 13 (Zone 2 South) would be beneficial to provide sufficient fire flow to this zone.

There are large areas of Zone 1 South and Zone 2 South that are not yet developed in Rainbow Valley. These areas are in the same elevation range as Zone 1 South and Zone 2 South. Therefore, pressures and fire flow capacity in these areas are predicted to be similar to the developed areas of current development in each zone.

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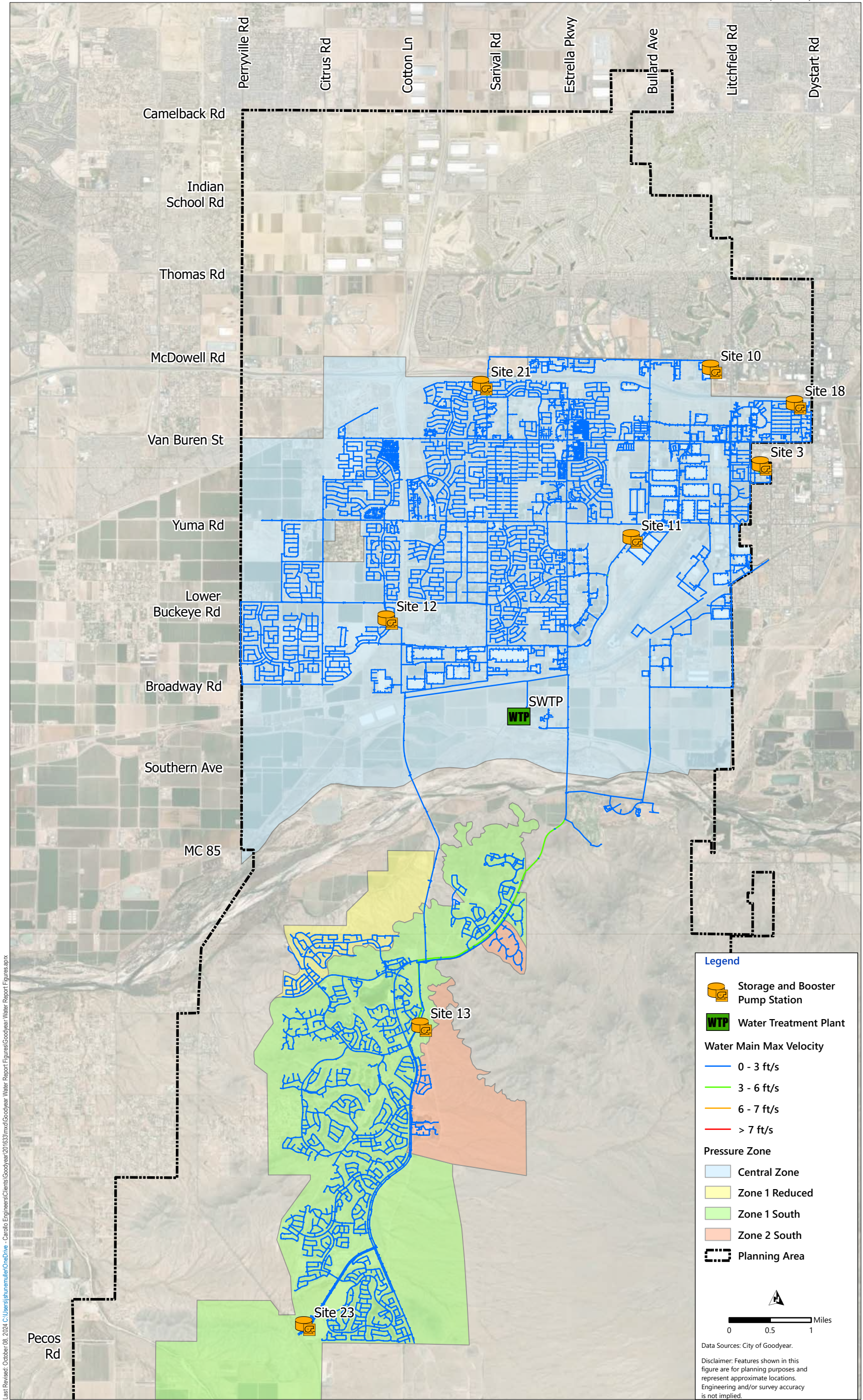
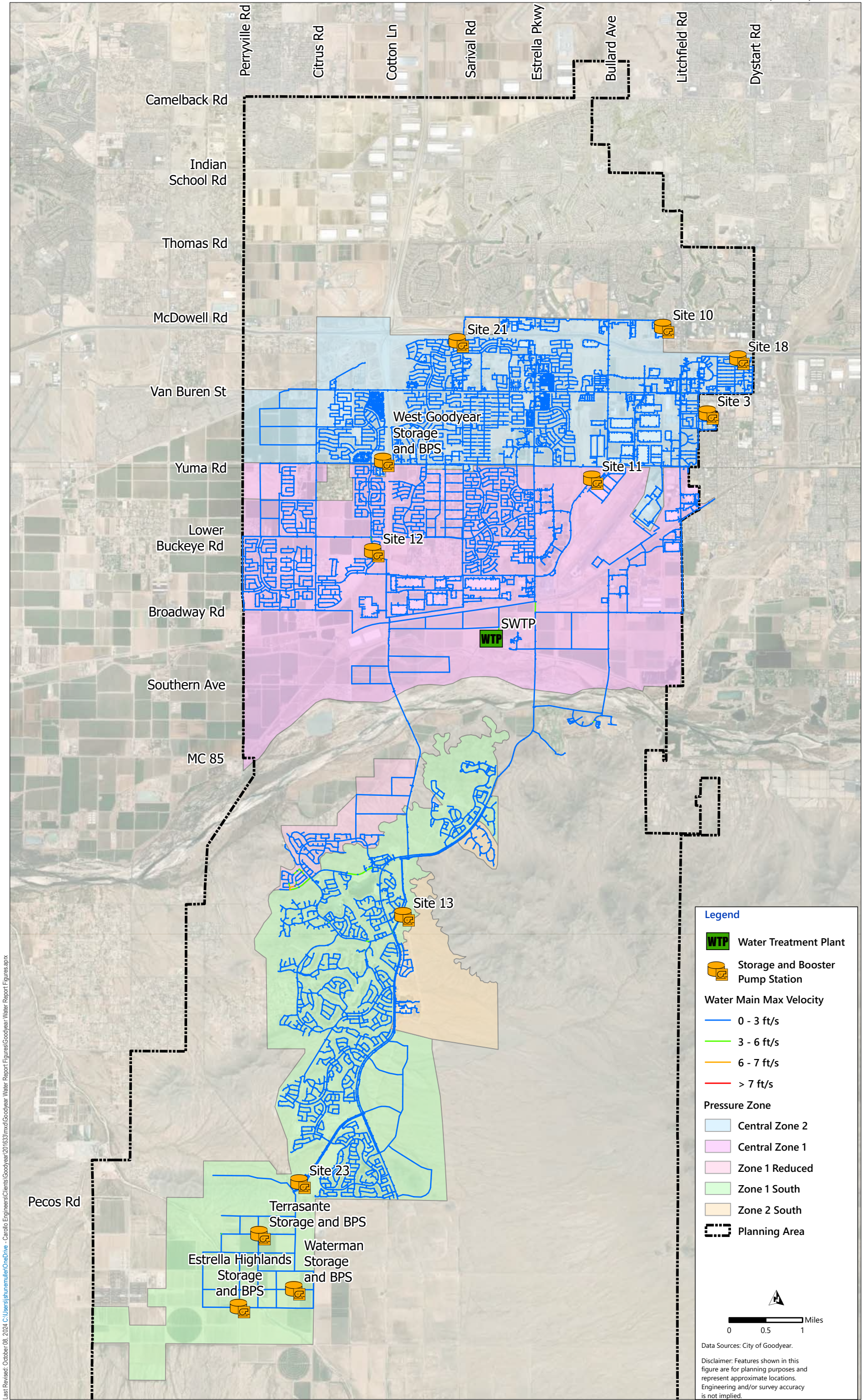


Figure 4.21 2023 Distribution System, Pipe Velocities with Peak Hour Demands
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN



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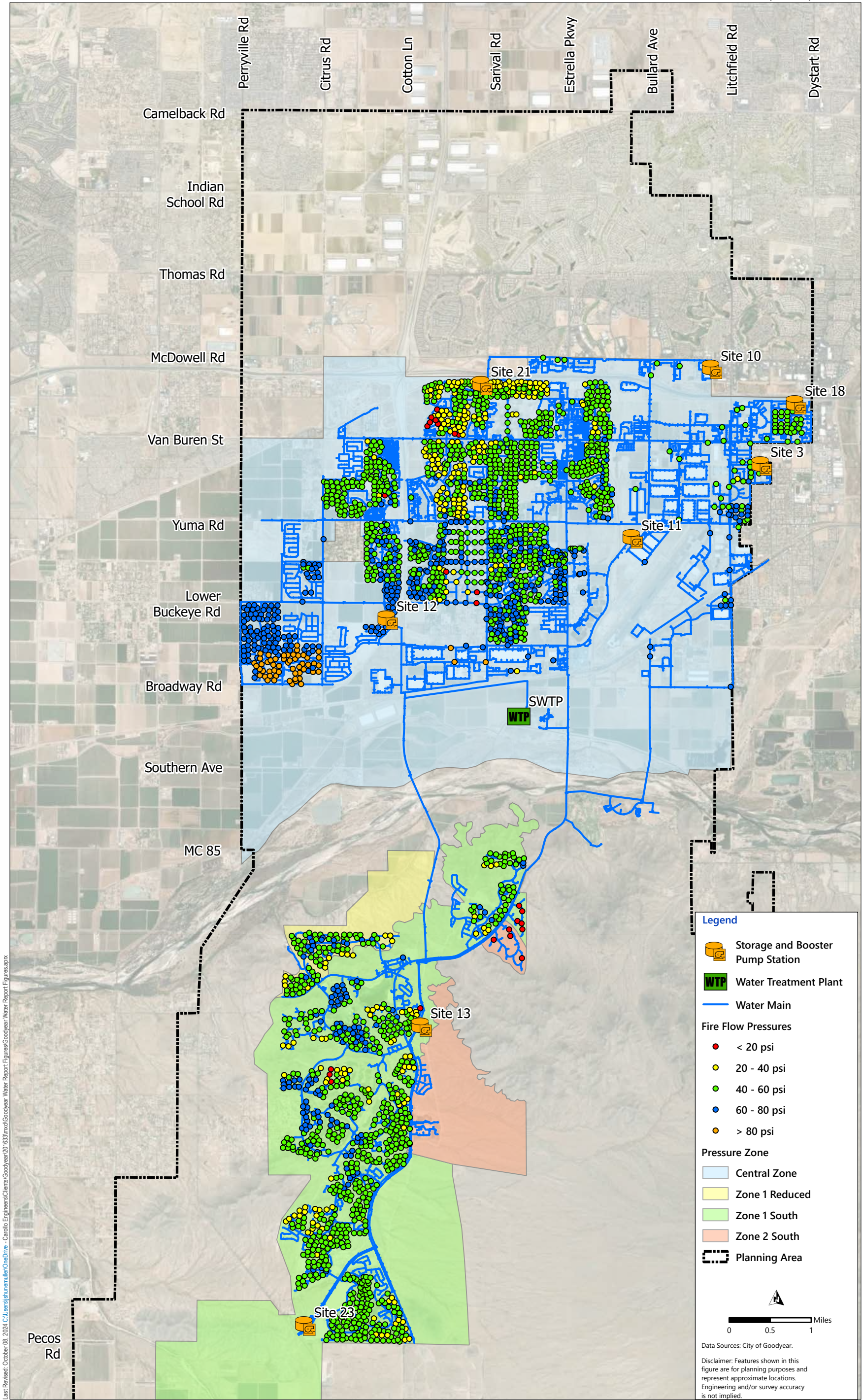


Figure 4.23 2023 Distribution System Fire Flow Pressures
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

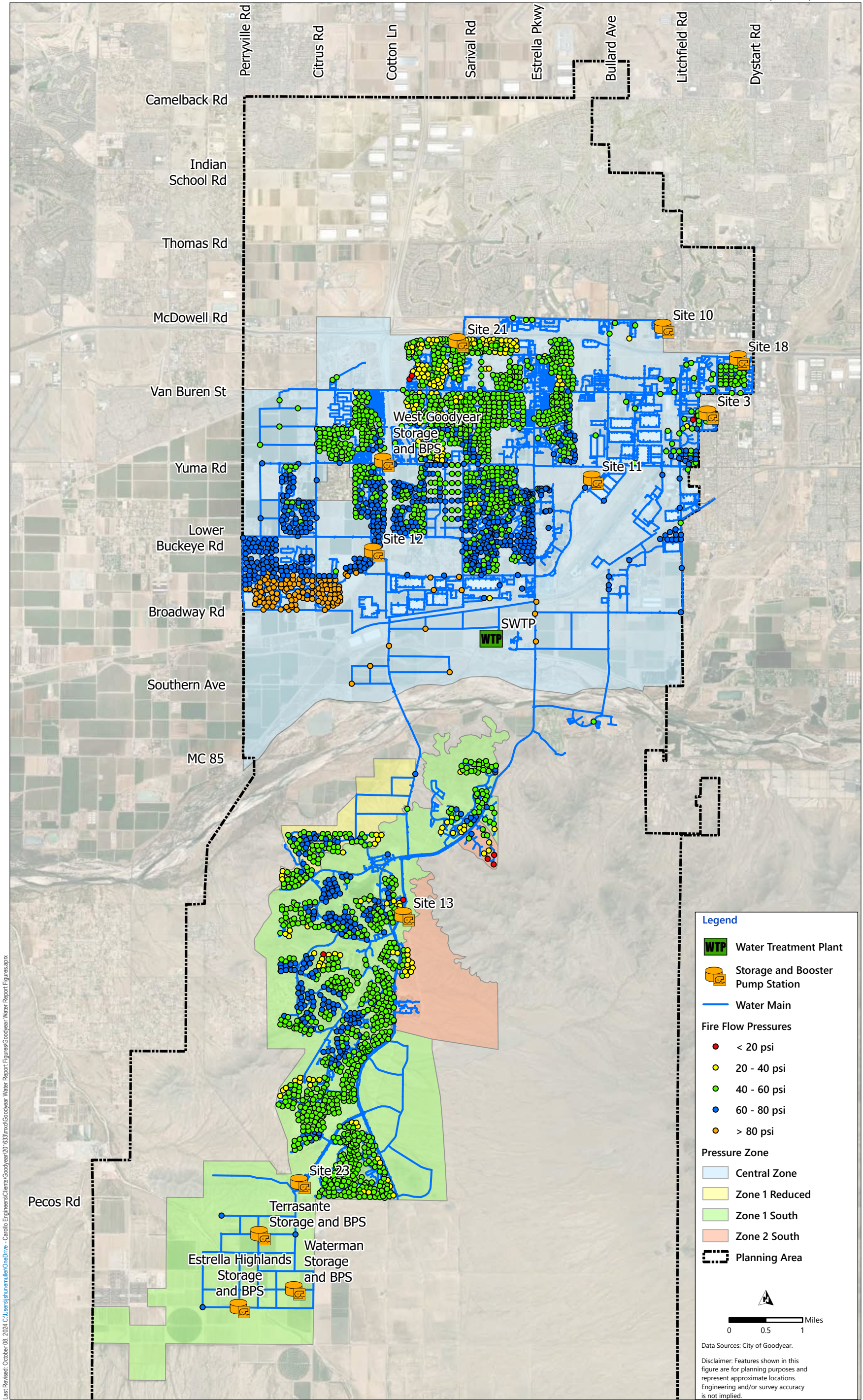


Figure 4.24 2040 Distribution System Fire Flow Pressures without Central Zone Split
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

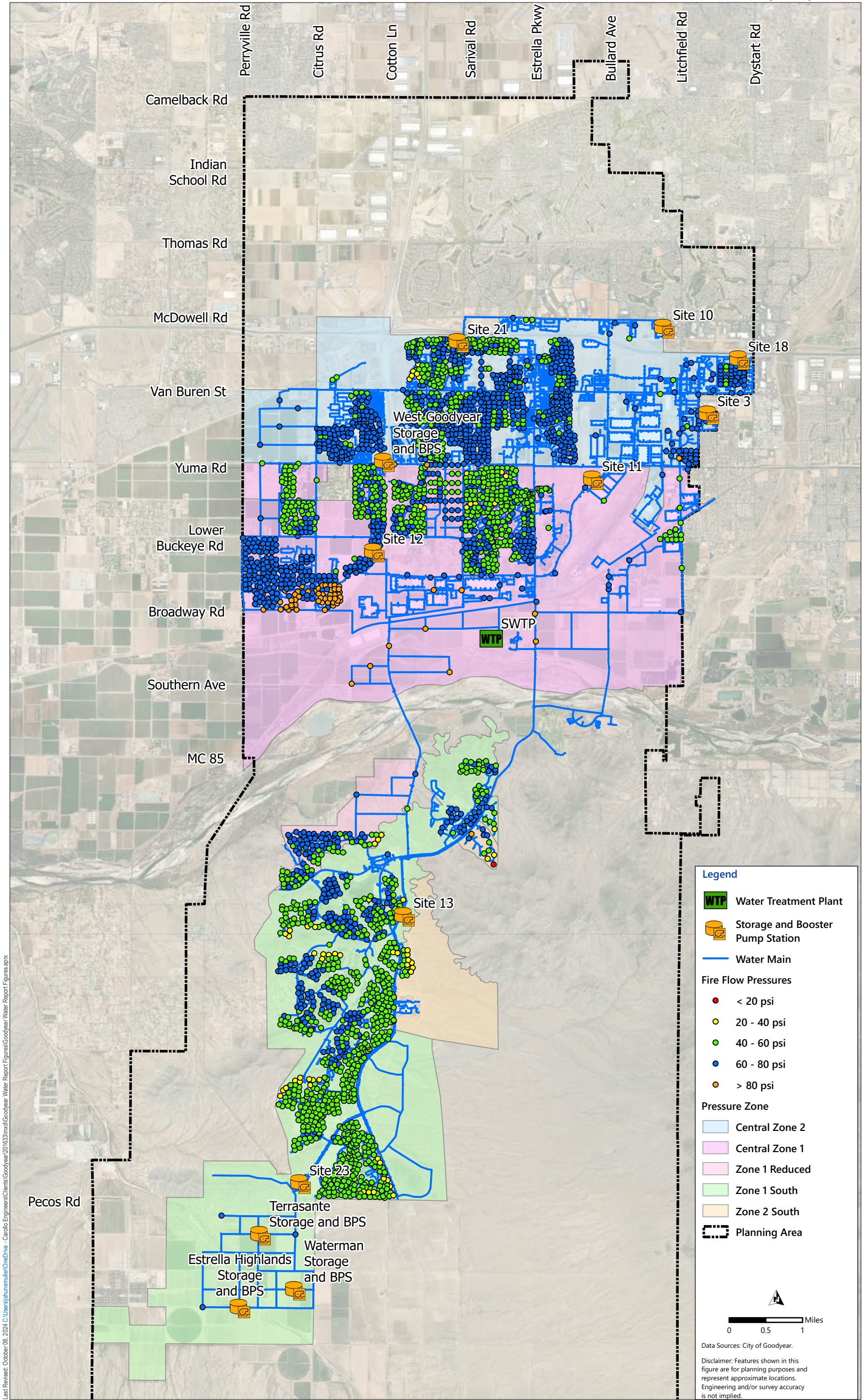


Figure 4.25 2040 Distribution System Fire Flow Pressures with Central Zone Split
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

4.8 Water System Capital Improvement Projects

Based on the system evaluations performed in this plan, projects have been identified to water system capacity where needed. This report recommends that the Central Planning Area be split into a north and south zone, primarily along the Yuma Rd alignment. The recommended projects in this section include the required infrastructure to create the pressure zone split. Figure 4.26 shows the recommended CIP projects for the water distribution system.

4.8.1 City Funded Projects

Table 4.21 through Table 4.25 list the water system improvements the City may fund.

Table 4.21 City Funded Water Supply Projects

Project #	Facility Type	Planning Period	Location	Justification	Diameter/Size (in/MG/mgd)	Length/Qty (ft/#)
W-21.6	Well	2035	Yuma Rd and Cotton Ln	Supply water to the West Goodyear Storage and Booster Pump Station.	2	1
W-28	WTP	2030	SWTP Expansion	Expand water production and storage capacity at SWTP.	9.5	1
W-31	Well	2030	Replace Well 18B	Increase Central Zone water production capacity. Arsenic treatment needed.	1.25	1
W-32	Well	2035	Site 21	Remove nitrate from Adaman well water.	2.25	1
W-42	Well	2035	Well 18 and 18B	Remove PFAS from Well 18 and 18B water.	1.25	1

Table 4.22 City Funded Water Storage Projects

Project #	Facility Type	Justification	Location	Volume Phase 1/2 (MG)	Planning Phase	Length/Qty (ft/#)
W-21.2	Tank	Provide additional storage capacity to Central Zone 2.	West Goodyear Storage Tanks	1.5/1.5	2035	2
W-41	Tank	Replace retired storage at Site 7 and Site 8.	Site 18	1.5	2030	1

Table 4.23 City Funded Pumping Facility Projects

Project #	Facility Type	Justification	Location	Flow Rate (gpm)	Planning Period
W-21.1	Pump Station	Provide redundant pumping capacity to Central Zone 2.	West Goodyear Booster Pump Station	5.75	2035
W-30	Pump Station	Provide additional pumping and fire flow capacity to Zone 2 South.	Site 13 (Zone 2 South) Pump Station	2.25	2040

Table 4.24 City Funded Pipeline and PRV Station Projects

Project #	Facility Type	Justification	Location	Diameter (in)	Length/Qty (ft/#)	Planning Phase
W-7	Water Main	Serve future developments and improve system looping.	Broadway Rd, from Estrella Pkwy to Bullard Ave	12	10,480	2030
W-14	Water Main	Serve future developments and improve system looping.	Desert Trumpet Rd to Westar Dr	12	3,385	2035
W-21.3	Water Main	Improve transmission capabilities for West Goodyear BPS.	From Citrus Rd and Jefferson St to Van Buren St at RV Park	24	3,895	2035
W-21.4	Water Main	Improve transmission capabilities for West Goodyear BPS.	From Citrus Rd and Yuma Rd to Yuma Rd and 175h Dr	24	2,409	2035
W-22	PRV	Split Central Zone into two pressure zones.	Yuma Rd and 173rd Ave	8	1	2035
W-23	PRV	Split Central Zone into two pressure zones.	Sarival Ave and Yavapai St	8	1	2035
W-24	PRV	Split Central Zone into two pressure zones.	Yuma Rd and 158th Dr	6	1	2035
W-25	PRV	Split Central Zone into two pressure zones.	Yuma Rd and 157th Ave	8	1	2035
W-26	PRV	Split Central Zone into two pressure zones.	Yuma Rd and Estrella Pkwy	8	1	2035
W-27	PRV	Split Central Zone into two pressure zones.	Yuma Rd and Litchfield Rd	8	1	2035
W-38	PRV	Split Central Zone into two pressure zones.	Yuma Rd and Bullard Ave	8	1	2035
W-39	PRV	Split Central Zone into two pressure zones.	Yuma Rd and Canyon Trails Blvd	8	1	2035
W-33	Water Main	Improve transmission capabilities from SWTP to western Goodyear.	From County Rd 85 and Sarival Ave to Citrus Rd and Broadway Rd	24	7,530	2035
W-34	Water Main	Parallels existing 16". Improve transmission capabilities from Site 12.	From Site 12 to Cotton Ln and County Rd 85	16	6,106	2040
W-35	Water Main	Replace undersized pipes to remove bottlenecks in pipeline.	Pipeline Replacements from Central zone to Site 13	20	3,548	2035
W-36	Water Main	Improve transmission from the SWTP.	From MC85 & North of SWTP to Estrella Pkwy and MC85	24	2,660	2030
W-37	Water Main	Improve transmission capacity to Microsoft sites.	16-Inch Pipe on Litchfield Rd from El Cielo to Main St	16	750	2030

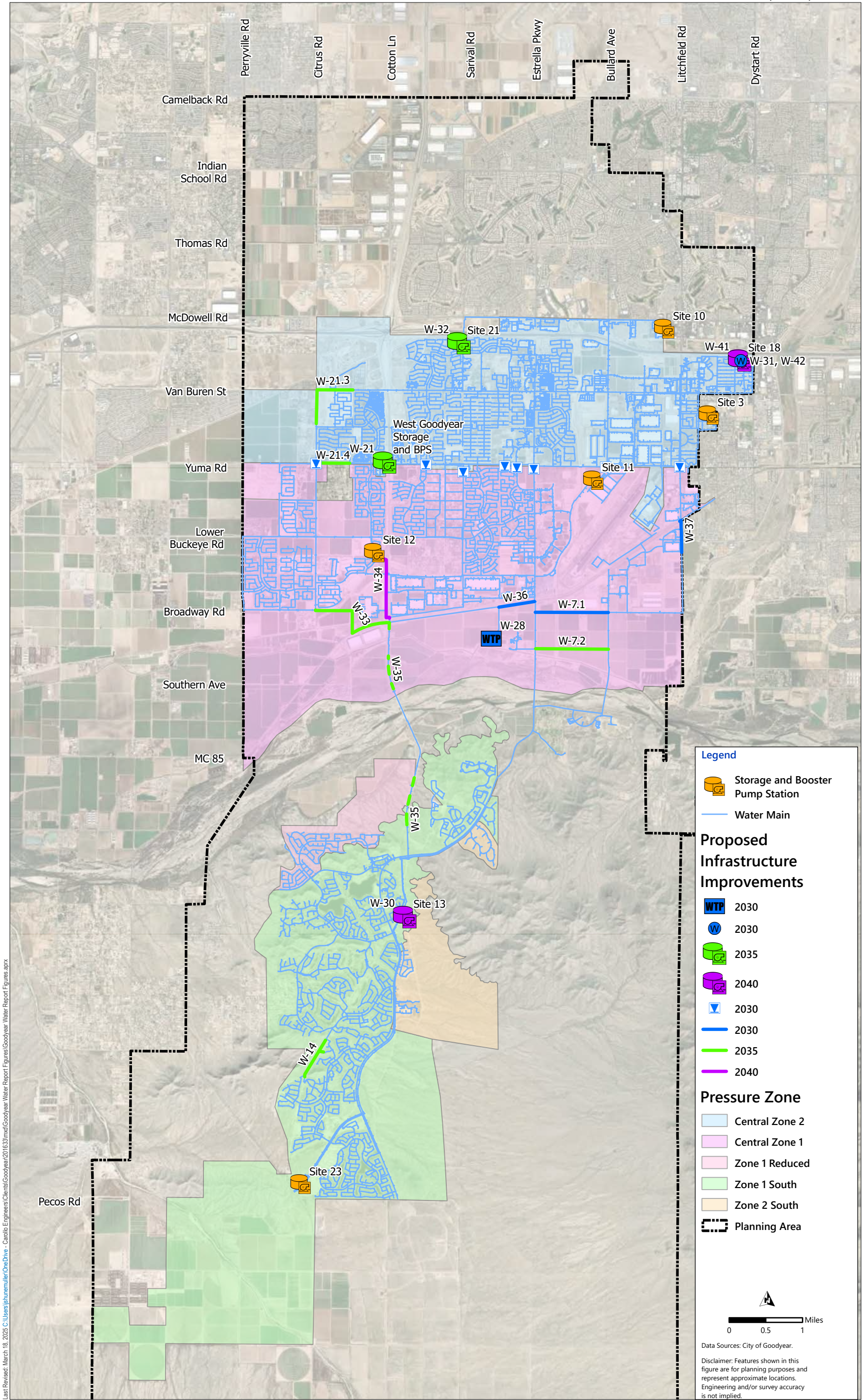


Figure 4.26 Water System Recommended CIP Projects
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

4.8.2 Developer-Funded Projects

Table 4.25 through Table 4.28 list the infrastructure projects that a developer may fund. Figure 4.27 shows the recommended developer-funded projects for the water distribution system.

Table 4.25 Developer-Funded Water Supply Projects

Project #	Facility Type	Planning Period	Location	Justification	Diameter/Size (in/MG/mgd)	Length/Qty (ft/#)
W-17.3	Well	2035	Terrasante Well	Serve new customers	2	1
W-20.3	Well	2035	Waterman Well	Serve new customers	2	1
W-40.1	Well	2040	Estrella Highlands	Serve new customers	2	1

Table 4.26 Developer-Funded Water Storage Projects

Project #	Facility Type	Justification	Location	Volume Phase 1/2 (MG)	Planning Phase	Planning Phase	Length/Qty (ft/#)
W-17.2	Tank	Serve new customers	Terrasante Storge Tanks	1/1	2035	2028	2
W-20.2	Tank	Serve new customers	Waterman Storage Tanks	1/1	2035	2040	2
W-40.2	Tank	Serve new customers	Estrella Highlands Storage Tanks	1/1	2040	2040	2

Table 4.27 Developer-Funded Pumping Facility Projects

Project #	Facility Type	Justification	Location	Flow Rate (gpm)	Planning Period
W-17.1	Pump Station	Serve new customers	Terrasante Booster Pump Station	5.6	2035
W-20.1	Pump Station	Serve new customers	Waterman Booster Pump Station	5.6	2035
W-40.3	Pump Station	Serve new customers	Estrella Highlands Booster Pump Station	5.6	2040

Table 4.28 Developer-Funded Pipeline Projects

Project #	Facility Type	Justification	Location	Diameter (in)	Length/Qty (ft/#)	Planning Phase
W-8	Water Main	Serve future developments	South of MC 85, from Cotton Ln to SWTP	12	9,944	2030
W-9	Water Main	Serve future developments	Southeast of Buckeye Canal Rd and Cotton Ln	12	9,827	2030
W-10	Water Main	Serve future developments	Southwest of Buckeye Canal Rd and Cotton Ln	12	8,063	2030
W-11	Water Main	Serve future developments	Van Buren St to Yuma Rd and Perryville Rd to Citrus Rd	12	19,949	2030
W-12	Water Main	Serve future developments	Yuma Rd to Lower Buckeye Rd, east of Perryville Rd	12	7,930	2030
W-13	Water Main	Serve future developments	North of San Gabriel Dr, west of Cotton Ln	12	12,119	2030
W-15	Water Main	Serve future developments	Estrella Development Area	12	23,137	2035
W-16.1	Water Main	Serve future developments	Rainbow Valley Phase 2028 Developments	12	13,272	2035
W-16.2	Water Main	Serve future developments	Rainbow Valley Phase 2028 Developments	16	6,557	2035
W-16.3	Water Main	Serve future developments	Rainbow Valley Phase 2028 Developments	24	630	2040
W-18.1	Water Main	Serve future developments	Rainbow Valley Phase 2033 Developments	12	15,888	2040
W-18.2	Water Main	Serve future developments	Rainbow Valley Phase 2033 Developments	16	13,205	2035
W-19.1	Water Main	Serve future developments	Rainbow Valley Phase 2038 Developments	12	14,544	2035
W-19.2	Water Main	Serve future developments	Rainbow Valley Phase 2038 Developments	16	10,650	2030

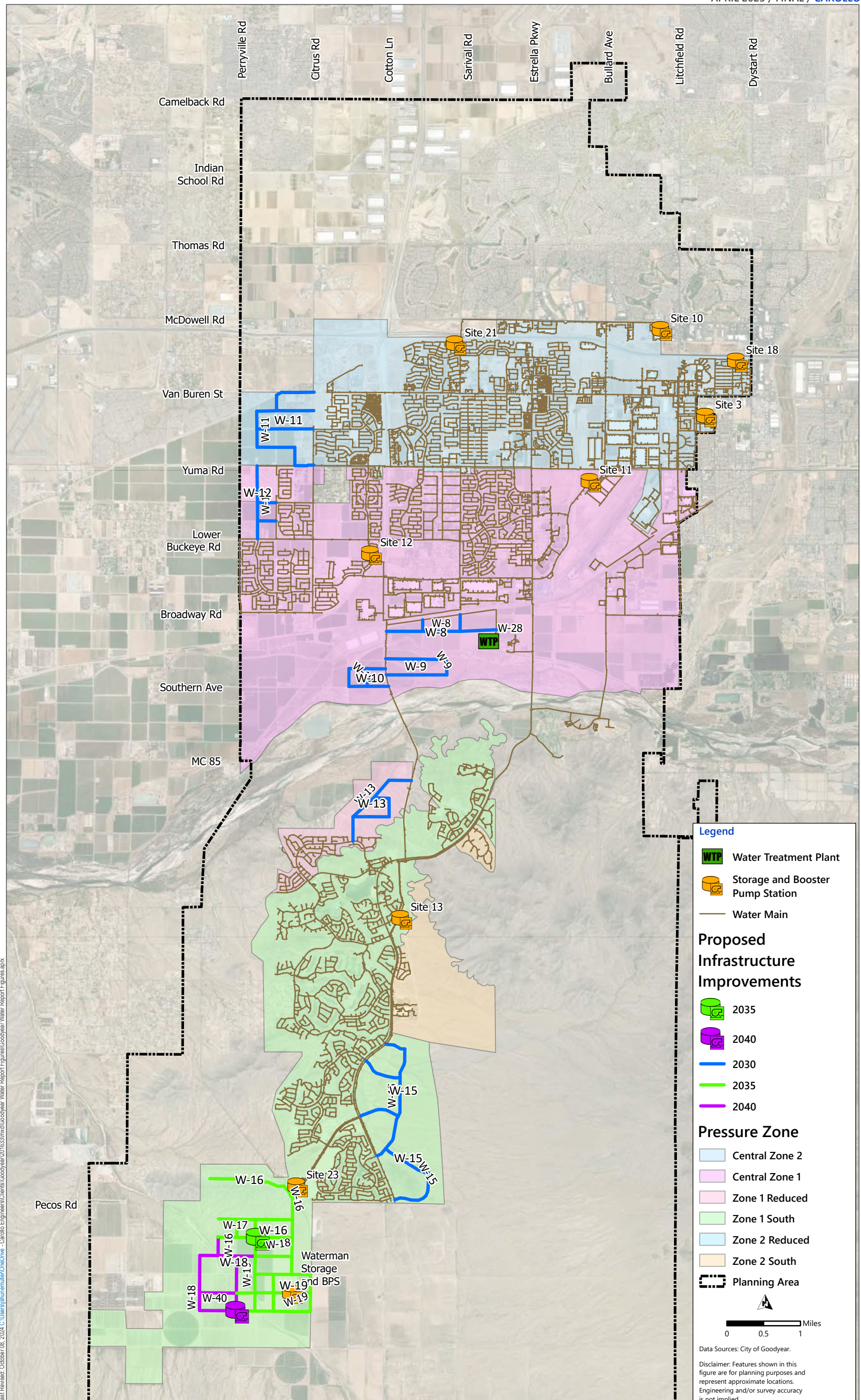


Figure 4.27 Water System Developer Funded Projects
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

4.9 Conclusion and Recommendations

4.9.1 Central Goodyear Improvements

New multi-family residential developments are being constructed in the Central Goodyear with additional residential developments projected through buildout. The existing distribution system supplies adequate pressures for current development, and the following infrastructure improvements are recommended to meet pressure and fire flow requirements through buildout:

1. The Surface Water Treatment Plant should be expanded to increase its capacity to 16-mgd by 2030. A new 4-MG storage facility and 8,000-gpm of pumping capacity should be included in the expansion.
2. A new 1.5-MG storage tank should be installed at Site 18 by 2030 to replace the retiring storage at Sites 7 and 8.
3. Ion exchange treatment should be installed at Site 21 by 2030 to treat water when the third Adaman well is brought online.
4. Well 18B should be repaired and brought online by 2030, along with any required arsenic and PFAS treatment.
5. The City should construct transmission mains to improve the transmission capabilities from water production sites and the proposed West Goodyear Storage and Booster Pump Station. Detailed descriptions of the recommended transmission main projects are provided in Sections 4.6 and 4.8 and in Chapter 7 of this report.
6. Construction of the West Goodyear Storage and Booster Pump Station by 2035 will improve the City's ability to meet demands from developing areas in western and northern Central Goodyear.
7. Splitting the Central Zone into northern and southern pressures zones by 2035 will allow the City to increase discharge pressures at Sites 3, 10, 18, and 21 to provide improved fire flows.

4.9.2 Central Pressure Zone Split

Due to the large elevation range in the Central Pressure Zone creates operational challenges in the Central Pressure Zone. Although pressures in the Central Zone meet requirements, the following recommendations could improve pressures and simplify pump station operations:

1. Split the Central Zone into Central Zone 1 and Central Zone 2 by installing 8 pressure reducing valves along the Yuma Rd alignment, by 2035. A pressure zone split will give the City the ability to improve pressure throughout the Central Zone.
2. The City should construct the West Goodyear Storage and Booster Station by 2035 to be located at the intersection of Cotton Ln and Yuma Rd with a 2-MG storage tank, 5.75-mgd of pumping capacity, and a 2 mgd well. This station will provide water to the new Central Zone 2.
3. A water main should be constructed between the West Goodyear Pump Station and the 24-inch water main that runs north from Site 12 at 173rd Ave and Yuma Rd. This connection will give the City the option of moving water north from Central Zone 1 to Central Zone 2 via the West Goodyear Storage and Booster Pump Station.

4.9.3 Estrella and Rainbow Valley Improvements

Demands in Goodyear's South Zone 1 pressure zone are expected to increase significantly as the Estrella area continues to develop and new developments in Rainbow Valley come online. To continue to meet pressure and fire flow requirements in the southern pressure zones, it is recommended that:

1. The City should upsize smaller-diameter pipe sections on the pipeline on Cotton Ln that provides water to the South Zones from the Central Zone by 2035. Improving this pipeline to have a uniform diameter will increase the City's capacity to deliver water to Sites 13 and Site 23.
2. The Site 13 (Zone 2) pump station should be expanded by 2040 to improve fire flow coverage in the South Zone 2 pressure zone.
3. Three new well, storage, and booster pump stations (Tartesso by 2030, Waterman by 2035, and Estrella Highlands by 2040) should be constructed by developers in Rainbow Valley to serve planned developments. New wells are expected to need arsenic treatment.

CHAPTER 5 WASTEWATER INFRASTRUCTURE MASTER PLAN

5.1 Introduction

Chapter 5 presents the wastewater system evaluation for the City as part of the 2024 IWMP. The purpose of the wastewater master plan is to identify the wastewater system growth, improvements, and timing to serve the City's needs through the 2030, 2035, and 2040 infrastructure planning periods. To develop the master plan, a hydraulic model was prepared to evaluate the capacity of the collection system in each infrastructure planning period. Proposed future infrastructure was evaluated, the timing of future wastewater treatment facility expansions was determined, and a plan for future collection system expansion was developed.

This chapter of the IWMP contains the following sections:

- 2024 Wastewater Collection System.
- Wastewater Collection System Hydraulic Model Update.
- Hydraulic Model Calibration.
- Wastewater System Performance Criteria.
- Future Infrastructure.
- Collection System Evaluations.
- Wastewater System Capital Improvement Program.
- Conclusion and Recommendations.

5.2 2024 Wastewater Collection System

The City's wastewater collection system is organized by the water planning areas defined in Chapter 2 and shown in Figure 5.1. WPA 1 and WPA 2 is served by the 157th Avenue WRF. The 157th Avenue WRF is the largest WRF owned by the City.

Liberty Utilities serves the remainder of the City north of I-10. This service area was not evaluated in the IWMP because it is not owned by the City.

WPA 3 is located south of the Gila River and currently includes only the Estrella community although additional developments are planned in WPA 3. The Corgett WRF serves the northern part of Estrella exclusively and is located south of the Gila River toward the west side of Estrella. The Rainbow Valley WRF serves the southern part of the Estrella community and is located near the at the south end of Estrella. The Rainbow Valley WRF is planned to serve currently undeveloped lands in the northern Part of WPA 4.

The central and southern portions of WPA 4 will be served by the future Waterman Wash WRF. The Waterman Wash WRF is expected to be developed beyond 2040 and is therefore not evaluated in this IWMP update.

Development of WPA 5 is not expected to begin before 2040. The City's current perspective is that WPA 5 may be served by a private utility, so a wastewater plan is not prepared in the IWMP for WPA 5.

5.2.1 Wastewater Treatment Facilities

5.2.1.1 157th Avenue WRF

Most of the developed area within the City is served by the 157th Avenue WRF, which is located at 157th Avenue and Romley Road, north of the BWCD Canal. Wastewater is conveyed to this facility through two interceptors (24-inch and 36-inch) that enter the plant's influent pump station from the north. The current treatment plant capacity is 6.1 million gallons per day (mgd) average annual daily flow (AADF). The 2023 flows to the 157th Avenue WRF are 5.3 mgd AADF.

There is an area in WPA 2 located south of I-10, north of Van Buren St., and west of Cotton Lane that is served either by septic systems.

In the future, the King Ranch development located south of the Gila River will be served by the 157th Avenue WRF. Even though King Ranch is located in WPA 3 and is closer to the Corgett WRF, reclaimed water from the Corgett WRF is used by Estrella. By transporting this wastewater flow to the 157th Avenue WRF. The City can use the reclaimed water generated by this development to augment the City's water resource portfolio.

5.2.1.2 Corgett WRF

The Corgett WRF is located northwest in the Estrella community west of San Gabriel Drive. Wastewater is conveyed to this facility through a 24-inch interceptor that enters the plant from the east. The current treatment capacity is 0.8 mgd AADF. The 2023 flows to the Corgett WRF are 0.5 mgd AADF.

5.2.1.3 Rainbow Valley WRF

The Rainbow Valley WRF is located on the northeast corner of the Rainbow Valley Road and Willis Road intersection southwest of the Montecito development in the Estrella community. Wastewater is conveyed to this facility through a 30-inch gravity sewer on the north and a 21-inch gravity sewer on the south. The current treatment capacity is 0.75 mgd AADF. The 2023 flows to the Rainbow Valley WRF are 0.5 mgd AADF. Current development that is served by the Rainbow Valley WRF is all in WPA 3, but future growth in WPA 4 over the next 15 years is planned to be served by the Rainbow Valley WRF.

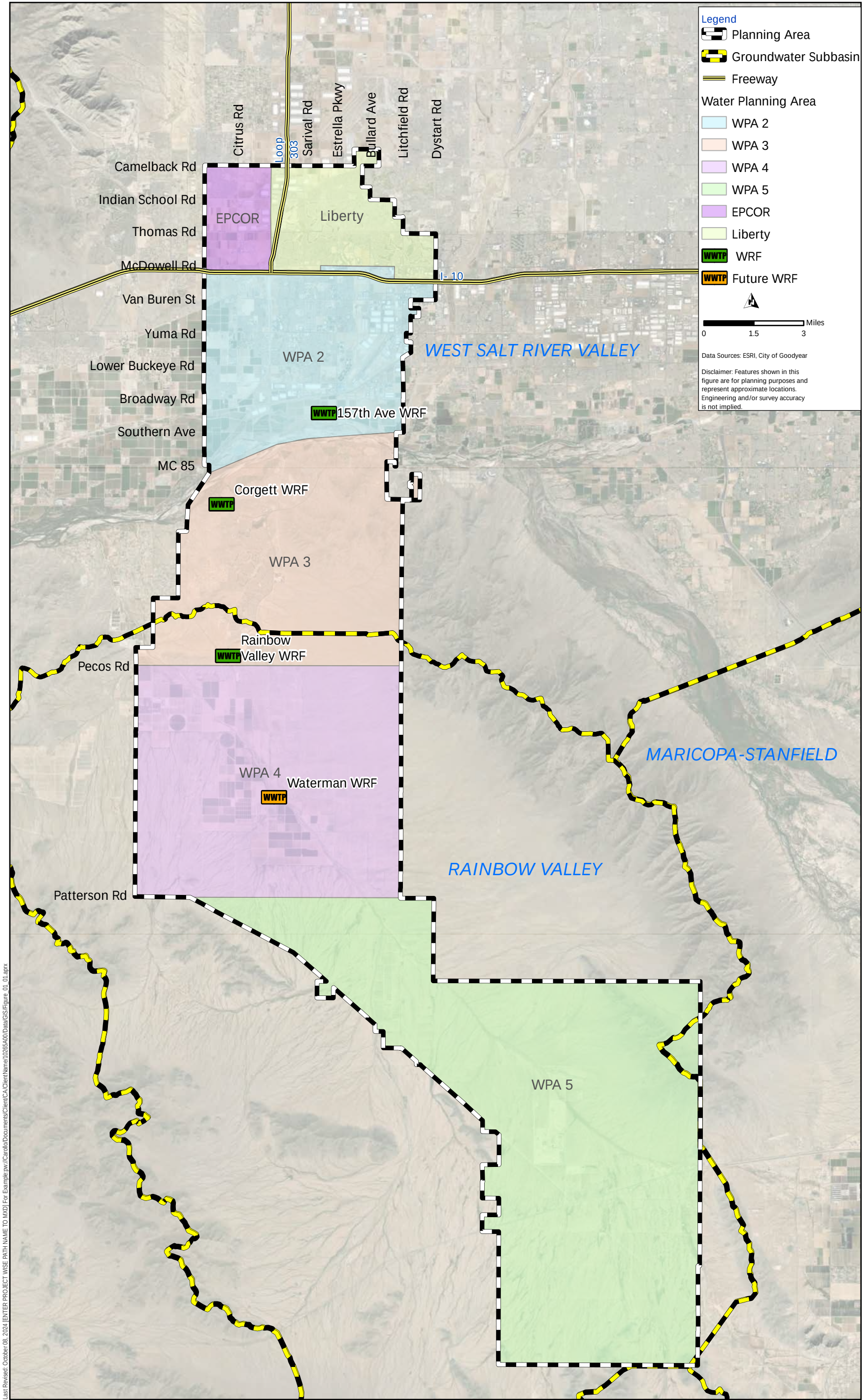


Figure 5.1 City of Goodyear Planning Area and Wastewater Treatment Facility Locations
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

5.2.2 Gravity Collection System

The City's existing wastewater collection system consists of 343 miles of gravity collection system pipes ranging from 4 to 60 inches in diameter, with approximately 7,108 manholes. Table 5.1 presents a summary of the gravity mains by diameter, based on the City's GIS geodatabase provided for this project. As shown in Table 5.1, roughly 84 percent of the City's gravity pipes are 8 to 12 inches in diameter. Figure 5.2 presents the 2024 wastewater collection system including gravity sewers, lift stations, and WRFs.

Table 5.1 Gravity Pipeline Summary by Diameter

Diameter (in)	Length (mi)	Percent of Collection System
≤6	9.0	2.6%
8	251.4	73.4%
10	14.8	4.3%
12	22.1	6.4%
15	12.2	3.6%
16	0.1	0.04%
18	11.1	3.2%
20	0.02	0.004%
21	3.7	1.1%
24	8.0	2.3%
27	1.2	0.3%
30	3.3	1.0%
33	0.6	0.2%
36	2.7	0.8%
42	0.5	0.2%
54	1.6	0.5%
60	0.4	0.1%
Total	342.6	

Table 5.2 summarizes the existing gravity mains by material. As shown in Table 5.2, the majority of the City's gravity pipelines are made of PVC. Approximately 70 percent of the gravity pipelines are PVC, 14 percent are vitrified clay pipe, and 1 percent are fiberglass pipe. Approximately 14 percent of the City's sewer gravity pipes do not have a pipe material classification in the City's GIS.

Although only a small percentage of the total pipe in the collection system, Orangeburg pipe is known to have a substandard quality, so these pipes should be considered for replacement.

Table 5.2 Gravity Pipeline Summary by Material

Pipe Material	Length (mi)	Percent of System
PVC	238.6	69.63%
Vitrified Clay	48.9	14.28%
Fiberglass	3.7	1.09%
Ductile Iron	2.3	0.66%
Orangeburg	1.0	0.30%
HOBAS	1.0	0.28%
Cement	0.6	0.17%
Precast	0.4	0.12%
Asbestos	0.1	0.017%
Unknown	46.0	13.44%
Total	342.6	

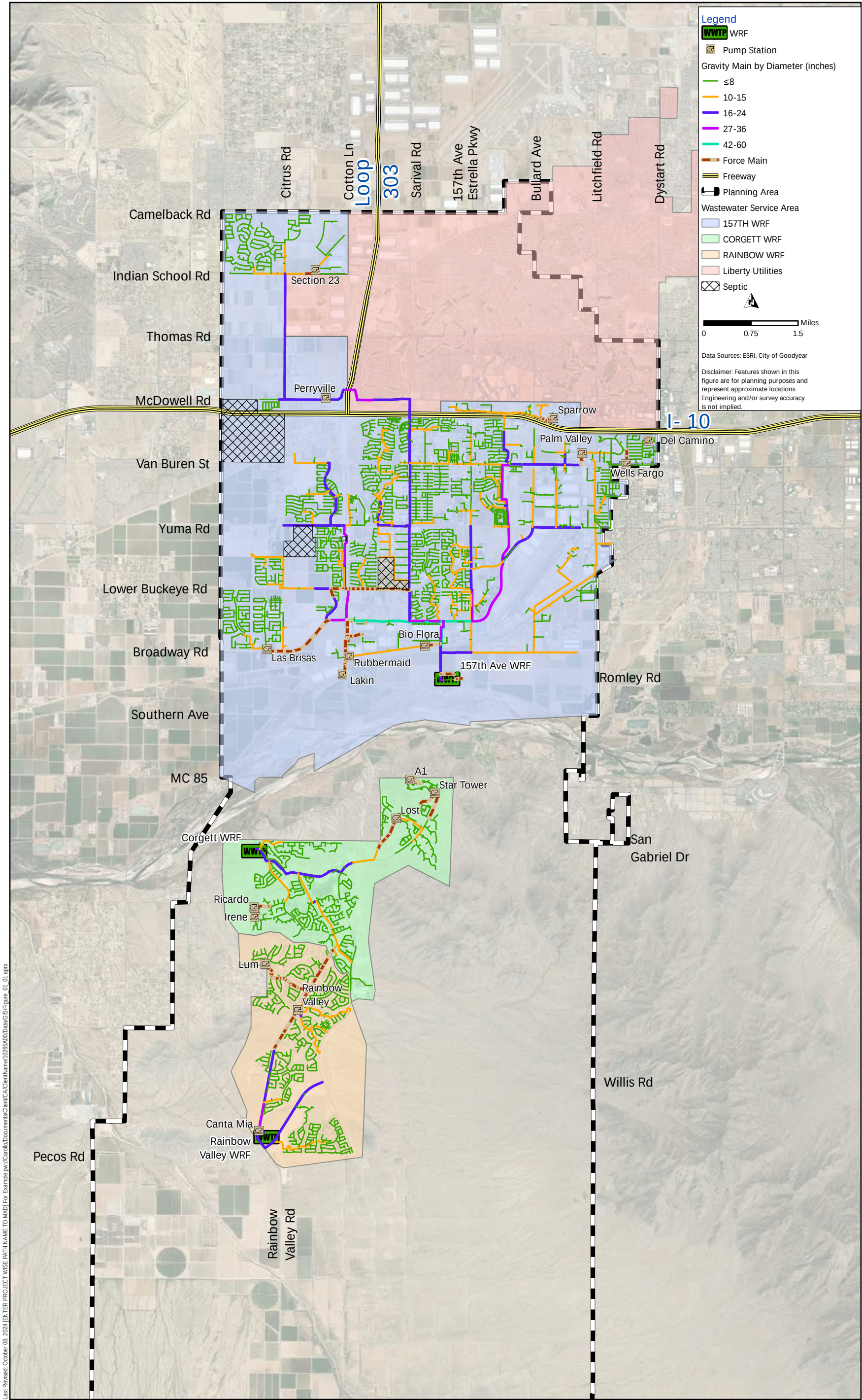


Figure 5.2 City of Goodyear 2024 Wastewater Collection System
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

5.2.3 Lift Stations

Most of the City's wastewater collection system flow by gravity directly to a water reclamation facility. However, lift stations are required to pump flow from lands with a lower elevation. The City currently operates and maintains 18 wastewater lift stations and 28 miles of force mains with diameters of 4 inches up to 12 inches in diameter, as shown in Figure 5.2. Table 5.3 summarizes lift station information, including the location, number of pumps, pump capacity, and discharge force main size.

Table 5.3 Lift Station Facilities

Lift Station Name	Location	Number of Pumps	Pump Capacity (gpm)	Lift Station Firm Capacity (gpm)	Force Main Diameter (in)
Goodyear WRF Service Area					
Bio Flora	Bio Flora Fertilizer Division	2	250	250	6
Del Camino	Country Aire Apartments	2	250	250	8
Las Brisas	181st Ave and Broadway Rd	3	400	800	8, 10
Palm Valley	Celebrate Life Way by the Cancer Treatment Centers of America	2	330	330	8
Rubbermaid	MC 85 and Cotton Ln	2	220	220	4
Wells Fargo	Van Buren St and Central Ave	2	250	250	6
Lakin	Buckeye Canal Rd and Cotton Ln	2	710	710	10, 12
Section 23	Indian School Rd and Cotton Ln	2	475	475	6, 6
Sparrow	145th Ave and McDowell Rd	2	300	300	4
Corgett WRF Service Area					
Irene	Santa Irene De and Wilson Ln	2	150	150	4
Lost	Northwest of Allen St and 168th Dr	2	710	710	8, 8
Ricardo	San Ricardo Dr	2	150	150	4
A1	Sophie Ln and 166th Dr	2	150	150	4
Star Tower	Hillside Dr and Estrella Pkwy	2	200	200	4
Sendero ⁽¹⁾	Sendero Dr and Ardmore Rd	2	150	150	4
Arroyo Ranch ⁽¹⁾	Cheyenne Rd and 188th Ave	2	150	150	4
Rainbow Valley WRF Service Area					
Canta Mia	Rainbow Valley WRF	2	250	250	4
Lum	Westar Dr and Sunward Dr	2	475	475	8
Rainbow Valley	Westar Dr and Lavender Ln	3	1,050	2,100	12, 12

Notes:

gpm - gallons per minute

(1) Sendero and Arroyo Ranch Lift Stations are planned for construction in the end of 2024 and 2025.

5.3 Wastewater Collection System Hydraulic Model Update

A sewer collection system model is a numerical representation of the actual sewer system. Sewer models can assess the conveyance capacity for a collection system and can also be used to perform "what if" scenarios to assess the impacts of future developments and land use changes. The City's collection system hydraulic model was updated using GIS data and operational information provided by the City. A model of the City's wastewater collection system was available from a previous study using the Innovyze InfoSewer hydraulic modeling software. However, this modeling software is being discontinued. Therefore, the model was converted from InfoSewer to the AquaTwin sewer modeling software by Aquanuity, which has similar features to the Infosewer software.

5.3.1 Wastewater Flow Allocation

Determining the magnitude and location of dry weather wastewater flows generated by a municipality is an important component of the master planning and modeling process. Good estimates of wastewater flows are important to evaluate existing and future wastewater collection system capacity requirements. Baseline wastewater flows were allocated in the hydraulic model at a parcel level based on the land use type. Parcels were linked to the closest gravity main, and flows were allocated to the upstream manhole of the gravity main. Chapter 2 describes the process used to calculate flows based on unit flows and developed status. The allocated flows were adjusted, as necessary, during the calibration process to closely match the actual measured flows recorded during the flow monitoring period for each flow monitoring basin.

5.4 Hydraulic Model Calibration

Hydraulic model calibration is a crucial component of the hydraulic modeling effort. Calibrating the model is used to get the model to provide a reasonable correlation between the model and flow data collected during the flow monitoring program. This section summarizes the methodology employed to calibrate the City's wastewater collection system hydraulic model and presents a summary of the calibration results.

5.4.1 Field Test

A wastewater system field test was conducted to record flow at 16 locations throughout the collection system starting June 11, 2023, and ending on June 23, 2023. The locations selected for flow monitoring were mostly the same sites metered in the 2016 IWMP that were performed by Carollo. The field test locations and collection basins are shown in Figure 5.3.

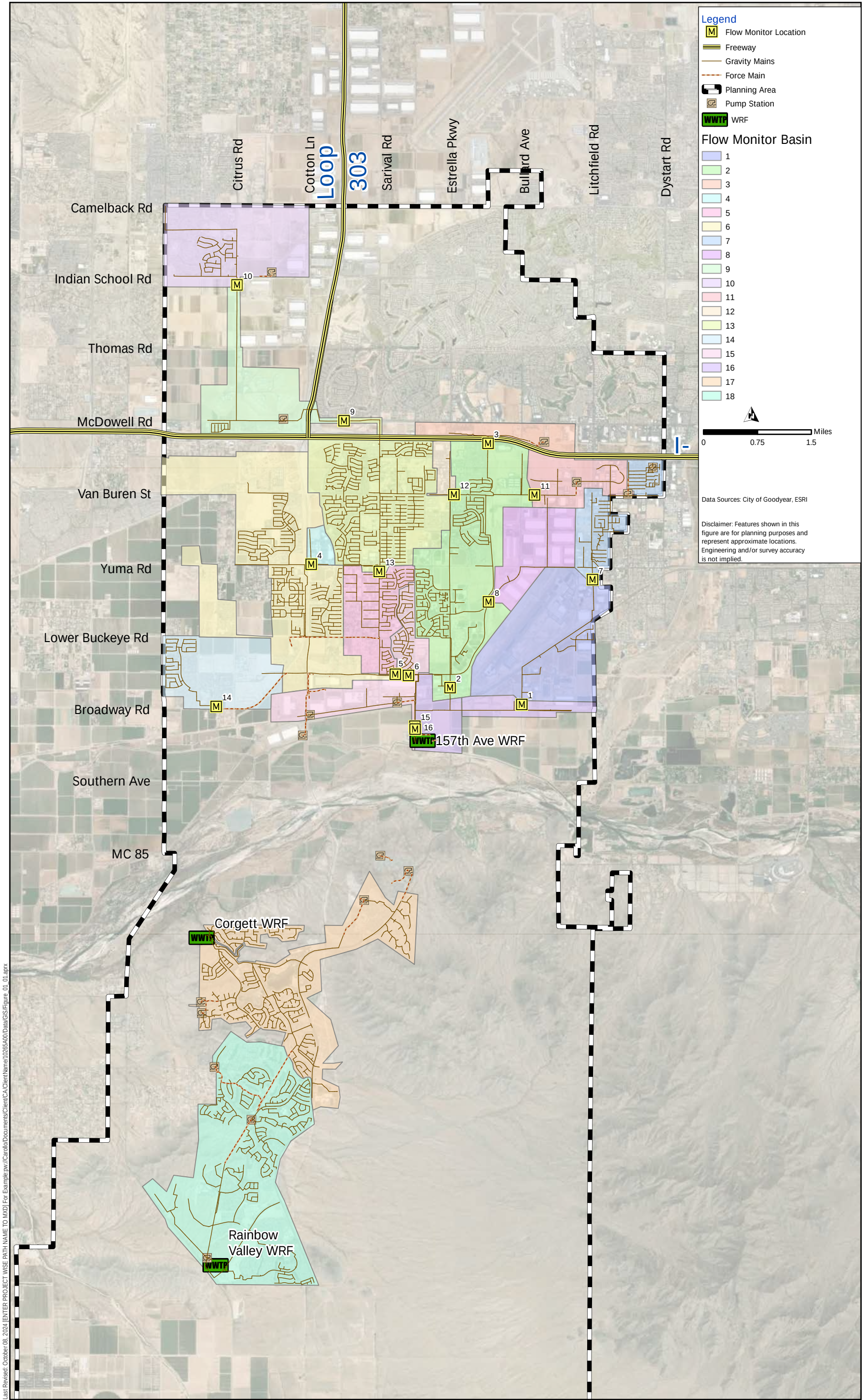


Figure 5.3 Wastewater Flow Monitoring Basins
CITY OF GOODYEAR
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Table 5.4 lists the manholes where the flowmeters were installed. Figure 5.4 provides a schematic representation of the flowmeters and collection basins upstream of each temporary flowmeter. The purpose of the schematic is to show the connectivity between each basin and flowmeter. The temporary flowmeter locations are all in the 157th Avenue WRF service area.

The flowmeters at the inlets to the Corgett and Rainbow Valley WRF were used to measure flow going into the facility. Each flowmeter has a flowmeter basin number that shows the tributary area of flow that directly goes to the flowmeter. The flow measurements from the flowmeters correspond to the flow from the upstream basin plus any additional flow measured from upstream flowmeters. Data from the flow monitoring program was used to develop diurnal flows and calibrate the hydraulic model.

Table 5.4 Wastewater Flowmeter Locations

Flowmeter Number	Location	Pipe Diameter (in.)	Manhole ID
FM-1	S Bullard Ave between Broadway Rd and W La Estrella	12	MH88C-301
FM-2	4040 Estrella Pkwy	12	MH86D-405
FM-3	Bullard Wash, south of the I-10	15	MH57B-304
FM-4	Northeast of Cotton Ln and Yuma Rd	15	MH64D-403
FM-5	W Elwood St, west of 161st Ave	30	MH86A-301
FM-6	W Elwood St, between 161st Ave and Estrella Pkwy	54	MH86C-202
FM-7	Litchfield Rd, east of Lancaster Arms store	12	MH79A-101
FM-8	S Bullard Ave, north of Durango St alignment	24	MH77B-308
FM-9	North of W McDowell Rd and west of Clubhouse Dr	24	MH45C-401
FM-10	N Citrus Rd, south of Indian School Rd	18	MH34A-102
FM-11	W Van Buren St between Bullard Ave and 145th Ave	18	MH58C-302
FM-12	W Van Buren St, east of Estrella Pkwy	12	MH67A-104
FM-13	Sarival Ave, south of Yuma Rd	24	MH75B-203
FM-14	Las Brisas Lift Station	8	MH83D-301
FM-15	North of 157th Ave WRF	24	MH96B-107
FM-16	North of 157th Ave WRF	36	MH96B-303

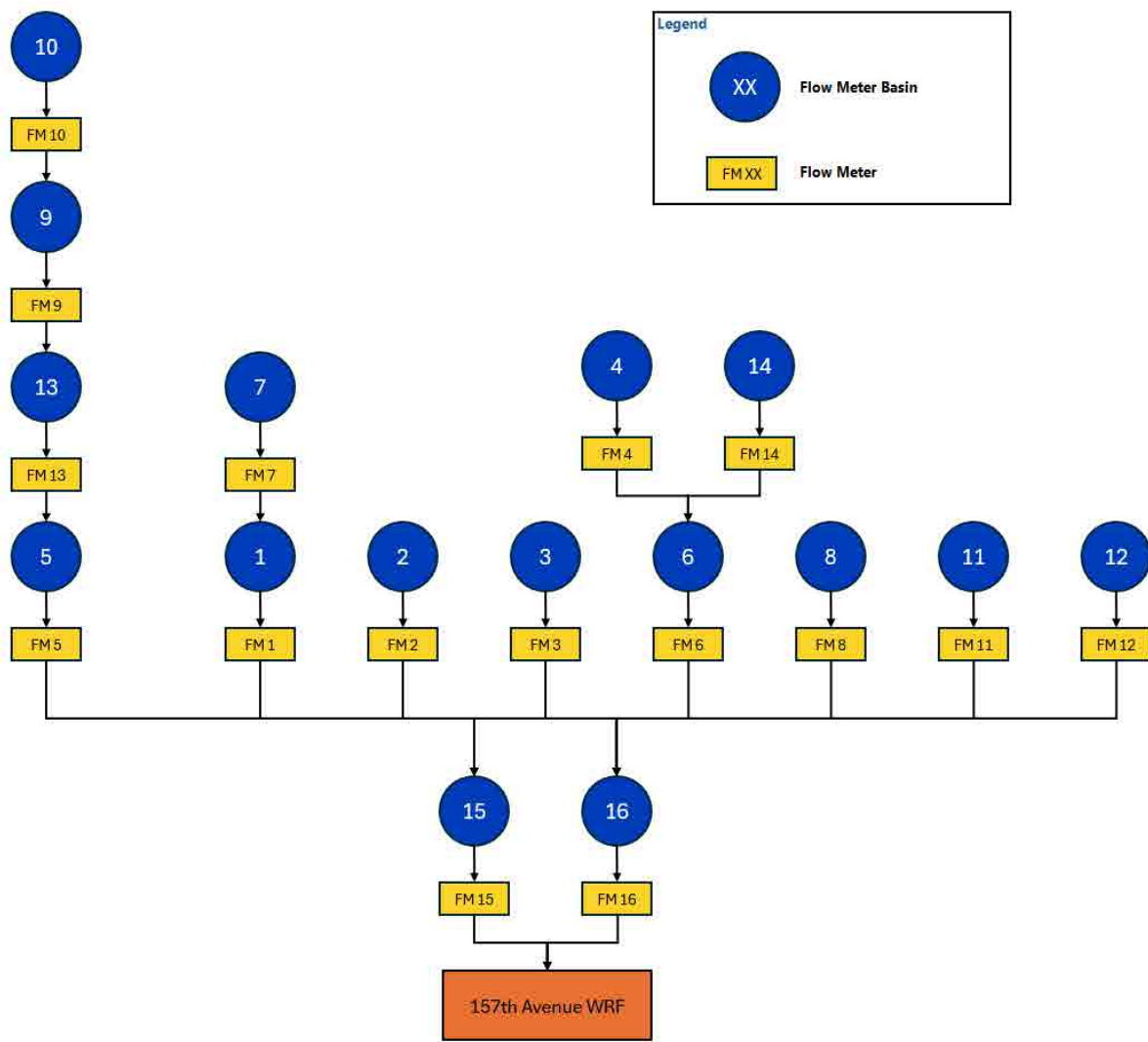


Figure 5.4 Collection Basin and Flowmeter Schematic

5.4.2 Flow Monitoring Program Results

Table 5.5 summarizes the results of the flow monitoring program, including average and maximum flows and depths observed during the flow monitoring program. The flows listed in Table 5.5 are the flows measured at each flowmeter, including flow from any upstream flowmeters. As shown in Table 5.5, the maximum to average flow peaking factors ranges from 1.52 to 4.26. There was no rain during the flow monitoring period. Table 5.5 also lists the maximum depth (d) recorded during the flow monitoring program and the pipe diameter (D). Site 13 had the highest d/D ratio of 0.62. There was no surcharging at any of the flow monitoring sites during the field test. Appendix 5A contains the flow monitoring test results.

Table 5.5 Flow Monitoring Results Summary

Flowmeter Site	Average Flow (mgd)	Maximum Flow (mgd)	Maximum to Average Flow Peaking Factor	Pipe Diameter, D (in)	Maximum Depth, d, (in)	Maximum d/D Ratio
Site 1	0.21	0.44	2.14	12	4.83	0.40
Site 2	0.12	0.24	1.96	12	3.32	0.28
Site 3	0.11	0.46	4.26	15	4.76	0.32
Site 4	0.05	0.12	2.50	15	1.23	0.08
Site 5	1.83	3.99	2.18	30	11.15	0.37
Site 6	1.92	4.75	2.47	54	11.14	0.21
Site 7	0.13	0.50	3.92	12	6.15	0.51
Site 8	0.51	0.97	1.88	24	8.30	0.35
Site 9	0.46	0.72	1.58	24	5.80	0.24
Site 10	0.18	0.26	1.44	18	4.01	0.22
Site 11	0.29	0.52	1.79	18	5.28	0.29
Site 12	0.13	0.27	2.05	12	4.69	0.39
Site 13	1.79	4.04	2.25	24	14.90	0.62
Site 14	0.18	0.38	2.12	8	4.14	0.52
Site 15	2.13	3.24	1.52	24	12.36	0.52
Site 16	3.42	6.17	1.80	36	16.29	0.45

5.4.3 Calibration Results

After reviewing the data from the flow monitoring period, Thursday June 15th was selected as the calibration day because the data for each site on this day appeared reasonable, and the evening peak was also consistently higher than other days. The model is only calibrated for dry weather flow (DWF) as there was no rainfall during the flow monitoring period. Goodyear is in a desert where wet weather flow (WWF) occurs infrequently, and storm inflows are small and last only a short time.

Flow calibration was completed for each of the flow monitoring sites. The flows were calibrated for Thursday June 15, 2023, because on average, the highest flows occurred on that day and not on the weekend. Figure 5.5 is an example graph comparing the modeled and measured flow at Site 14. Appendix 5B contains calibration graphs for each flowmeter site. Flows from flowmeter sites 15 and 16 were combined for calibration because the flowmeter basins for these sites were connected upstream of the meters. The calibrated modeled flows are within 10 percent of the measured average flows at each of the flow monitoring sites, which is a good calibration.

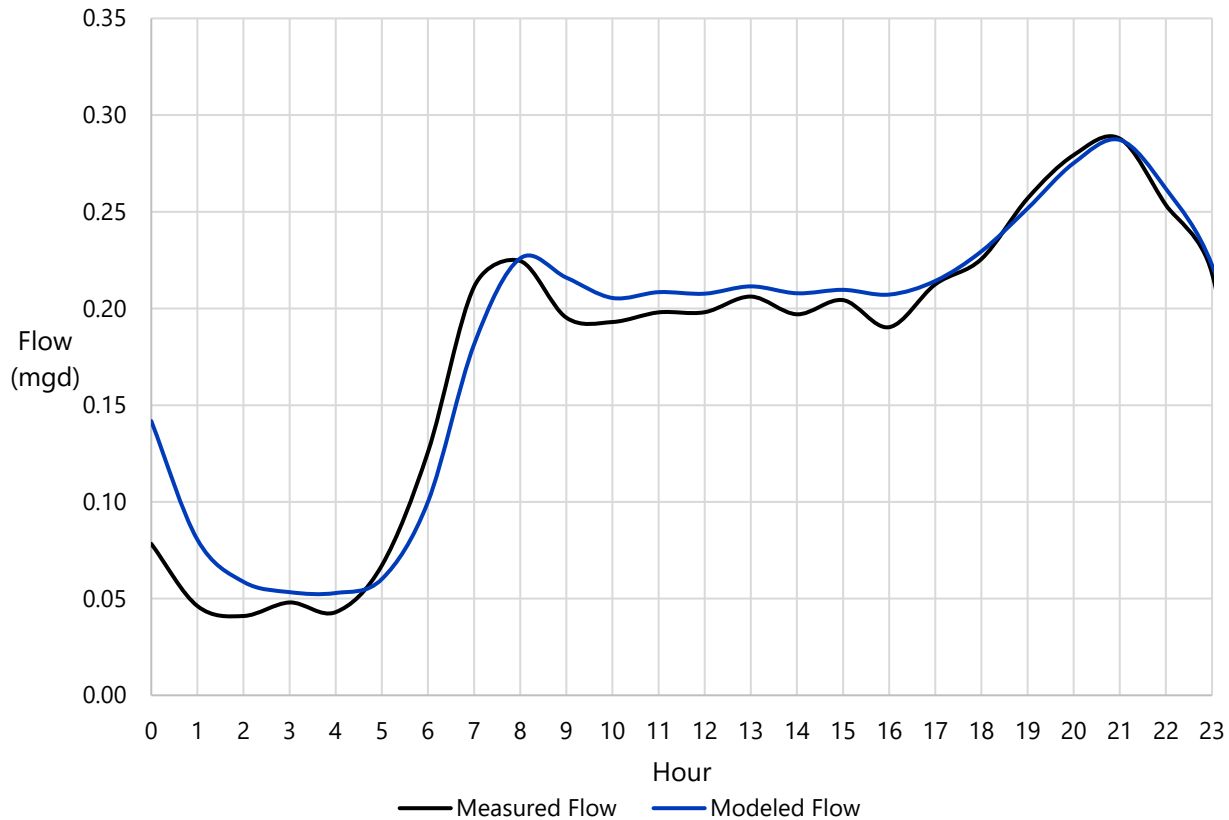


Figure 5.5 Flow Calibration Graph for Site 14

5.5 Wastewater System Performance Criteria

Performance criteria are the standards of measurement used to evaluate the adequacy of wastewater collection system infrastructure including pipe (gravity and force main), lift station, and treatment facility capacity. Performance criteria are based on legal requirements and engineering best practices. Design criteria are also included in this section for reference and is applied to future infrastructure.

The wastewater design standards and performance criteria are described below.

5.5.1 Gravity Pipe Capacity

Sewer capacity is dependent on factors, including pipe roughness, maximum allowable flow depth, limiting velocity, and pipe slope.

Gravity sewers should be designed and constructed to have:

- A minimum of 4 feet of cover or sufficient depth to serve the ultimate drainage area.
- A target depth of 7 feet of cover for new sewer main installation.

Gravity sewers and force mains must have a minimum separation of 6 feet from potable water mains and reclaimed water mains unless they are provided with increased protection in accordance with A.A.C. R-18-5, Article 4 and A.A.C. R-18-9, Article 6.

Manholes with sewers intersecting at greater than or equal to 90-degree angles should provide 0.2 foot of invert drop across the manhole. Other manholes should provide a minimum 0.1 foot of invert drop.

5.5.1.1 Pipe Roughness

The Manning's coefficient 'n' is a friction coefficient that varies with respect to pipe material, size of pipe, depth of flow, smoothness of joints, root intrusion, and other factors.

For planning purposes, and 'n' value of 0.013 is used. The A.A.C. requires the use of a Manning's coefficient of 0.013 for the design of new sewers (A.A.C. R18-9-E301(D)(2)(e)).

5.5.1.2 Flow Depth

When designing sewers, it is common practice to establish a flow depth capacity criterion to evaluate pipe capacity. This criterion is expressed as a ratio of maximum depth of flow (d) to pipe diameter (D). Design d/D ratios typically range from 0.5 to 0.75, with the lower value typically used for smaller pipes that may experience flow peaks greater than planned or may experience blockages from debris.

The City's performance criteria from the 2016 IWMP state that new sewer pipes should be sized for a d/D ratio of 0.6 during peak hour dry weather flow, and 0.65 for peak hour, wet weather flows. Existing sewers will be evaluated based on a flow depth criterion of 0.9 at peak hour, wet weather flows because there are fewer unknowns, especially in established, built out areas, and because there is no need to replace or provide relief for an existing sewer until flows are at the maximum design capacity of the pipe.

The hydraulic criteria used for sizing new, proposed gravity sewers will have a greater factor of safety than the criteria used to evaluate the capacity of the existing system due to the uncertainties in making projections of future flows. This approach allows full use of existing sewer capacity and avoids upsizing sewer prematurely.

5.5.1.3 Velocity and Minimum Slope

To minimize the settlement of solids in the flow and promote scouring, it is standard design practice to specify that a minimum velocity of 2 ft/sec be maintained when the pipe is flowing half full. The City of Goodyear requires 2.5 ft/sec to be maintained in gravity sewers that are 8 inches in diameter or smaller. At these velocities, sewer flows will typically provide self-cleaning for the pipe. Due to the hydraulics of a circular pipe, the velocity for half-full pipe flow approaches the velocity of nearly full pipe flow.

Table 5.6 lists the minimum slopes for maintaining self-cleaning velocities at half or full flow with d/D = 0.5 or 1.0, which provides the most conservative minimum slope. The minimum slope listed in the table is 0.0008 foot per foot (ft/ft), which is the minimum practical slope for gravity construction.

Table 5.6 Recommended Minimum Slopes for Circular Gravity Sewers

Pipe Diameter (in.)	Minimum Slope (ft/ft)	Pipe Capacity	
		(gpm)	(mgd)
8	0.0052	392	0.56
10	0.0025	493	0.71
12	0.0020	717	1.03
15	0.0015	1,126	1.62
18	0.0012	1,638	2.36
21	0.0010	2,255	3.25
24	0.0008	5,221	7.52
≥36	0.0008	8,490	12.23

Notes:

- (1) Slopes are calculated using Manning's Equation for full pipe flow ($d/D = 1.0$) with a minimum velocity of 2 ft/sec for all diameters except for 8 inches for which the minimum slope corresponds to 2.5 ft/sec.
- (2) Sewers larger than 24 inches should have a slope ≥ 0.0008 .
- (3) Pipe Capacity based on full pipe flow or $d/D = 1.0$.

Greater slopes are desirable if they are compatible with existing topography and infrastructure, provided that the wastewater velocity does not exceed the maximum velocity criteria of 10 ft/sec established in A.A.C. R-18-9-E301(D)(2)(f) unless scour resistant material is used. Velocities greater than 10 ft/sec may also result in turbulent flow conditions that contribute to odor problems.

5.5.1.4 Changes in Pipe Size

When a smaller sewer joins a larger sewer, the invert of the larger sewer will be lowered sufficiently to maintain the same energy gradient. Since GIS data is available for the City's existing sewer mains, this information will be used for the sewer inverts in the hydraulic model when available. For planning sewer pipes, sewer crowns were matched at manholes when a smaller sewer joins a larger one.

5.5.1.5 Manhole Spacing

Manholes are typically installed at grade changes, changes in sewer pipe sizes, alignment changes, and intersections with other sewer pipes. In addition, manholes should be located to facilitate sewer cleaning. The recommended maximum manhole spacing for different diameters of sewer pipe are listed in Table 5.7.

Table 5.7 Recommended Maximum Manhole Spacing

Sewer Pipe Diameter (in)	Maximum Manhole Spacing (ft)
10 in and less	400
12 in and larger	500

5.5.2 Lift Stations

Lift Stations should be sized for a "firm" capacity greater than the peak daily flow rate. Lift station firm capacity was compared to the peak hour dry weather inflow and sized to pump the maximum daily flow with the largest pump out of service.

Lift station wet well sizing takes into consideration the fill time, based on average flow, and the minimum pump cycle. The A.A.C. R-18-9-E301(D) requires that the minimum wet well volume in gallons be 1/4 of the product of the minimum pump cycle time, in minutes, and the total pump capacity, in gpm. The volume of the wet well should provide a retention period not to exceed 30 minutes of average daily design flow. In addition, regional lift stations should be provided with additional wet well capacity for redundancy. When selecting the minimum cycle time, the pump manufacturer's duty cycle recommendations shall be utilized. Starting and stopping more than seven times an hour for any one pump is not recommended.

5.5.3 Force Mains

The A.A.C. requires that new force mains be designed to maintain a minimum flow velocity of 3 ft/sec and a maximum flow velocity of 7 ft/sec (A.A.C. R-18-9-E301(D)(4)(a)). These velocity criteria promote scouring so that the solids deposited in the force main while the pumps are off will be transported downstream when the pumps are operating. Wastewater retention time in the pipeline should also be considered in sizing force mains to avoid excessive hydrogen sulfide generation. The City requires that force mains be sized for velocities between 2 and 6 ft/sec.

Manholes at the force mains discharge should be constructed with corrosion resistant coatings to prevent concrete corrosion due to sulfates. Force mains should be dropped into manholes to prevent raw sewage from splashing against the manhole walls and releasing odors.

A typical Hazen-Williams friction coefficient of 120 was used for force mains.

5.5.4 Water Reclamation Facilities

Maricopa County is responsible for enforcing state regulations associated with water quality related to water reclamation facilities. Water reclamation facility performance criteria requirements include the required design capacity of the treatment facility. When the average daily maximum month flow reaches 80 percent of the rated design capacity of a water reclamation facility, design for a facility expansion must be initiated. When the average daily maximum month flow reaches 90 percent of the rated design capacity, construction of the expansion needs to have commenced.

5.5.5 Performance Criteria Summary

Table 5.8 summarizes the performance criteria used to evaluate the collection system. Note Table 5.8 contains just the criteria that was used to evaluate the performance of the existing and proposed collection system.

Table 5.8 Performance Criteria

Category	Performance Criteria
Gravity Mains	
Maximum d/D	0.9 (Existing Sewers) 0.65 (Proposed/Future Sewers)
Minimum Velocity	2 ft/sec
Lift Stations	
Firm Capacity	≥ peak hour dry weather inflow
Force Main Velocity	3-7 ft/sec
Treatment Facilities	
Design Phase For An Expansion	80% of maximum monthly flow

5.6 Future Infrastructure

This section outlines planned facilities to serve future growth areas for development through 2040. The future facilities include gravity pipelines, lift stations, and force mains are shown in Figure 5.6. The future facilities include infrastructure that is in the City's capital improvement program and infrastructure that would be paid for by developers.

5.6.1 Water Planning Area 2

Multiple large high density residential developments are expected to start developing in the 157th WRF service area in the next fifteen years as shown in Figure 5.7. The increased flows from these residential developments were evaluated to evaluate collection system capacity.

Lands generally referred to as West Goodyear are located west of Cotton Lane in WPA 2. These areas are expected to develop by 2040 and are therefore included in the capacity evaluation.

The southwest corner of WPA 2 is not projected to develop within the time frame of the master plan, so future wastewater infrastructure was not considered for this area.

5.6.2 Water Planning Areas 3 and 4

South of the Rainbow Valley WRF, the Terrasante, Estrella Highlands, and Rainbow Valley developments are expected to begin developing in the next fifteen years. The developments would require a lift station with a force main to deliver wastewater to the Rainbow Valley WRF. This lift station should be located where all three of the developments can use the lift station. The force main from this lift station would deliver wastewater directly to the Rainbow Valley WRF to avoid sending wastewater through the Canta Mia Lift Station which would require an expansion.

The King Ranch development resides south of the Gila River and is planned to be a part of the 157th WRF Service Area. This development is all residential zoning and is planned to be partially developed in the next fifteen years. A future lift station in the north section of King Ranch is planned to pump flow from the development to the 54-inch gravity main along Elwood Street.

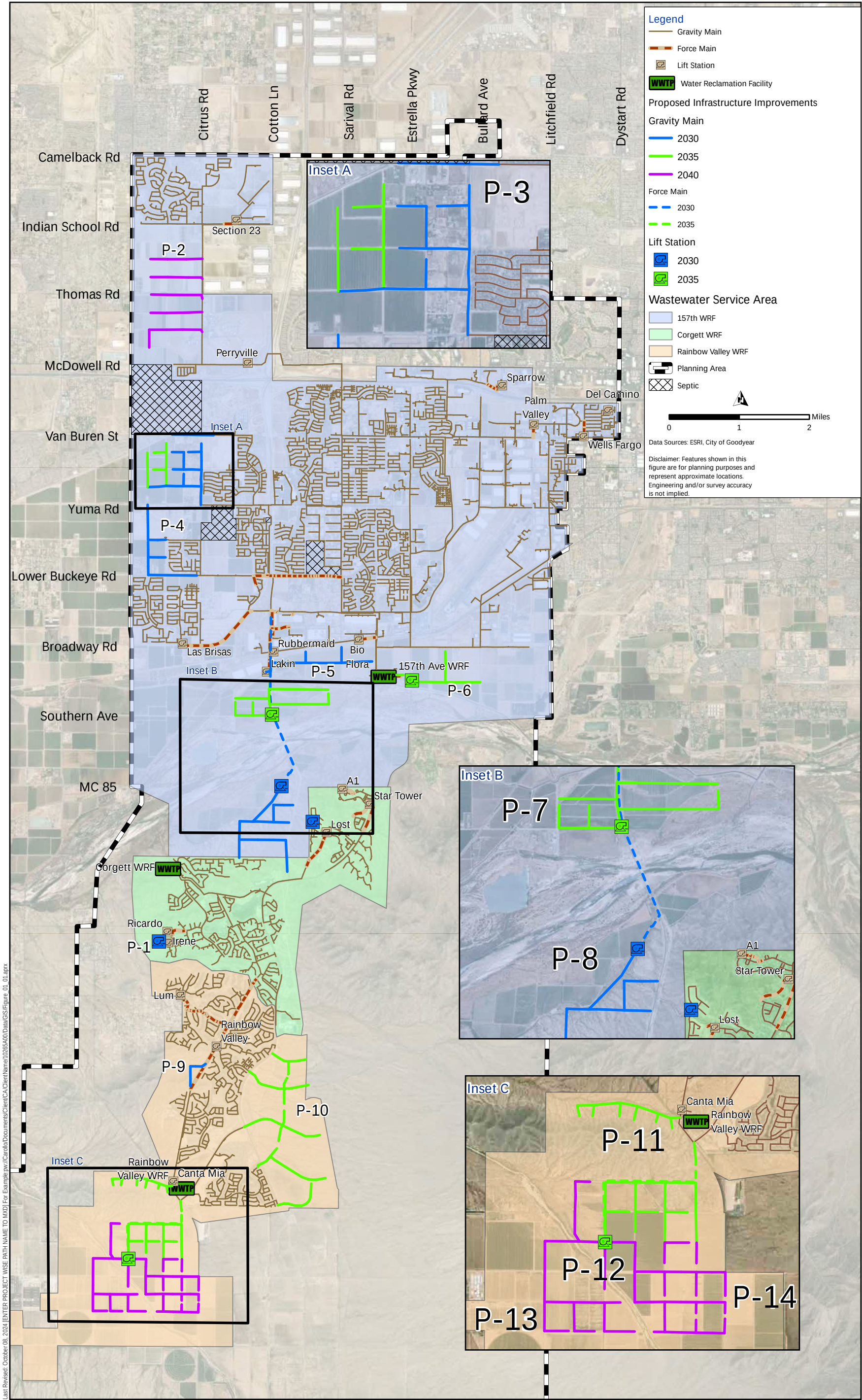


Figure 5.6 Proposed Future (2024 through 2040) Wastewater System Improvements
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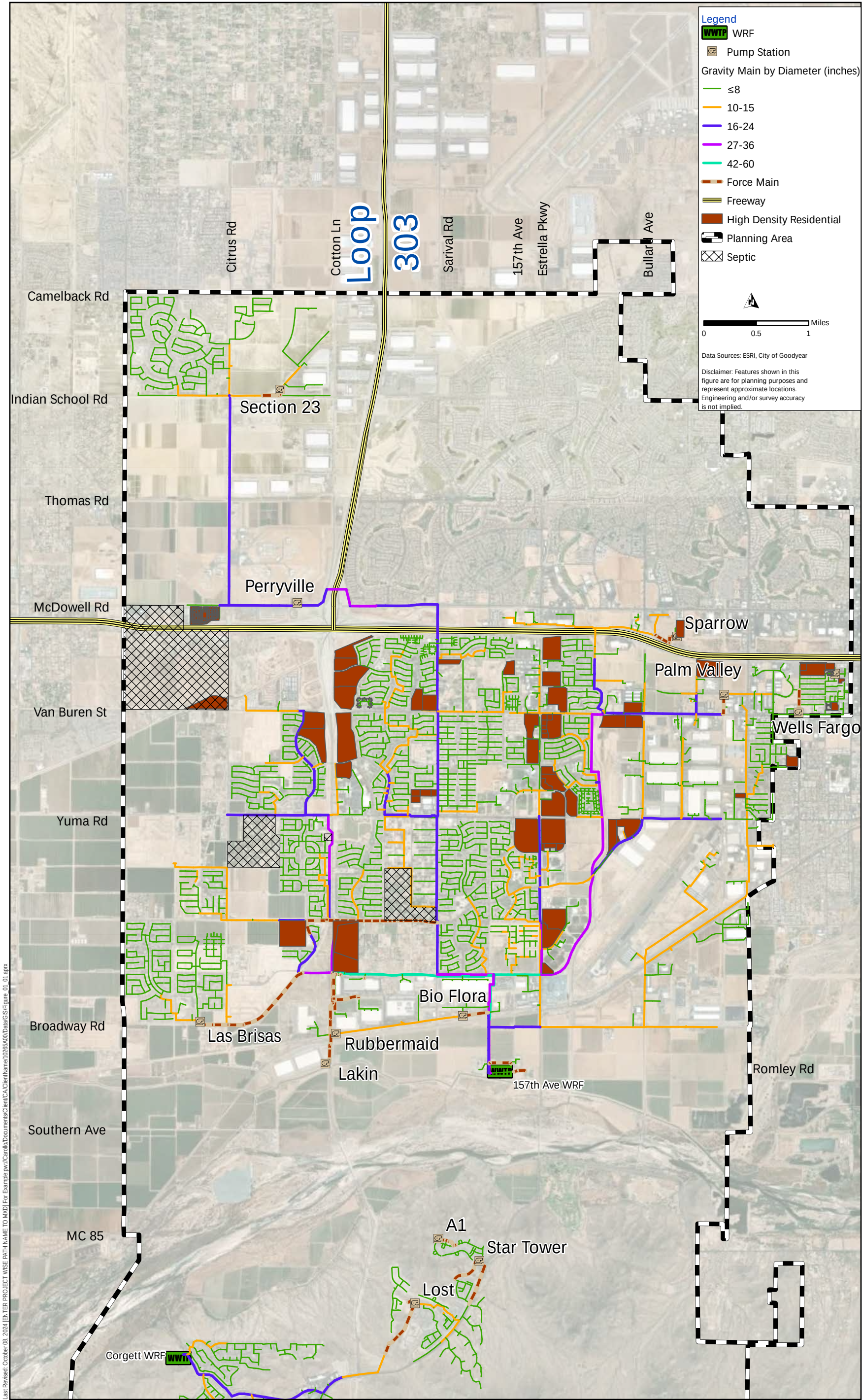


Figure 5.7 High Density Zoning in 157th WRF Service Area
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

5.7 Collection System Evaluation

A capacity analysis of the existing and future collection system was performed to determine if there are gravity mains or lift stations that do not have sufficient capacity. Sewers that lack sufficient capacity to convey peak flows can potentially cause sanitary sewer overflows (SSOs). The collection system was evaluated based on planning criteria listed in Table 5.8.

A global multiplier of 1.3 was applied to dry weather flows to simulate peak wet weather conditions. The 1.3 factor was used in the 2016 IWMP to simulate peak wet weather flow (PWWF) so the same method was used to estimate peak flows. Since wet weather flow events are rare and small, the 1.3 peaking factor provides a level of conservatism in the modeling analysis results.

In all collection system capacity evaluations, if the model predicts a pipe that is out of capacity, then the next step is to conduct flow monitoring at the location where the pipe capacity is predicted to be limited. Flow monitoring is a relatively inexpensive way to validate model results before investing in a pipe replacement project.

5.7.1 2023 Pipeline Capacity Evaluation

The 2023 wastewater collection system was evaluated using the same dry weather flows that were used for model calibration, multiplied by the peak wet weather flow multiplier of 1.3. The model predicted that the existing pipes in the City's collection system have sufficient capacity to convey wet weather flows. One pipe was predicted to be near capacity with a maximum d/D of 0.9. This pipe is located along West Auto Drive, downstream of the Wells Fargo Lift Station force main, as shown in Figure 5.8. Flows through the Wells Fargo lift station were recently routed through this pipe. Flow through the pipe is set by the Wells Fargo pump size, and there are plans to expand the lift station in 2025. The capacity expansion at the Wells Fargo Lift Station has not been determined and that may affect the recommended sizing of the gravity main expansion along West Auto Drive.

5.7.2 Future Pipeline Capacity Evaluation

A capacity analysis of the planned future collection system (2030, 2035, and 2040) was performed by applying the planned future wastewater flows in the model with the existing and planned future pipes that are anticipated in each future planning period. The flow projections were established for the MDAWS application where projected flows were calculated for 2028, 2033, and 2038 planning years. The purpose of this evaluation is to verify that planned future pipes are adequately sized and to determine if currently installed pipes are adequate to convey future flows.

Table 5.9 summarizes the flows for each of the planning periods by flow monitoring basin. There are several pipes where the estimated d/D exceeded 0.9 for 2030, 2035, and 2040 flow conditions as shown in Figure 5.8.

Table 5.9 Wastewater Flow Projections by Flowmeter Basin

Flow Monitoring Basin	Projected Wastewater Flow (mgd)			
	2023	2028	2033	2038
1	0.33	0.39	0.45	0.49
2	0.70	0.86	0.96	1.04
3	0.05	0.07	0.08	0.09
4	0.01	0.01	0.01	0.01
5	0.16	0.17	0.18	0.18
6	0.73	0.90	1.11	1.21
7	0.26	0.29	0.29	0.29
8	0.10	0.11	0.12	0.12
9	0.89	0.92	0.95	0.97
10	0.32	0.40	0.50	0.57
11	0.08	0.09	0.10	0.11
12	0.03	0.03	0.03	0.03
13	0.86	0.91	0.95	0.98
14	0.27	0.30	0.35	0.39
15	0.28	0.30	0.33	0.36
16	0.00	0.03	0.06	0.09
Corgett WRF	0.61	0.69	0.77	0.84
Rainbow Valley WRF	0.54	0.59	0.72	0.86
Outside the Flow Monitoring Basin Boundaries	0.01	0.25	0.68	1.32
Total	6.23	7.31	8.64	9.95

5.7.2.1 Capacity Evaluation Results

An 8-inch gravity main upstream of the Las Brisas Lift Station surcharges during the 2035 PWWF. Two 12-inch gravity mains connect to the surcharging pipeline from Broadway Road and Pueblo Avenue. The 8-inch pipeline appears to be a bottleneck because there is one 12-inch and one 8-inch gravity main upstream of the pipe. The 8-inch pipe should be expanded to a 12-inch pipe to alleviate the surcharging upstream of the lift station.

The following sections summarize the proposed improvements to existing sewers that will serve future users. The future improvements for existing infrastructure are shown in Figure 5.9.

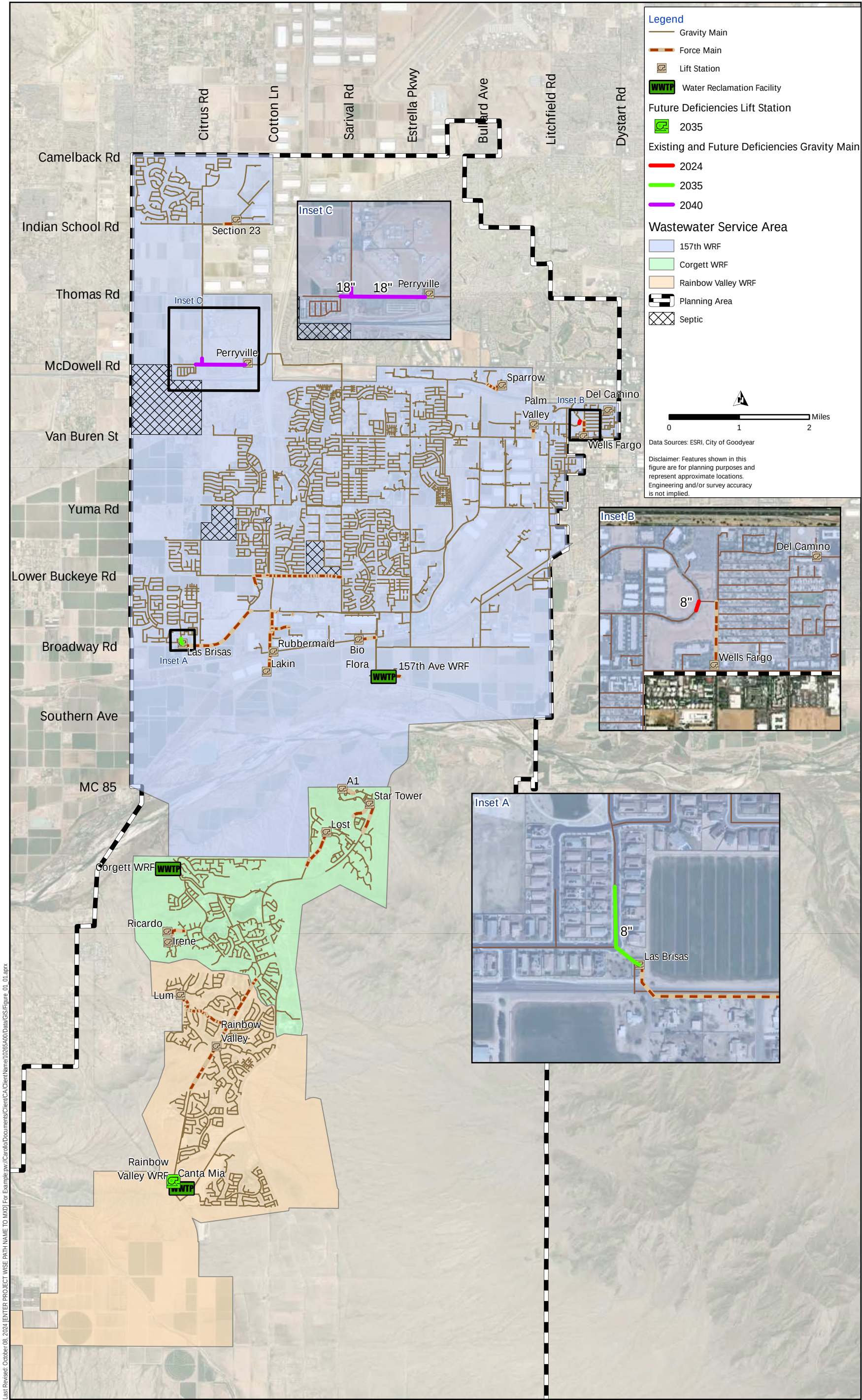


Figure 5.8 Pipeline and Lift Station Limitations by Planning Period
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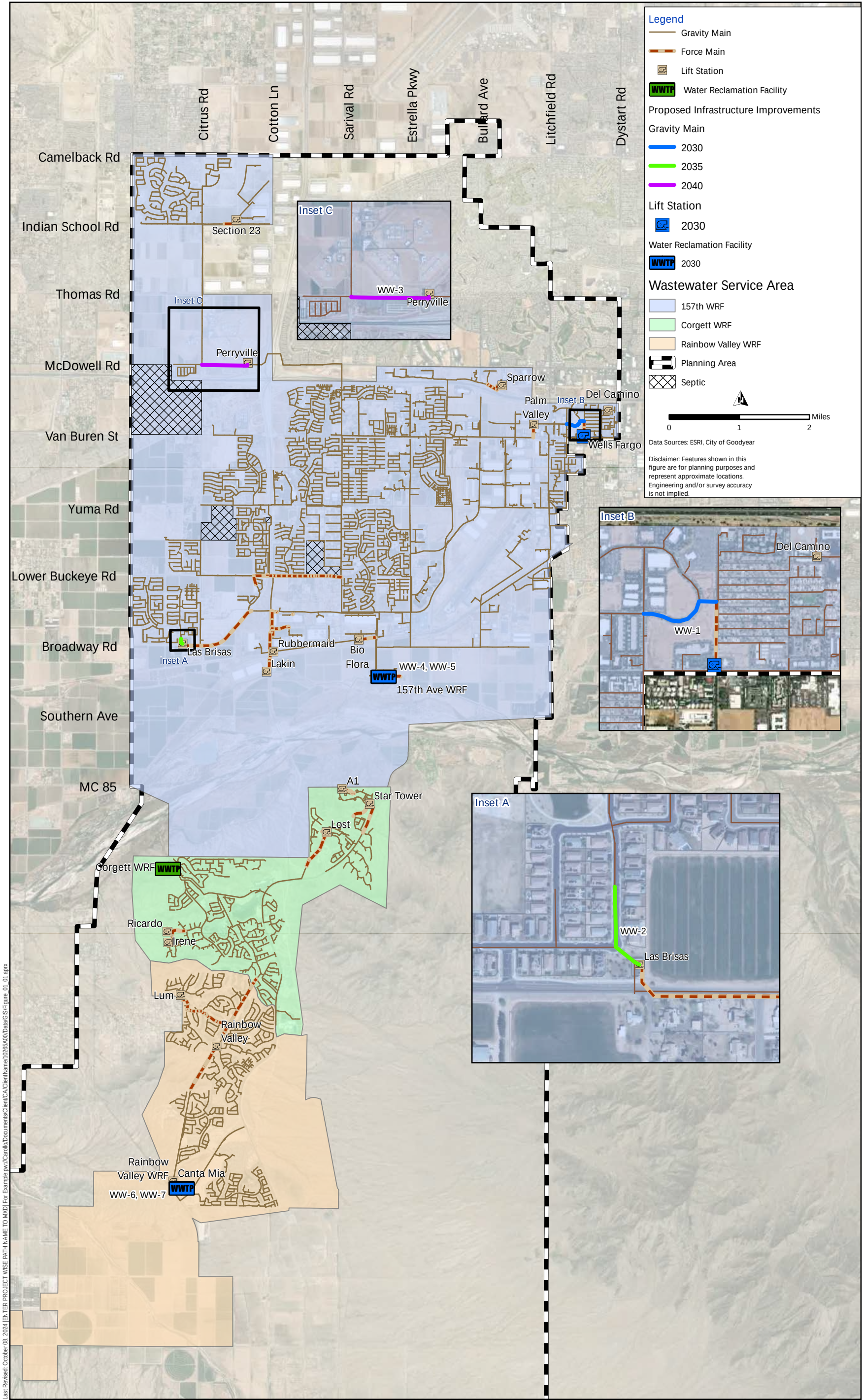


Figure 5.9 Proposed Collection System Improvements
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2024 INTEGRATED WATER MASTER PLAN

5.7.2.2 2030 Improvements

There are no 2030 improvements required for existing infrastructure.

5.7.2.3 2035 Improvements

The proposed improvements to address 2035 deficiencies are shown in Figure 5.7 in green and are summarized below.

- **WW-2 (181st Dr and Pueblo Ave)** – This project consists of replacing approximately 425 feet of 8-inch diameter pipeline at the intersection of 181st Drive and Pueblo Avenue upstream of the Las Brisas Lift Station. The existing pipeline surcharges under 2033 PWWF. To provide adequate capacity, the pipeline should be replaced with a 12-inch diameter pipeline.

5.7.2.4 2040 Improvements

The proposed improvements to address 2040 deficiencies are shown in Figure 5.9 in purple and are summarized below.

- **WW-3 (McDowell Rd between Citrus Rd and the Perryville lift station)** – This pipeline is predicted to be out of capacity by 2040. One option for providing sufficient capacity is to run a new sewer south along Citrus Rd. under the freeway and tie into planned future gravity sewers down to Yuma Road, where the wastewater would flow into the existing collection system. Alternatively, the 18-inch pipe along McDowell Road could be replaced with a larger pipe, or a parallel relief sewer could be constructed. The parallel relief sewer is the least expensive option, so this is the option that is being recommended. This project consists of constructing approximately 3,500 feet of 18-inch diameter pipeline at the intersection of McDowell Road and Citrus Road to run parallel to the existing 18-inch gravity main along McDowell Road.

5.7.3 Lift Station Capacity Analysis

The peak hour inflow for each planning period was compared to the existing lift station firm capacity. Table 5.10 summarizes the lift station capacity analysis and includes the existing firm capacity as well as the peak dry weather inflow and capacity surplus or deficit for each planning period. The lift station capacity deficiencies are shown in Figure 5.8 and are color coded based on the planning period the deficiency is triggered.

Table 5.10 Lift Station Capacity Analysis

Lift Station ID	Lift Station Name	Planning Period	Number of Pumps	Firm Capacity (gpm)	2024		2030		2035		2040	
					Peak Hour Inflow (gpm)	Surplus/Deficit (gpm)	Peak Hour Inflow (gpm)	Surplus/Deficit (gpm)	Peak Hour Inflow (gpm)	Surplus/Deficit (gpm)	Peak Hour Inflow (gpm)	Surplus/Deficit (gpm)
LS86-1	Bio Flora	Existing	2	250	157	93	229	21	242	8	239	11
LS59-2	Del Camino	Existing	2	250	11	239	17	233	17	233	17	233
LS83-1	Las Brisas	Existing	3	800	125	675	244	556	314	486	306	494
LS58-1	Palm Valley	Existing	2	330	162	168	244	86	242	88	286	44
LS95-1	Rubbermaid	Existing	2	220	47	173	55	165	57	163	58	162
LS59-1	Wells Fargo	Existing	2	250	102	148	172	78	172	78	224	26
LS94-1	Lakin	Existing	2	710	22	688	295	415	511	199	513	197
LS24-1	Section 23	Existing	2	475	4	471	25	450	48	427	54	421
LS58-1	Sparrow	Existing	2	300	0	300	6	294	11	289	10	290
LS134-2	Irene	Existing	2	150	10	140	18	132	21	129	24	126
LS116-1	Lost	Existing	2	710	153	557	370	340	449	261	457	253
LS134-1	Ricardo	Existing	2	150	2	148	4	146	5	145	6	144
LS116-2	A1	Existing	2	150	5	145	38	107	57	93	70	80
LS116-3	Star Tower	Existing	2	200	46	154	65	135	63	137	51	149
LS164-1	Canta Mia ⁽²⁾	Existing	2	250	114	136	137	113	430	(180)	431	(181)
LS134-3	Lum	Existing	2	475	112	337	113	362	113	362	113	362
LS144-2	Rainbow Valley	Existing	3	2,100	1,080	1,020	1,080	1,020	1,080	1,020	738	1,362
STOR110-Future	Future Lift Station 1 on Southern Ave and Cotton Ln	2030	2	300	-	-	32	268	94	206	156	144
STOR112-Future	Future Lift Station 2 on Roeser Rd and Estrella Pkwy	2030	2	300	-	-	69	231	146	154	136	164
STOR122-Future	Future Lift Station 3 on MC 85 and Cotton Ln	2030	2	600	-	-	84	516	180	420	272	328
STOR124-Future	Future Lift Station 4 on Maplewood Rd and 187th Ave	2030	2	700	-	-	30	670	179	521	486	214

Notes:

(1) Perryville LS capacity was not evaluated.

(2) Canta Mia Lift Station is planned to be abandoned in the future and replaced with a gravity main to Rainbow Valley WRF.

5.7.4 Wastewater Treatment Capacity

The wastewater treatment facilities were evaluated against the projected wastewater flows presented in Chapter 2 to determine the need and timing for future wastewater treatment plant expansions. The City's WRF capacity is provided in terms of average day maximum monthly flows. The average day maximum monthly flows are assumed to be 15 percent more than the average daily flows.

5.7.4.1 157th Avenue WRF

The City is working on capacity improvements so that the 157th WRF can be permitted for 10 mgd by 2028. The 157th Avenue WRF has an existing capacity of 6.1 mgd. The facility is under construction to bring the capacity to 6.7 mgd by the fourth quarter of 2024. As shown in Figure 5.10, the design phase for an additional upgrade from 6.7 mgd to 9.5 is suggested in 2026. Another upgrade from 9.5 to 12 mgd will be triggered in 2030.

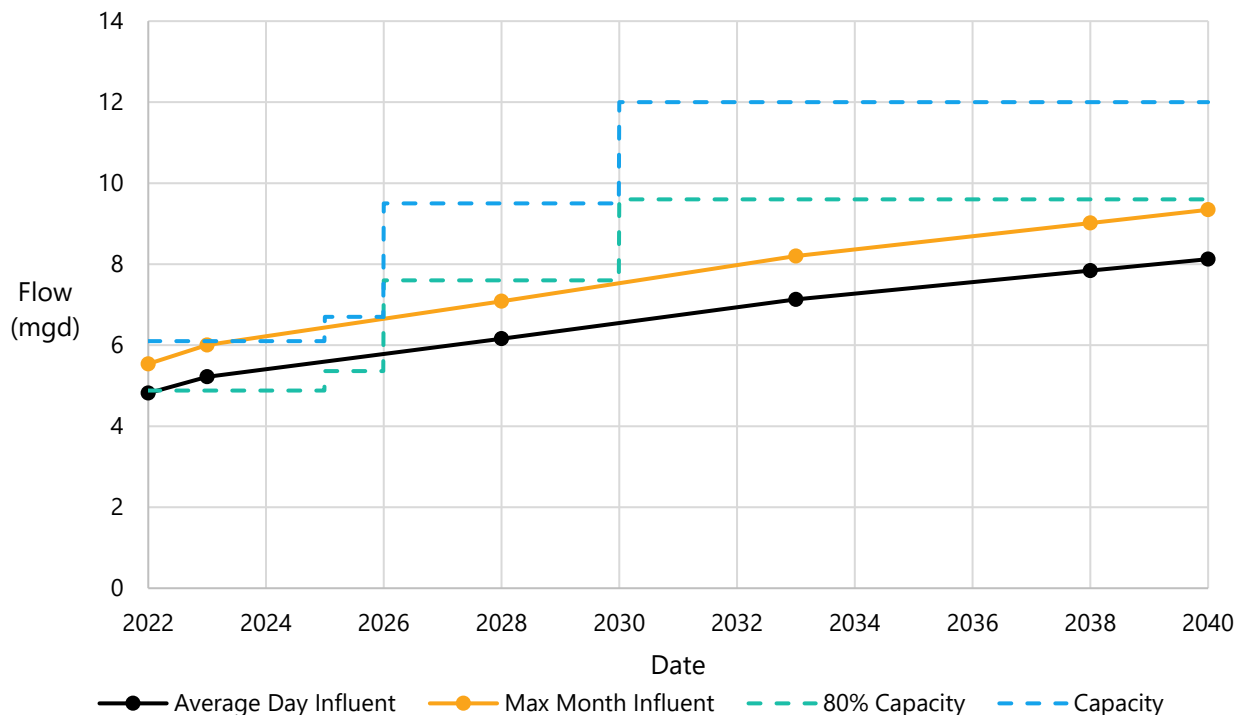


Figure 5.10 157th Avenue WRF Treatment Capacity

5.7.4.2 Corgett WRF

The Corgett WRF has an existing capacity of 0.8 mgd. As shown in Figure 5.11, the projected average day maximum monthly flow surpasses the 80 percent trigger expansion but there are no plans to connect future developments to Corgett. Therefore, there are also no plans for expansion.

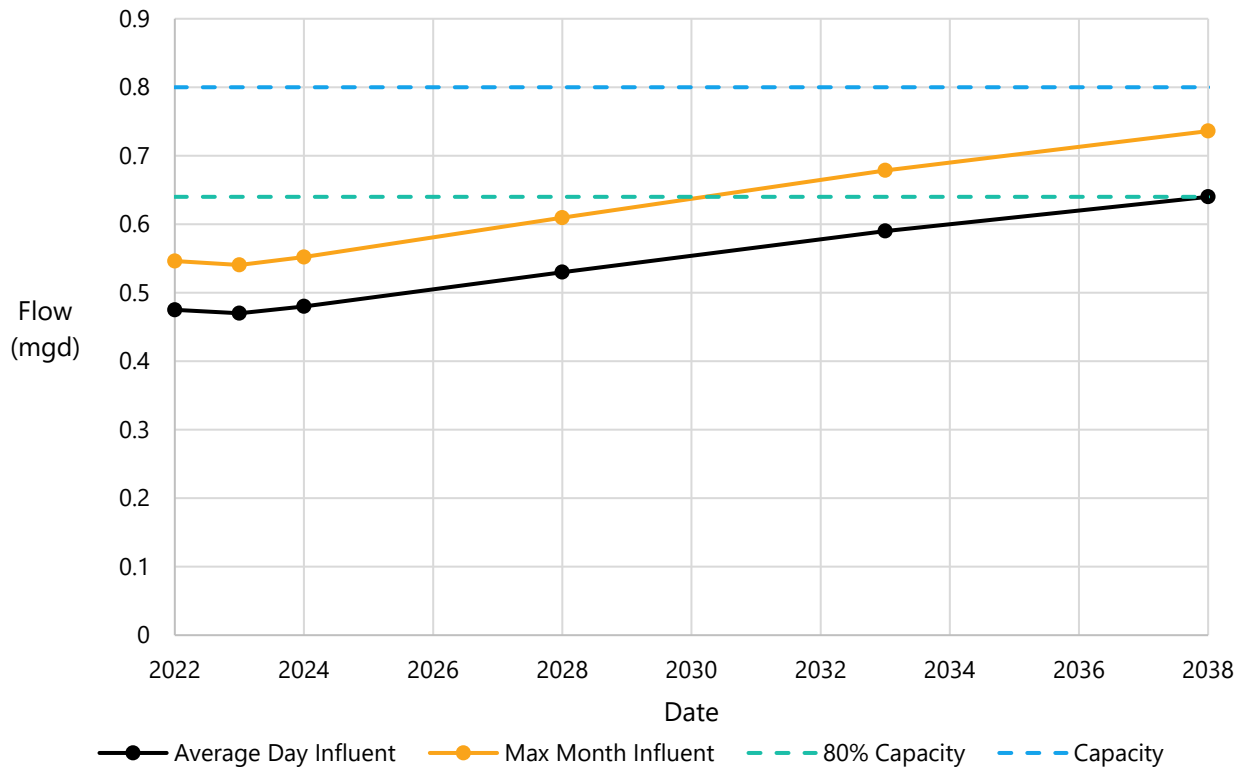


Figure 5.11 Corgett WRF Treatment Capacity

5.7.4.3 Rainbow Valley WRF

The Rainbow Valley WRF has an existing capacity of 0.75 mgd. The existing average day maximum monthly flow is above the 80 percent trigger capacity, so it is recommended for the treatment facility to be expanded as soon as possible. As shown in Figure 5.12, the Rainbow Valley maximum monthly flow has a projection based on the master plan flow projections and an adjusted maximum monthly flow to account for potential additional developments that may develop in Rainbow Valley based on recent information obtained from the development community. There is an expansion project planned to raise the capacity of the facility to 2.5 mgd by the end of 2026. The average day maximum monthly flow at the Rainbow Valley WRF approaches 80 percent of the design capacity by 2038, so a second expansion is recommended by 2038. The projected average day maximum monthly buildout flow is 9.7 mgd, so additional expansions would be needed to reach an ultimate capacity of 10 mgd.

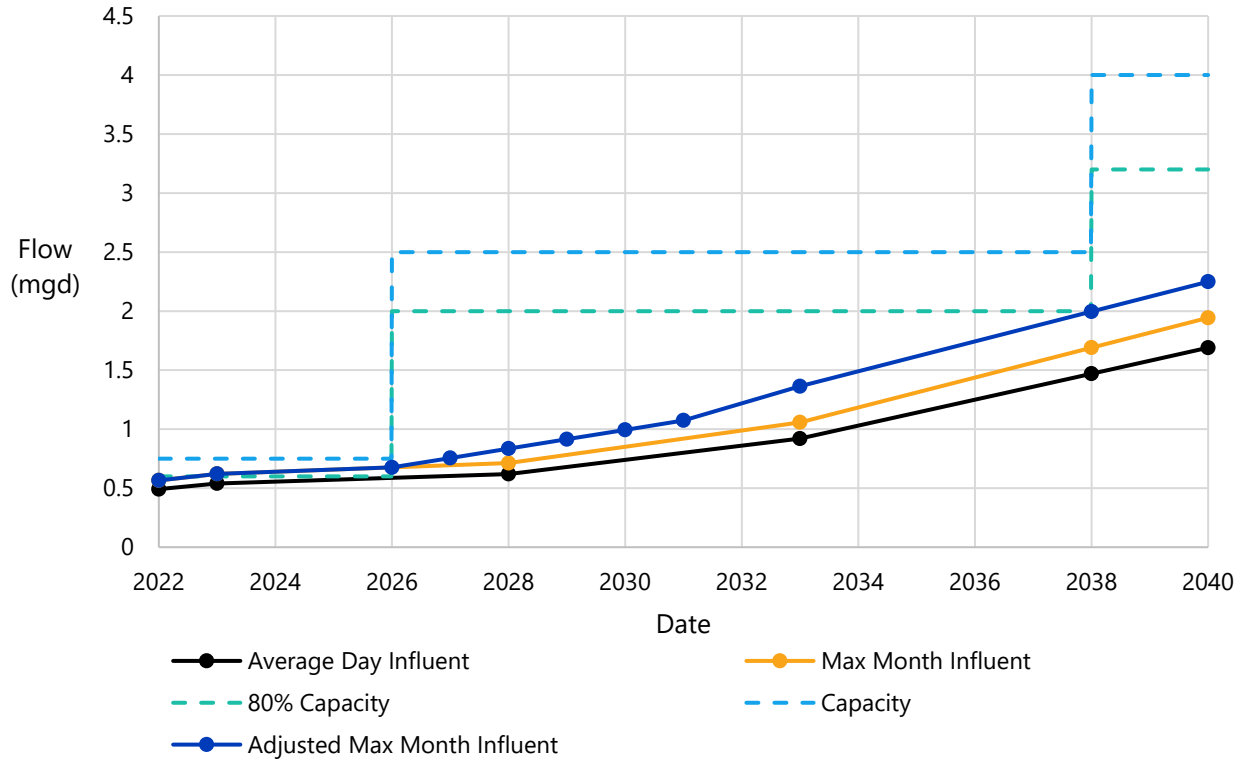


Figure 5.12 Rainbow Valley WRF Treatment Capacity

5.8 Wastewater System Capital Improvement Program

Based on the system evaluation and improvement projects identified in Section 5.7 and Section 5.8, the following projects have been identified and are described below.

5.8.1 City Funded Projects

The projects shown in Table 5.11 have been identified for the collection system and are described in more detail below.

5.8.2 Developer Funded Projects

The projects shown in Table 5.12 have been identified as projects to serve new growth areas in the collection system that would be paid for by developers. These projects are described in more detail below.

Table 5.11 City Funded Projects

Project #	Description	Justification	Location	Diameter/Size (in/mgd)	Length/Qty (ft/#)	Planning Period
WW-1	Expand gravity main along Auto Drive downstream of Wells Fargo Lift Station	To help prevent surcharging when the lift station is expanded	157th WRF Service Area	12	1,214	2030
WW-2	181st Dr and Pueblo Ave	Surcharging under 2033 PWWF	157th WRF Service Area	12	425	2035
WW-3	Construct parallel 18-inch gravity main along McDowell Rd from Citrus Rd	Surcharging under 2038 PWWF	157th WRF Service Area	3,500	18	2040
WW-4	Expand the 157th WRF from 6.7 mgd to 9.5 mgd	Required for increasing flows due to development	157th WRF Site	2.8	1	2030
WW-5	Expand the 157th WRF from 9.5 mgd to 12 mgd capacity	80% of 2028 Treatment plant capacity is less than 2038 projected ADWF	157th WRF Service Area	2	1	2030
WW-6	Expand the Rainbow Valley WRF from 0.8 mgd to 2.5 mgd	Required for increasing flows due to development	Rainbow Valley WRF site	1.7	1	2030
WW-7	Expand the Rainbow Valley WRF from 2 mgd to 4 mgd	Required for increasing flows due to development	Rainbow Valley WRF site	2.0	1	2040

Table 5.12 Developer Funded Projects

Project #	Description	Justification	WRF Service Area	Diameter/Size (in/mgd)	Length/Qty (ft/gpm)	Planning Period
P-1	12-inch gravity main west of North Citrus Rd, along West Osborn Rd	Convey flows from future developments to collection system	157th WRF	12	3,925	2030
P-2	12-inch gravity main west of North Citrus Rd, along West Earl Dr	Convey flows from future developments to collection system	157th WRF	12	3,925	2030
P-3	12-inch gravity main from West of North Citrus Rd, along West Thomas Rd	Convey flows from future developments to collection system	157th WRF	12	3,925	2030
P-4	12-inch gravity main from West of North Citrus Rd, along West Virginia Ave	Convey flows from future developments to collection system	157th WRF	12	3,925	2030
P-5	12-inch gravity main from West of North Citrus Rd, along West Encanto Blvd and south along 185th Ave	Convey flows from future developments to collection system	157th WRF	12	5,320	2030
P-6	12-inch gravity main along West Van Buren St to Roosevelt Canal	Convey flows from future developments to collection system	157th WRF	12	3,113	2030
P-7	12-inch gravity main along South Citrus Rd from West Yuma Rd to West Adam St	Convey flows from future developments to collection system	157th WRF	12	4,623	2030
P-8	12-inch gravity main along West Hadley St from South Citrus Rd to South 185 Ave and along South 181st Ave from Lilac St to West Hadley St	Convey flows from future developments to collection system	157th WRF	12	4,970	2030
P-9	12-inch gravity main along West Harrison St from South Citrus Rd to 183rd Ave	Convey flows from future developments to collection system	157th WRF	12	2,162	2030
P-10	12-inch gravity main along South 181st Ave from West Harrison St to West Jefferson St and along West Jefferson St from 181st Ave to 183rd Ave	Convey flows from future developments to collection system	157th WRF	12	2,206	2030
P-11	12-inch gravity main along West Jefferson St from North Citrus Road to North 181st Ave	Convey flows from future developments to collection system	157th WRF	12	986	2030
P-12	12-inch gravity main along North 183rd Ave from West Hadley St to Adam St and along West Harrison St from 183rd Ave to 185th Ave	Convey flows from future developments to collection system	157th WRF	12	4,193	2030
P-13	12-inch gravity main along West Jefferson St from 183rd Ave to 185th Ave	Convey flows from future developments to collection system	157th WRF	12	944	2030

Project #	Description	Justification	WRF Service Area	Diameter/Size (in/mgd)	Length/Qty (ft/gpm)	Planning Period
P-14	12-inch gravity main along South 185th Ave from West Hadley St to West Jefferson St	Convey flows from future developments to collection system	157th WRF	12	2,585	2030
P-15	12-inch gravity main along West Lower Buckeye Rd from South Citrus Rd to South 185th Ave	Convey flows from future developments to collection system	157th WRF	12	3,652	2030
P-16	12-inch gravity main along South 185th Ave from West Lower Buckeye Rd to West Durango St	Convey flows from future developments to collection system	157th WRF	12	2,483	2030
P-17	12-inch gravity main along South 185th Ave from West Durango St to West Yuma Rd	Convey flows from future developments to collection system	157th WRF	12	2,642	2030
P-18	12-inch gravity main along West Watkins St and along West Durango St from South 185th Ave to 183rd Ave	Convey flows from future developments to collection system	157th WRF	12	2,644	2030
P-19	12-inch gravity main along Wier Ave from South Cotton Ln to 159th Ave	Convey flows from future developments to collection system	157th WRF	12	7,618	2030
P-20	12-inch gravity main along South Cotton Ln from Wier Ave to Lakin Park Lift Station	Convey flows from future developments to collection system	157th WRF	12	960	2030
P-21	12-inch gravity main along 167th Ave and Sarival Ave from Wier Ave to County Road 85	Convey flows from future developments to collection system	157th WRF	12	1,995	2030
P-22	12-inch gravity main along Roeser Rd from South Bullard Ave to South Estrella Pkwy	Convey flows from future developments to collection system	157th WRF	12	5,303	2030
P-23	12-inch gravity main along 150th Dr from West Broadway Rd to Roeser Rd	Convey flows from future developments to collection system	157th WRF	12	2,311	2030
P-24	12-inch gravity main along West Southern Ave from South 175th Ave to South Cotton Ln	Convey flows from future developments to collection system	157th WRF	12	2,743	2030
P-25	600 gpm Lift Station on Southern Ave and Cotton Ln	Convey flows from future developments to collection system	157th WRF	0.86	1	2030
P-26	8-inch force main from future Lift Station on Southern Ave and Cotton Ln to Lakin Lift Station	Convey flows from future developments to collection system	157th WRF	8	3,430	2030
P-27	600 gpm Lift Station on Estrella Pkwy and Roeser Rd	Convey flows from future developments to collection system	157th WRF	0.86	1	2030
P-28	8-inch force main from future Lift Station on Estrella Pkwy to Romley Rd	Convey flows from future developments to collection system	157th WRF	8	1,930	2030

Project #	Description	Justification	WRF Service Area	Diameter/Size (in/mgd)	Length/Qty (ft/gpm)	Planning Period
P-29	12-inch gravity main along South 175th Ave from West Sunland Ave to West Southern Ave	Convey flows from future developments to collection system	157th WRF	12	1,001	2030
P-30	12-inch gravity main along South 173rd Ave from West Sunland Ave to West Southern Ave	Convey flows from future developments to collection system	157th WRF	12	1,001	2030
P-31	12-inch gravity main along West Sunland Ave from South 175th Ave to South Cotton Ln	Convey flows from future developments to collection system	157th WRF	12	2,532	2030
P-32	12-inch gravity main along Chambers St from 164th Dr to South Cotton Ln	Convey flows from future developments to collection system	157th WRF	12	4,458	2030
P-33	12-inch gravity main along West Hidalgo Ave from 164th Dr to South Cotton Ln and along 164th Dr from West Hidalgo Ave to Chambers St	Convey flows from future developments to collection system	157th WRF	12	5,231	2030
P-34	12-inch gravity main along West Euclid Ave from 174th Dr to South Cotton Ln	Convey flows from future developments to collection system	157th WRF	12	3,510	2030
P-35	12-inch gravity main along South Cotton Ln from South Estrella Pkwy to West Euclid Ave	Convey flows from future developments to collection system	157th WRF	12	2,380	2030
P-36	12-inch gravity main along 174th Dr from West Paseo Way to West Magdalena Ln	Convey flows from future developments to collection system	157th WRF	12	2,751	2030
P-37	12-inch gravity main along West Magdalena Ln from 174th Dr to South Cotton Ln	Convey flows from future developments to collection system	157th WRF	12	3,710	2030
P-38	900 gpm Lift Station in King Ranch 1,500 ft west of Cotton Ln and 4,100 ft south of Gila River	Convey flows from future developments to collection system	157th WRF	1.3	1	2030
P-39	12-inch force main from future King Ranch Lift Station to South Cotton Ln and Dunlap Rd	Convey flows from future developments to collection system	157th WRF	12	13,800	2030
P-40	12-inch gravity main from West Magdalena Ln to the proposed lift station in King Ranch	Convey flows from future developments to collection system	157th WRF	12	1,300	2030
P-41	12-inch gravity main from South Cotton Ln to the proposed lift station in King Ranch	Convey flows from future developments to collection system	157th WRF	12	1,482	2030
P-42	8-inch gravity main along 184th Ln to West Cassia Way and connect to the gravity main parallel to the Rainbow Valley LS force main	Convey flows from future developments to collection system	Rainbow Valley WRF	8	2,689	2030

Project #	Description	Justification	WRF Service Area	Diameter/Size (in/mgd)	Length/Qty (ft/gpm)	Planning Period
P-43	12-inch gravity main along South 176th Ave from South Estrella Pkwy to Sarival Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	3,131	2030
P-44	12-inch gravity main along West Calistoga Dr from South Estrella Pkwy to Sarival Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	4,987	2030
P-45	12-inch gravity main along West Willis Rd from South Estrella Pkwy to Sarival Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	6,140	2030
P-46	12-inch gravity main along West Tanglewood Dr from South Estrella Pkwy to Sarival Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	5,957	2030
P-47	12-inch gravity main along West Cedarwood Ln from South Estrella Pkwy to Sarival Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	3,962	2030
P-48	12-inch gravity main along Pecos Rd west of South Rainbow Valley Rd to the RV WRF	Convey flows from future developments to collection system	Rainbow Valley WRF	12	4,558	2030
P-49	12-inch gravity main a quarter mile north of Willis Rd from 189th Ave to 181st Ave and from 181st Ave to South Rainbow Valley Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	7,090	2030
P-50	12-inch gravity main along 189th Ave from a quarter mile north of Willis Rd to Maplewood Rd and from 189th Ave to 187th Ave along Maplewood Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	3,832	2030
P-51	12-inch gravity main along Willis Rd from 185th Ave to 187th Ave and along 187th Ave from Willis Rd to a quarter mile north	Convey flows from future developments to collection system	Rainbow Valley WRF	12	2,360	2030
P-52	12-inch gravity main along 185th Ave from Willis Rd to a quarter mile north	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,320	2030
P-53	1,050 gpm Lift Station on 187th Ave and Maplewood Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	1.5	1	2030
P-54	8-inch force main from future Lift Station on 187th Ave and Maplewood Rd to Rainbow Valley Rd and Willis Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	7,450	2030
P-55	12-inch gravity main along 181st Ave from Maplewood Rd to a quarter mile north of Willis Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	2,640	2035
P-56	12-inch gravity main along 183rd Ave from Maplewood Rd to a quarter mile north of Willis Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	2,640	2035

Project #	Description	Justification	WRF Service Area	Diameter/Size (in/mgd)	Length/Qty (ft/gpm)	Planning Period
P-57	12-inch gravity main along Maplewood Rd from 181st Ave to 183rd Ave	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,070	2035
P-58	12-inch gravity main along Willis Rd from 181st Ave to 183rd Ave	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,070	2035
P-59	12-inch gravity main along Willis Rd from 183rd Ave to 185th Ave and along 185th Ave from Maplewood Rd to Willis Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,880	2035
P-60	12-inch gravity main along 187th Ave from Maplewood Rd to Willis Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	810	2030
P-61	12-inch gravity main along Maplewood Rd from 191st Ave to 189th Ave	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,522	2035
P-62	12-inch gravity main along 191st Ave from Ryan St to Maplewood Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	3,960	2035
P-63	12-inch gravity main along Superstition Dr from 187th Ave to 191st Ave	Convey flows from future developments to collection system	Rainbow Valley WRF	12	2,645	2035
P-64	12-inch gravity main along Ryan St from 189th Ave to 191st Ave	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,072	2035
P-65	12-inch gravity main along Ryan St from 187th Ave to 189th Ave and along 189th Ave from Ryan St to Superstition Dr	Convey flows from future developments to collection system	Rainbow Valley WRF	12	2,162	2035
P-66	12-inch gravity main along 187th Ave from Ryan St to Superstition Dr	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,267	2035
P-67	12-inch gravity main along 187th Ave from Maplewood Rd toward Superstition Dr	Convey flows from future developments to collection system	Rainbow Valley WRF	12	2,066	2035
P-68	12-inch gravity main along Maplewood Rd from 185th Ave to 187th Ave	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,336	2035
P-69	12-inch gravity main along 183rd Ave from Germann Rd to Maplewood Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	894	2040
P-70	12-inch gravity main along 181st Ave from Germann Rd to Maplewood Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	894	2040

Project #	Description	Justification	WRF Service Area	Diameter/Size (in/mgd)	Length/Qty (ft/gpm)	Planning Period
P-71	12-inch gravity main along Superstition Dr from 185th Ave to 187th Ave	Convey flows from future developments to collection system	Rainbow Valley WRF	12	700	2040
P-72	12-inch gravity main along Ryan St from 185th Ave to 187th Ave	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,336	2040
P-73	12-inch gravity main along 185th Ave from Superstition Dr to Maplewood Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	2,641	2040
P-74	12-inch gravity main along Germann Rd from Rainbow Valley Rd to 185th Ave	Convey flows from future developments to collection system	Rainbow Valley WRF	12	4,008	2040
P-75	12-inch gravity main along Superstition Dr from Rainbow Valley Rd to 185th Ave	Convey flows from future developments to collection system	Rainbow Valley WRF	12	4,008	2040
P-76	12-inch gravity main along Ryan St from Rainbow Valley Rd to Waterman Wash	Convey flows from future developments to collection system	Rainbow Valley WRF	12	3,110	2040
P-77	12-inch gravity main along 183rd Ave from Superstition Dr to Germann Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,040	2040
P-78	12-inch gravity main along 181st Ave from Superstition Dr to Germann Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,040	2040
P-79	12-inch gravity main along Rainbow Valley Rd from Superstition Dr to Germann Rd	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,040	2040
P-80	12-inch gravity main along 183rd Ave from Ryan St to Superstition Dr	Convey flows from future developments to collection system	Rainbow Valley WRF	12	1,327	2040
P-81	12-inch gravity main along 181st Ave from 500 ft north of Ryan St to Ryan St	Convey flows from future developments to collection system	Rainbow Valley WRF	12	500	2040
P-82	12-inch gravity main along 181st Ave from 500 ft south of Superstition Dr to Superstition Dr	Convey flows from future developments to collection system	Rainbow Valley WRF	12	500	2040
P-83	12-inch gravity main along Rainbow Valley Rd from 500 ft north of Ryan St to Ryan St	Convey flows from future developments to collection system	Rainbow Valley WRF	12	500	2040
P-84	12-inch gravity main along Rainbow Valley Rd from 500 ft south of Superstition Dr to Superstition Dr	Convey flows from future developments to collection system	Rainbow Valley WRF	12	500	2040

5.9 Conclusion and Recommendations

1. Most of the City's 2024 wastewater system has sufficient capacity to convey existing and future peak wet weather flows through 2030. However, the gravity main downstream of Wells Fargo Lift Station along West Auto Drive should be monitored when the lift station is expanded to see if it should be upsized to a 12-inch diameter pipeline.
2. The City should increase the 157th WRF design capacity from 6.1 mgd to 9.5 mgd in the 2030 planning period and then to 12 mgd in the 2040 planning period so the average day maximum monthly flows do not exceed 80 percent of the treatment plant capacity.
3. The City should increase the Rainbow Valley WRF design capacity from 0.75 mgd to 2.5 mgd in the 2030 planning period so the average day maximum monthly flows do not exceed 80 percent of the treatment plant capacity.
4. The gravity main upstream of Las Brisas Lift Station should be upsized in the 2035 planning period to a 12-inch diameter pipeline to avoid surcharging.
5. A parallel 18-inch gravity main along McDowell Road to the Perryville lift station should be constructed in the 2040 planning period as additional developments are constructed in the northwest along Citrus Road to prevent surcharging in the existing 18-inch gravity main.
6. The City should increase the Rainbow Valley WRF from 2 mgd to 4 mgd in the 2040 planning period so the projected average day maximum monthly flows do not exceed 80 percent of the treatment plant capacity.

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CHAPTER 6 RECLAIMED WATER MASTER PLAN

6.1 Introduction

Chapter 6 presents the reclaimed water infrastructure evaluation for the City as part of the 2024 IWMP. This chapter presents the reclaimed water infrastructure implementation of the reclaimed water resource strategies that are in Chapter 3 of this IWMP. The purpose of the reclaimed water master plan is to identify the infrastructure needs and timing required for the City to beneficially use reclaimed water as the City grows. Reclaimed water management strategies are discussed in Chapter 3 and form the basis for the infrastructure recommendations presented here.

The reclaimed water system will adapt over time as the City grows and is able to fund capital improvements that increase the utilization of reclaimed water and use the water for the highest and best use for the City's benefit. The path for obtaining full utilization of this reclaimed water source is presented in this chapter.

This chapter of the master plan contains the following sections:

- 2024 Reclaimed Water System.
- Reclaimed Water Flows.
- Reclaimed Water Management Strategies.
- Reclaimed Water Infrastructure Plan.
- Reclaimed Water Projects.
- Recommendations.

6.2 2024 Reclaimed Water Systems

The City manages water resources in the City's five WPAs, named WPA 1, WPA 2, WPA3, WPA 4, and WPA 5. Each water planning area is served by one or more existing or planned WRFs that produce reclaimed water that can be used within the planning area where it was generated. Reclaimed water facilities in each planning area are discussed below. Figure 6.1 presents the City's reclaimed water system in each water planning area along with interconnected reclaimed water systems for Liberty Utilities and Estrella.

6.2.1 Water Planning Areas 1 and 2

The 157th Avenue WRF has a current capacity of 6.1 mgd with an expansion to 6.7 mgd in 2024 and a planned expansion to 9.95 mgd by 2028. The plant is located along Buckeye Canal Road and Estrella Parkway in WPA 2. The plant currently collects wastewater from WPA 1 and WPA 2. In the future, the plant will serve King Ranch located in WPA 3 so that the City can obtain use of the King Ranch reclaimed water at the 157th WRF.

The 157th WRF pump station has a planned firm capacity of 13 mgd at buildout of the service area. Reclaimed water from the 157th WRF is pumped into a transmission main system that can transport the reclaimed water to the Goodyear ballpark, the SAT site, Buckeye Canal, and to a connection with the Liberty Utilities reclaimed water distribution network. The reclaimed water transmission system consists of approximately 9 miles of reclaimed water mains ranging in size from 6 to 30 inches in diameter. A summary of the City's reclaimed water mains is shown in Table 6.1.

Table 6.1 Reclaimed Water Mains

Diameter (in)	Length (miles)
≤ 6-inch	0.5
8-inch	0.1
12-inch	0.5
16-inch	0.3
20-inch	2.1
24-inch	4.7
30-inch	0.9
Total	9.1

Reclaimed water is currently recharged in the spreading basins of the SAT site. In the past, reclaimed water has been delivered to the Goodyear ballparks and to vadose zone wells that are no longer in service. Any left-over reclaimed water is sent to the BWCDD canal. The City does not obtain groundwater credits for reclaimed water discharged to the canal because the canal is not permitted as a groundwater savings facility.

In the past, Liberty Utilities used to deliver its excess reclaimed water to Goodyear until a recharge basin was constructed within its service area. The City has no plans to use the connection between Goodyear and Liberty Utilities to deliver or receive additional reclaimed water, so the Liberty Utilities reclaimed system will not be considered as an option for additional resource capacity. Liberty Utilities is not likely to need the connection now that they have a recharge facility.

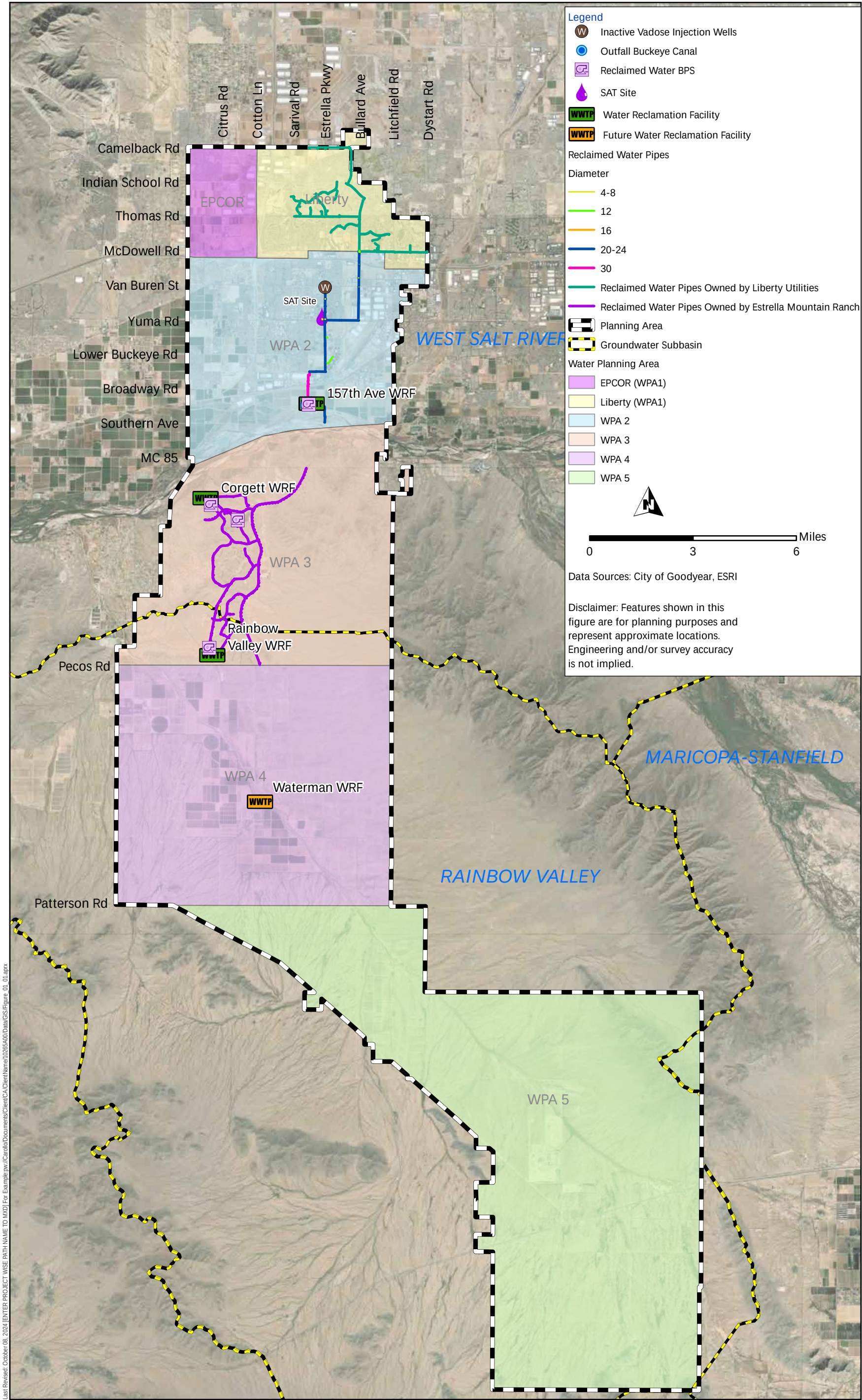


Figure 6.1 2024 Reclaimed Water Distribution System
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

6.2.2 Water Planning Area 3

The Corgett WRF has a treatment capacity of 0.8 mgd and is located northwest of the Estrella community west of San Gabriel Drive.

The Corgett WRF reclaimed water pump station has a total capacity of 3.2 mgd and a firm capacity of 1.6 mgd. Reclaimed water is discharged through a privately owned reclaimed water distribution system to the Estrella lakes to irrigate turf in the Estrella development. The Estrella development takes possession of all the reclaimed water from the Corgett WRF, so the City does not benefit from reclaimed water from this plant. If there is more reclaimed water at the plant than can be used by Estrella, the excess water is discharged to the Corgett wash. The Corgett wash is not permitted as a managed recharge facility so reclaimed water credits cannot be obtained for water discharged to the Corgett wash.

The Rainbow Valley WRF has a treatment capacity of 0.75 mgd and is located on the northeast corner of Rainbow Valley Road and Willis Road intersection in the Estrella Community.

The Rainbow Valley WRF reclaimed water pump station has a total capacity of 3.3 mgd and a firm capacity of 1.7 mgd. The treatment plant serves Estrella and Canta Mia developments in WPA 3 and is planned to serve future developments in WPA 3 and WPA 4. Reclaimed water is discharged through a privately owned reclaimed water distribution system owned by the Estrella and Canta Mia developments to irrigate turf in the and the Canta Mia lakes. The portion of reclaimed water created by this plant that is not used by Estrella and Canta Mia is currently discharged to a nearby wash that is not permitted as a managed recharge facility, but in the future the City can construct a recharge facility to recharge this reclaimed water and obtain groundwater credits.

6.2.3 Water Planning Area 4

The Rainbow Valley WRF is located north of the border of WPA 4 and is planned to serve developments in WPA 4 including Terrasante, Rainbow Valley, and Estrella Highlands.

The future Waterman Wash WRF is located near the center of WPA 4 and is planned to serve development in WPA 4 that is not served by the Rainbow Valley WRF. There are no plans for development in the Waterman Wash WRF service area within the planning periods of this IWMP.

6.2.4 Water Planning Area 5

WPA 5 is not planned for development within the planning periods of this master plan and will likely be served by a private utility so reclaimed water infrastructure has not been planned in WPA 5 in this IWMP.

6.3 Reclaimed Water Flows

6.3.1 Reclaimed Water Production

The City's reclaimed water supply is primarily generated at the 157th Avenue WRF. Based on the data for 2023, the total reclaimed water volume at the facility was 5,799 ac-ft. This is equivalent to an annual average flow of 5.18 mgd. Corgett and Rainbow Valley produced approximately 500 and 580 ac-ft of reclaimed water respectively, in 2023. Table 6.2 summarizes the historical, average annual reclaimed water flow for the WRFs in Goodyear from 2019 through 2023.

Table 6.2 Historical Reclaimed Water Production

Water Reclamation Facility	Historical Reclaimed Water Flow (mgd)				
	2019	2020	2021	2022	2023
157th Avenue	3.83	4.54	4.80	4.81	5.18
Corgett	0.41	0.45	0.48	0.51	0.45
Rainbow Valley	0.36	0.41	0.46	0.47	0.52
Total	4.60	5.40	5.74	5.79	6.15

Table 6.3 summarizes the historical, average monthly reclaimed water production, and the average monthly flow rates to recharge and irrigation delivery points. Based on 2023 data, most of the reclaimed water produced by the 157th Avenue WRF is sent to the BWCDD Canal where the City is not receiving a groundwater storage credit. In 2023, 1,937 AFY was sent to the BWCDD Canal.

In WPA 3, the reclaimed water produced by Corgett and Rainbow Valley WRFs are mostly used for turf irrigation and the lakes at Estrella, with very little being sent to washes. Figure 6.2 and Figure 6.3 present the 2023 reclaimed water deliveries by planning area.

Table 6.3 2023 Average Monthly Reclaimed Water Deliveries

Month	157th Avenue		Corgett		Rainbow Valley		
	Discharge to BWCDD (mgd)	Discharge to SAT Site (mgd)	Discharge to Corgett Wash (mgd)	Discharge to Estrella Lakes (mgd)	Discharge to Estrella (mgd)	Discharge to Santa Mia (mgd)	Discharge to Wash (mgd)
January	3.91	0.66	0.00	0.54	0.19	0.09	0.27
February	4.08	0.61	0.04	0.56	0.41	0.02	0.12
March	3.70	0.81	0.01	0.56	0.41	0.17	0.00
April	2.99	1.92	0.00	0.56	0.42	0.14	0.00
May	3.95	1.11	0.00	0.47	0.43	0.09	0.00
June	3.37	2.00	0.00	0.36	0.36	0.11	0.00
July	3.23	2.40	0.00	0.35	0.36	0.09	0.00
August	3.01	2.86	0.00	0.37	0.35	0.12	0.00
September	2.44	3.16	0.00	0.38	0.31	0.16	0.00
October	2.63	2.74	0.00	0.39	0.33	0.17	0.00
November	5.06	0.09	0.00	0.42	0.36	0.19	0.00
December	2.45	2.42	0.00	0.41	0.37	0.19	0.00
Average	3.40	1.73	0.00	0.45	0.36	0.13	0.03

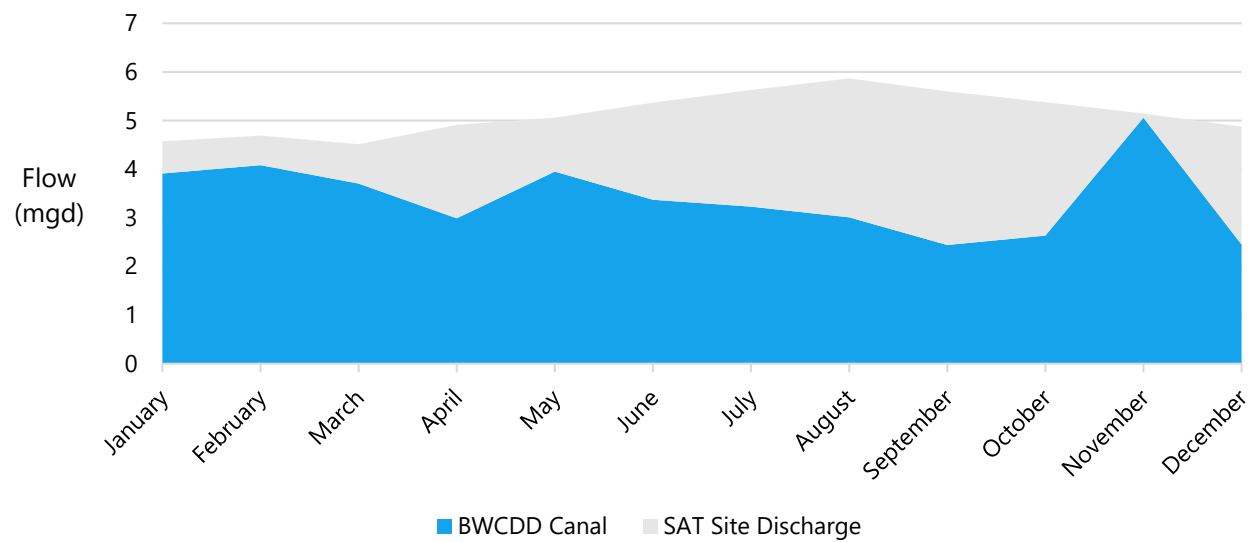


Figure 6.2 2023 Reclaimed Water Deliveries in WPA 2

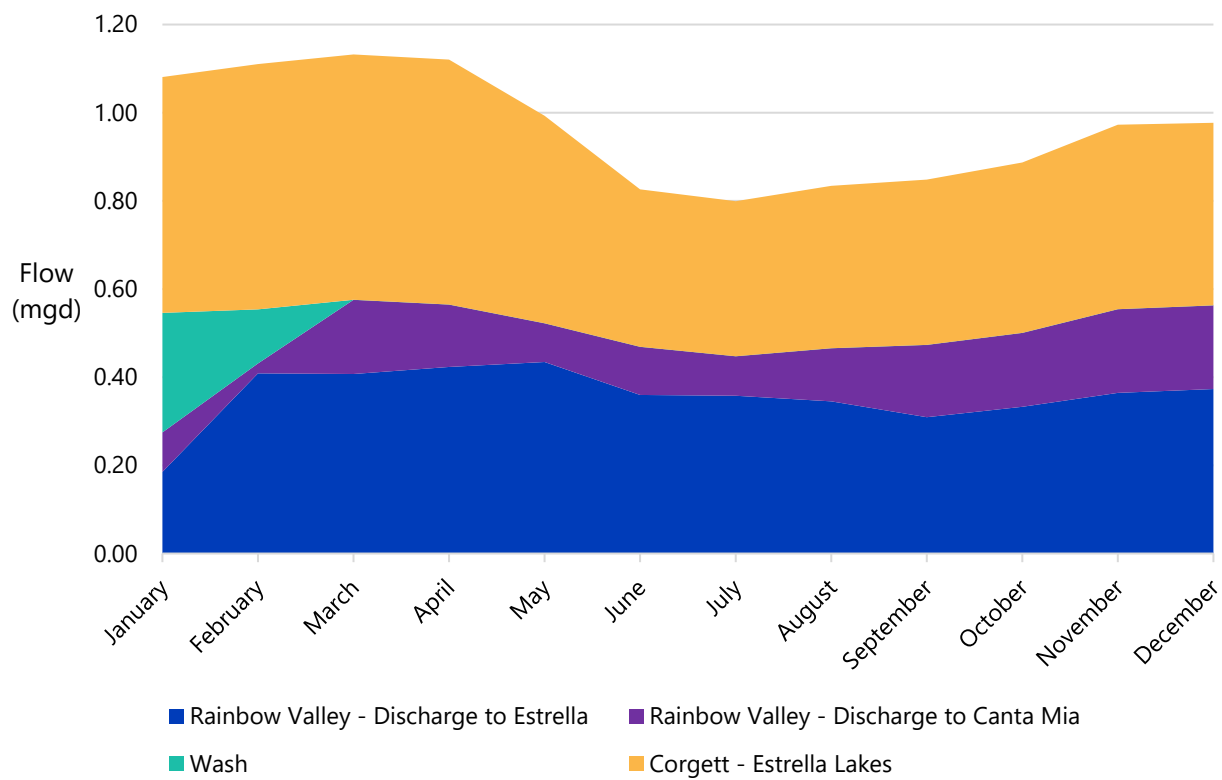


Figure 6.3 2023 Reclaimed Water Deliveries in WPA 3

6.3.2 Projected Reclaimed Water Flows

The reclaimed water flow projections described in Chapter 2 are presented in Table 6.4. These flows are used to plan the reclaimed water that can be beneficially used, and to size infrastructure. The flow projections in Chapter 2 were calculated for three five-year planning periods to align with the MDAWS renewal over a fifteen-year time period (2028, 2033, 2038). The infrastructure plan is scoped for the 2030, 2035, and 2040 planning periods. Flow projections used to calculate the MDAWS are used for the infrastructure recommendations, and the planning periods where infrastructure recommendations are placed are set to provide the capacity needed for the five-year infrastructure planning periods.

Table 6.4 Reclaimed Water Flow Projections

WRF	Projected Reclaimed Water Flow (mgd)			
	2023	2028	2033	2038
157th Avenue	5.11	5.72	6.63	7.29
Corgett	0.46	0.49	0.55	0.60
Rainbow Valley	0.53	0.58	0.86	1.36
Total	6.1	6.8	8.0	9.3

6.4 Reclaimed Water Management Strategies

The objective of reclaimed water systems and reclaimed water management is to accomplish the following:

- Maximize the value of reclaimed water as a water resource, whether for long-term storage credits or direct use.
- Find the highest and best use for the reclaimed water.
- Implement reclaimed water utilization alternatives that provide the best value.

The following reclaimed water management strategies are potentially viable in Goodyear, and are listed in order by increasing relative cost:

1. **Irrigation** – Reclaimed water used for irrigation is a viable reclaimed water management strategy as long as the reclaimed water use offsets potable water use and does not increase total water consumption by irrigating lands that would not otherwise be irrigated. To make the best use of reclaimed water for irrigation, an aquifer storage facility is also needed to take water when not needed for irrigation, and to provide water for irrigation when reclaimed water supplies are not sufficient.
2. **Exchange Reclaimed Water for Surface Water** – The City could implement an exchange agreement with the BWCD to deliver reclaimed water in exchange for surface water to beneficially use the water in the City's portfolio.
3. **Managed recharge facilities** – Managed recharge facilities are usually natural systems such as stream beds and require limited engineering to design, which typically includes only a turnout structure and may include temporary levees to slow water flows in the stream bed to enhance infiltration.

4. **Constructed recharge facilities** – Spreading basins are constructed recharge facilities consisting of engineered basins that have been excavated, shored, and planned in a way for operators to control flow to one or more basins. Water can be delivered to basins that go through wet and dry cycles to dry out the basin to perform the maintenance required to maintain percolation rates. The long-term feasibility of surface recharge is largely determined by hydrogeologic conditions and the ability of the soil to continuously percolate water. Site specific recharge rates need to be developed using site specific hydrogeologic studies and soil testing.
5. **Aquifer storage and recovery (ASR) wells** – ASR wells are typically designed like a water production well with depths between 500 and 2500 feet below land surface (bls). Water recharged through an ASR well enters the aquifer and can be recovered later through the same well as a water source. The bi-directional flow of an ASR well allows cycling that helps to avoid clogging.
6. **Direct potable reuse (DPR)** – DPR requires an advanced treatment facility to treat the reclaimed water to a potable standard. This treatment often includes a reverse osmosis treatment process that creates a brine stream that needs to be managed. DPR is the most expensive option for utilizing reclaimed water, but it also provides the greatest flexibility for use of the water and does not depend on aquifer conditions which are not always favorable for aquifer storage and recovery.

6.5 Reclaimed Water Infrastructure Plan

6.5.1 Reclaimed Water System Performance Criteria

The City's reclaimed water system infrastructure recommended in the 2024 IWMP is sized to provide acceptable levels of performance and reliability.

Performance criteria focuses primarily on sizing the reclaimed water infrastructure to provide sufficient capacity and reliability to take reclaimed water from the WRFs and deliver it to customers or to recharge sites. Reclaimed water infrastructure should satisfy the following criteria:

1. **Pump stations** – The firm capacity (largest pump out of service) of the pump stations in the reclaimed water system needs to be able to pump the peak hour flows with the largest pump in the station out of service.
2. **Recharge basins** – When used along with irrigation, recharge facilities need to be capable of recharging water produced by the WRFs for time periods up to a month when winter storms eliminate the need for outdoor irrigation. The total recharge flow rate capacity in each basin should equal the total reclaimed water flow to the basin plus 50 percent so basins can be out of service for maintenance.
3. **ASR wells** – ASR wells should have a capacity that is 20 percent higher than the required maximum recharge flow rate or have one extra ASR well, whichever is greater, for mechanical redundancy and for well redevelopment.
4. **Distribution pipe velocity** – Pipe velocities should not exceed 7 ft/sec when delivering peak hour flows.

6.5.2 Water Planning Areas 1 and 2 Reclaimed Water Strategy

The following strategies are recommended to maximize the benefit of reclaimed water to the City. Multiple infrastructure strategies are used where less expensive strategies are implemented first to satisfy the water resource strategies outlined in Chapter 3.

1. **Maximize utilization of the SAT site** – The SAT site has a capacity of 8,960 AFY and a total permitted underground storage capacity of 6,570 AFY. The 2023 reclaimed flow data shows that 1,950 AFY was discharged to the SAT site, which is only 30 percent of the site's permitted recharge capacity. The remaining reclaimed flow produced from 157th WRF in 2023 was discharged to the BWCDD canal. Future reclaimed water should be sent to the SAT site to obtain groundwater recharge credits up to the capacity of the facility. The SAT site recharge permit expires in 2040, and permit renewal is recommended because the SAT site is the least expensive way to constructively use the reclaimed water resource.

To increase flow into the SAT site, the pipe between the reclaimed water transmission main and the SAT site needs to be upsized. The pipes into the SAT site have a diameter of 8 inches. A 16-inch main would be large enough to deliver a flow equal to the permitted capacity of the SAT site. This new main to the SAT site is relatively inexpensive and should be constructed as soon as practical to obtain the full benefit of this site. The SAT site can recharge most of the reclaimed water that is currently produced at the 157th Avenue WRF.

2. **Construct ASR wells** – The City should construct ASR wells along or near the reclaimed water transmission mains in WPA 2 to increase the recharge capacity to fully use the available reclaimed water, and to recharge the additional reclaimed water that will be available due to growth through 2040. The wells would be constructed to provide extra capacity to defer the need for a DPR facility beyond 2040. Where possible, the ASR wells should be located within a mile of potable wells so that ADWR will give full credit for the water being recharged. The former vadose well locations may be appropriate sites for ASR wells, and the City should also consider locations that are within a mile of potable production wells. Other entities have applied for aquifer storage facilities in the West Salt River Valley aquifer, so a groundwater study will be needed to determine how much reclaimed water can be recharged using the ASR wells. The allowable recharge volume will dictate how much ASR well recharge capacity can be constructed.
3. **Implement DPR** – A DPR facility would treat the reclaimed water to a potable standard once the aquifer storage and recovery alternatives have been fully developed. In 2019, the ADEQ proposed revisions to the A.A.C. removing the prohibition of reclaimed water being used for human consumption. This decision, in addition to other changes to the A.A.C. that were subsequently approved, means that a DPR site can be permitted. However, DPR is an expensive solution so the City will want to develop less expensive solutions first.

The costs and benefits of DPR for the City depends on many factors that should be studied, including:

- » The City's water demand projections and physical water supplies in the City's water resource portfolio.
- » Long-term aquifer recharge and recovery capacity, which could dictate how long the City's storage and recovery strategy is viable.
- » Wastewater quality and treatment needed to produce potable water.
- » The cost of building, operating, and maintaining an advanced water treatment facility (AWTF) along with staffing needs in terms of both manpower and training.
- » Public acceptance of DPR.

DPR provides a reliable, long-term supply even in times of drought. Due to the cost of DPR, the timing of a DPR facility is deferred until aquifer storage and recovery solutions do not provide sufficient capacity to meet the City's needs.

4. **Exchange with BWCDD** – The City may pump excess reclaimed water to BWCDD and exchange it for a surface water credit provided by the BWCDD using a reclaimed water to surface water ratio of 1.5. This will provide the City with a way to use reclaimed water to obtain an additional surface water right that may be particularly useful if the City's CAP water allocation is reduced. Exchanging reclaimed water with BWCDD could let the City delay the implementation of DPR until after 2040. To obtain the surface water, the BWCDD would allow the City to use one of its wells that currently pumps surface water sub flow along the Gila River. The BWCDD may allow the City to pump up to 2,000 AFY per year.

Table 6.5 summarizes the additional recharge capacity needed to recharge projected reclaimed water flows. Figure 6.4 presents the existing recharge infrastructure and potential expansion options in the 157th Avenue WRF service area.

Table 6.5 157th Avenue WRF Service Area Recharge Capacity

	Reclaimed Water Recharge Capacity by Planning Year (mgd)			
	2023	2030	2035	2040
Maximum Monthly Production ⁽¹⁾	5.92	6.64	7.70	8.46
Recharge at the SAT Site ⁽²⁾	1.58	4.52	4.52	4.52
Aquifer Storage and Recovery Wells ⁽³⁾		0.94	1.87	2.81
Reclaimed Water Exchanged with BWCDD ⁽⁴⁾		1.79	1.79	1.79
Subtotal Reclaimed Water Delivery Capacity	1.58	7.25	8.18	9.12
Reclaimed Water Flows Discharged without Water Resource Benefit ⁽⁵⁾	4.34	0.0	0.0	0.0

Notes:

- (1) The future maximum monthly reclaimed water production is assumed to be 16 percent greater than the average annual reclaimed water production.
- (2) The SAT Site currently has an 8-inch inlet pipe with a maximum allowable velocity of 7 ft/sec. A larger pipe is recommended to be installed to allow the permitted capacity of the site to be delivered.
- (3) Assumed capacity of 650 gallons per minute (gpm) per well with the largest well out of service.
- (4) The maximum amount that can be exchanged with BWCDD is 1.79 mgd.
- (5) Unused reclaimed water was sent to the Buckeye canal in 2023.

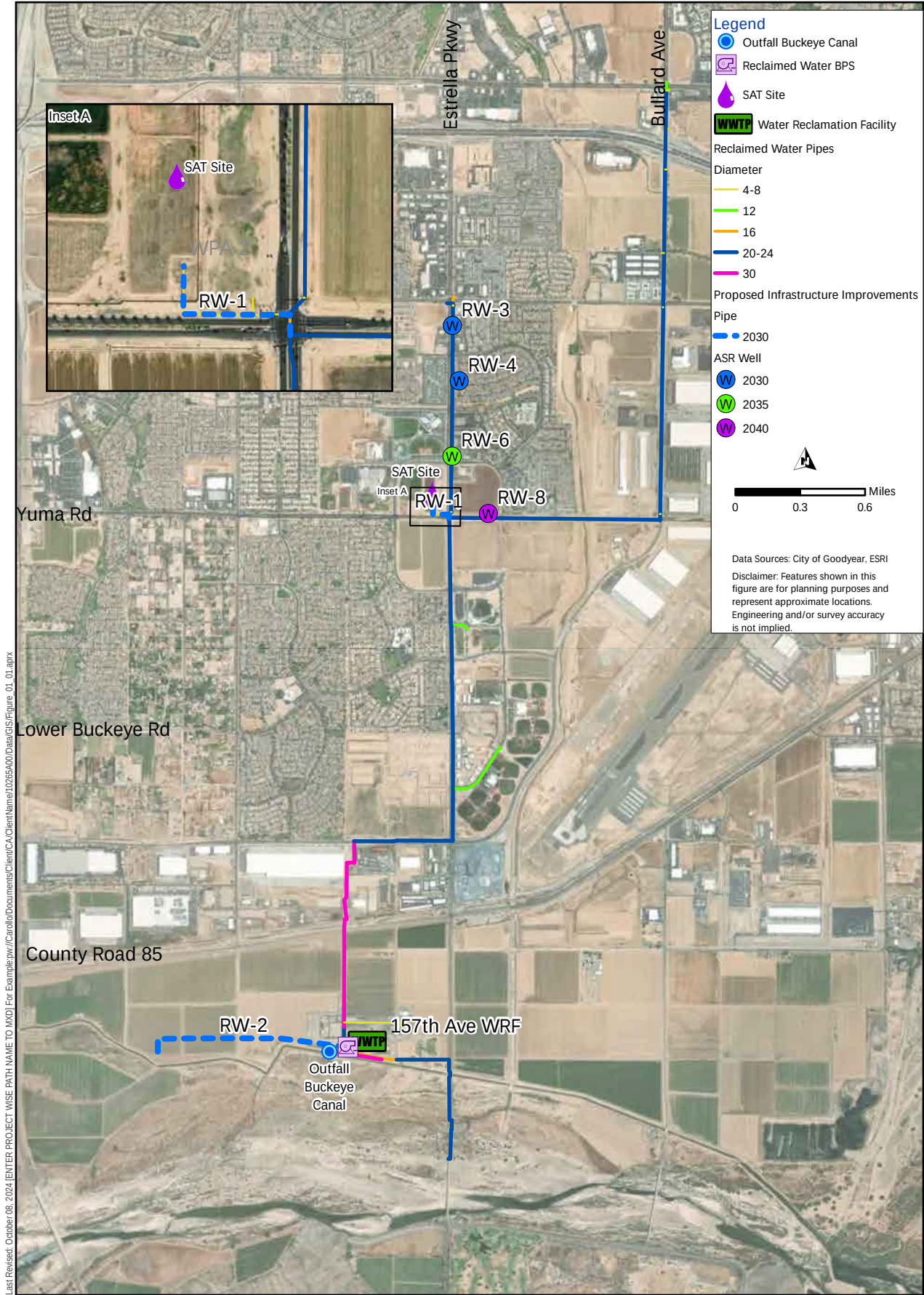
In addition to the physical recharge capacity, the capacity of the booster pump stations must be sufficient to pump the peak hour reclaimed water flows to the recharge sites. The 157th WRF pump station has a total capacity of 18 mgd and a firm capacity of 12 mgd. The pump station has sufficient capacity to pump reclaimed water through 2040.

6.5.3 Water Planning Areas 3 and 4 Reclaimed Water Strategy

The City is planning for new development in WPA 4 that will increase the reclaimed water produced at the Rainbow Valley WRF. The City will need to use this reclaimed water to strengthen its water resource portfolio in the Rainbow Valley groundwater basin as outlined in Chapter 3. Constructed recharge facilities are recommended over a managed aquifer storage facility because ADWR will recognize the full recharge volume minus a cut to the aquifer whereas a managed recharge facility can only get credit for 50 percent of the recharged volume.

The 2016 IWMP recommended the use of spreading basins in the Rainbow Valley service area to recharge groundwater. A 2007 study conducted by Hydro Systems, Inc. (HSI) was completed for the City to determine the viability of using the constructed recharge facilities in the Rainbow Valley Area. The conclusion of the study by HSI proposed infiltration basins with wetting and drying cycles and surface soil removal. The assumption from the 2016 IWMP to size the recharge basin for planning purposes is to use a conservative infiltration rate of 0.3 feet per day (ft/day).

The City may also construct ASR wells in WPA 4 to provide additional reclaimed water capacity as a substitute for the constructed recharge facilities. However, the ASR wells are not recommended because the costs to construct ASR wells are significantly higher than the constructed recharge facilities. The ASR wells do not require as much space as the constructed recharge facility so the ASR wells may become more attractive if land availability becomes an issue.



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Figure 6.4 Proposed Reclaimed Water Projects in the 157th Avenue WRF Service Area
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The City should explore options to improve recharge rates when infiltration basins are used. Some communities have improved recharge rates in poorly performing basins by constructing dry wells through confining clay layers and filling the wells with gravel material. The size of the recharge facility will be determined based on hydrogeological investigations at the selected recharge sites and potentially will require pilot testing various trenching and/or drilling methods.

The infiltration basin could be located south of the Canta Mia development along Rainbow Valley Road. The recharge basin would be split into multiple projects that will increase the size of the infiltration basin, starting at 5 acres and expanding to 60 acres.

Table 6.6 summarizes the additional recharge capacity needed to recharge the projected reclaimed water production from the Rainbow Valley WRF. Figure 6.5 presents the potential location of a spreading basin in the Rainbow Valley Groundwater Basin.

Table 6.6 Rainbow Valley WRF Service Area Recharge Capacity

	Reclaimed Water Recharge Capacity by Planning Year (mgd)			
	2023	2030	2035	2040
Maximum Monthly Rainbow Valley WRF Production ⁽¹⁾	0.58	0.67	1.00	1.58
Reclaimed Water from Corgett to Estrella ⁽³⁾	0.56	0.56	0.56	0.56
Committed Reclaimed Water to Estrella and Canta Mia ⁽²⁾	1.13	1.13	1.13	1.13
Flow Rate to the Future Spreading Basin		0.10	0.43	1.01

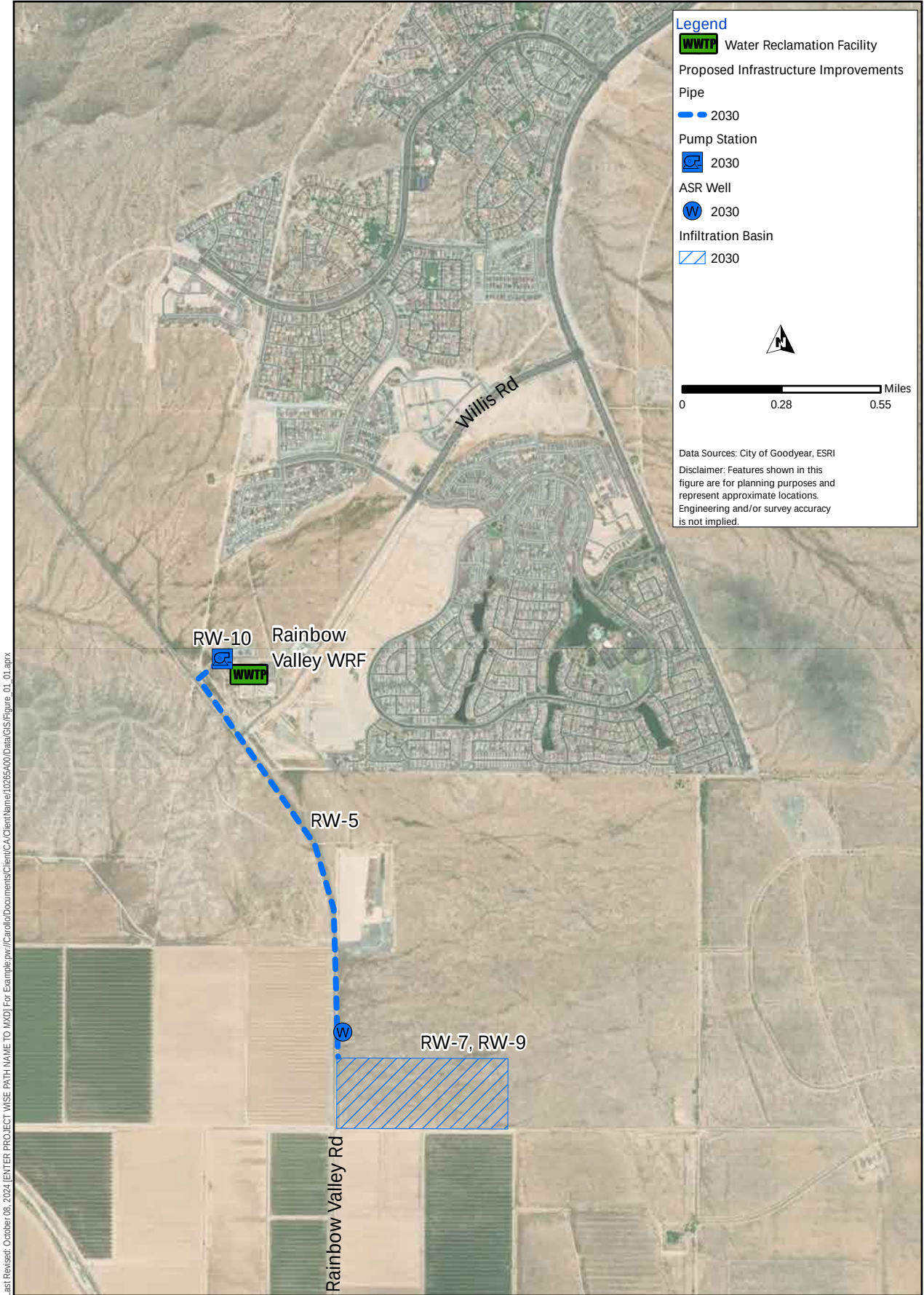
Notes:

- (1) The future maximum monthly reclaimed water production is assumed to be 16 percent greater than the average annual reclaimed water production.
- (2) Based on the maximum month delivered to Estrella and Canta Mia in 2023.
- (3) Based on the maximum month delivered from the Corgett WRF to Estrella Lakes in 2023.

The Rainbow Valley WRF pump station has a total capacity of 3.3 mgd and a firm capacity of 1.7 mgd. The Rainbow Valley WRF pump station capacity is sufficient to deliver flows through 2035. The pump station will require an expansion to 2.6 mgd of firm capacity before 2040 to meet peak hour requirements.

6.6 Reclaimed Water Projects

Table 6.7 summarizes the reclaimed water projects for the 2030, 2035, and 2040 planning periods.



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Figure 6.5 Proposed Reclaimed Water Improvement Projects in the Rainbow Valley WRF Service Area
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

Table 6.7 Proposed Reclaimed Water Infrastructure Facilities by Planning Period

Project #	Description	Justification	Location	Diameter/Size (in/mgd)	Length/Qty (ft/#)	Planning Period
RW-1	16-inch pipeline to the SAT Site	Deliver more flow into the site	WPA 2, SAT Site	16	640	2030
RW-2	Pipeline to BWCDD	To be able to deliver flow from 157th WRF to BWCDD	WPA 2, 157th WRF Service Area	12 in	5,120	2030
RW-3	First ASR Well in WPA 2	Provide additional recharge capacity	WPA 2, 157th WRF Service Area	650 gpm	3	2030
RW-4	Second ASR Well in WPA 2	Provide additional recharge capacity	WPA 2, 157th WRF Service Area	650 gpm	3	2030
RW-5.1	1 mgd pump station at Rainbow Valley WRF	Pump water to spreading basin	WPA 4, Rainbow Valley WRF Service Area	1	1	2030
RW-5.2	16-inch pipeline from Rainbow Valley WRF to the spreading basin	Deliver flow to the spreading basin	WPA 4, Rainbow Valley WRF Service Area	16	6,540	2030
RW-5.3	5-acre spreading basin south of Santa Mia	Provide recharge capacity for Rainbow Valley WRF flows	WPA 4, Rainbow Valley WRF Service Area	5-acre	1	2030
RW-5.4	(Option) First ASR Well in WPA 4	Provide additional recharge capacity	WPA 4, Rainbow Valley WRF Service Area	1	1	2030
RW-5.5	(Option) Second ASR Well in WPA 4	Provide additional recharge capacity	WPA 4, Rainbow Valley WRF Service Area	1	1	2030
RW-6	Third ASR Well in WPA 2	Provide additional recharge capacity	WPA 2, 157th WRF Service Area	1	1	2035
RW-7	Rainbow Valley 25-acre spreading basin expansion	Provide recharge capacity for Rainbow Valley WRF	WP A4, Rainbow Valley WRF Service Area	25-acre	1	2035
RW-8	Fourth ASR Well in WPA 2	Provide additional recharge capacity	WPA 2, 157th WRF Service Area	1	1	2040
RW-9	Rainbow Valley 30-acre spreading basin expansion	Provide recharge capacity for Rainbow Valley WRF	WPA 4, Rainbow Valley WRF Service Area	30-acre	1	2040
RW-10	3 mgd pump station expansion at Rainbow Valley WRF	Pump water to spreading basin	WPA 4, Rainbow Valley WRF Service Area	3	1	2040

6.7 Recommendations

1. The pipeline leading to the SAT site should be upsized to 16 inches in the 2030 planning period to fully utilize the permitted capacity of this site.
2. A 12-inch pipeline from 157th WRF to BWCCD should be constructed in the 2030 planning period to allow the City to exchange reclaimed water.
3. A siting study should be conducted within the 2030 planning period on the viability of ASR wells in central Buckeye. Once completed, the first two 650 gpm ASR wells should be constructed in WPA 2.
4. A study should be conducted within the 2030 planning period on the viability of recharge facilities in the Rainbow Valley WRF service area. Once completed, the first 5 acres of the spreading basin should be constructed along with a 1 mgd pump station and 16-inch pipeline from Rainbow Valley WRF to the spreading basin.
5. The third 650 gpm ASR well in WPA 2 should be constructed in the 2035 planning period to provide additional recharge capacity to the 157th WRF service area.
6. The spreading basin in the Rainbow Valley service area should be expanded from 5 acres to 30 acres in the 2035 planning period to provide additional recharge capacity to the Rainbow Valley service area.
7. The fourth 650 gpm ASR well in WPA 2 should be constructed in the 2040 planning period to provide additional recharge capacity to the 157th WRF service area.
8. The spreading basin in the Rainbow Valley WRF service area should be expanded from 30 acres to 60 acres and the pump station at Rainbow Valley WRF should be expanded by 3 mgd in the 2040 planning period.

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CHAPTER 7 CAPITAL IMPROVEMENT PROGRAM

7.1 Introduction

This chapter presents the CIP developed as part of the 2024 IWMP for the City. The purpose of the CIP is to define the costs of the capital improvements the City will need to expand the water, wastewater, and reclaimed water systems through 2040 to support growth and provide the infrastructure needed to fully utilize the City's water resources. The capital costs for projects assumed to be paid for by developers are also included in this chapter separate from the CIP projects to provide a complete picture of the improvements the City will need to expand through 2040. This chapter includes the following sections:

- Cost development methodology.
- Capital improvement projects.
- Developer funded projects.

7.2 Cost Development Methodology

7.2.1 Overview

7.2.1.1 Capital Project Definitions

Capital projects are funded differently and are therefore categorized differently depending on the funding source. Projects fall into the following categories:

- **CIP Projects** – These projects provide additional capacity to address existing deficiencies or provide capacity for future growth that would be paid for by the City and fall within the 15-year planning horizon (through year 2040).
- **Developer Funded Projects** – These projects define the major transmission, pumping, and storage facilities on undeveloped lands within the City's planning area to be constructed by developers. The plans for this infrastructure are at a conceptual level and may change significantly as specific development plans are prepared. These projects would be paid for by developers and are therefore not included in the CIP but are listed in this report to identify infrastructure needed for a complete picture of the projects to be added.

7.2.1.2 Cost Definitions

Unit Cost

The cost of infrastructure that contains detailed listing of components. The unit cost is multiplied by a length, volume, or capacity to determine the construction cost.

Construction Cost

The construction cost is the cost that would be paid to a contractor to construct the project. Construction costs were calculated by multiplying the estimated unit construction costs by a length or capacity to obtain the construction cost.

Project Cost

The Project Cost is the cost that a water utility would budget for the project. In addition to the construction cost, the project cost includes engineering design (10%), construction management (10%), and a contingency (20%) for a total multiplier of 1.4. The project cost does not include land acquisition, city administration, or Construction Manager at Risk (CMAR) fees.

7.2.2 Planning Level Cost Accuracy

Cost estimates have been developed for the water, wastewater, and reclaimed water capital improvement projects that were identified in Chapters 4, 5, and 6, respectively. The cost estimates presented in the CIP have been prepared for general master planning purposes and for guidance in project evaluation and implementation. Final costs of a project will depend on actual labor and materials costs, competitive market conditions, final project scope, implementation schedule, and other variable factors identified during the preliminary and final design stages. For water and sewer pipes this might include items such as preliminary alignment, investigation of alternative routings, and detailed utility and topography surveys.

This cost estimate was prepared in accordance with the guidelines of the Association for the Advancement of Cost Engineering International (AACEI) for a Class 5 estimate. According to the definitions of Association for the Advancement of Cost Engineering (AACE), the Class 5 estimate is defined as:

"CLASS 5 ESTIMATE. Generally prepared based on very limited information, where little more than proposed plant type, its location, and the capacity are known. Strategic planning purposes, such as but not limited to, market studies, assessment of viability, evaluation of alternative schemes, project screening, location and evaluation of resource needs and budgeting, long range capital planning, etc. Some examples of estimating methods used would be estimating methods such as cost/capacity curves and factors, scale up factors, parametric and modeling techniques. Typically, very little time is expended in the development of this estimate. The typical expected accuracy range for this class estimate is -20 percent to -50 percent on the low side and +30 percent to + 100 percent on the high side."

Table 7.1 summarizes the AACE International cost estimating classifications, the level of project definition (percent of design), use, appropriate cost estimating methodologies, and the expected accuracy of each class. Design work would need to be undertaken to obtain more precise cost estimates.

Table 7.1 AACE International Cost Estimating Classification Summary

Estimate Class	Maturity Level of Project Definition Deliverables - (Level of Engineering Design)	End Use	Typical Cost Estimating Methodology Used	Expected Accuracy Range (Low/High)
Class 5	0% to 2%	Conceptual screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -10% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

7.2.3 Unit Costs

Unit costs were developed for the recommended water and wastewater infrastructure based on Carollo's database of material, labor, and equipment from recent projects, R.S. Means and other unit cost databases. These costs form the basis of the capital improvement project costs. A detailed breakdown of information associated with the unit cost development is included in Appendix 7A and Appendix 7B for water and wastewater infrastructure, respectively.

Multipliers for construction overhead and profit (16%), sales tax (65 percent of applicable costs at 8.35%), and general conditions (10%) were then added to prepare unit construction costs. When multiplied by the capacity, quantity, or size of infrastructure, the construction cost represents what the City should expect to pay a contractor to construct the project. The City will have other expenses to complete the project including design, inspection, project management, and contingencies.

Table 7.2 summarizes the water infrastructure unit costs for the 2024 IWMP. Some projects do not require all the cost items that are developed in the unit costs. For these projects, a unit cost was calculated that includes only the required infrastructure components.

7.2.3.1 Water Unit Costs

Unit costs utilized for the proposed water system infrastructure are described in the sections below. The unit costs correspond with an Engineering News Record Construction Cost Index (ENR CCI) of 13532 for May 2024.

Water Main Unit Costs

Unit costs for the construction of potable or reclaimed water pipelines are shown in Table 7.2. The unit costs are based on an open cut construction method and assume "typical" field conditions with construction in stable soil at a depth ranging between 4 to 8 feet. Fittings, valves, and hydrants are included in the unit costs on a quantity-per-mile basis. The material for water mains is assumed to be ductile iron.

Table 7.2 Water Main Unit Costs

Pipe Diameter (in)	Construction Cost (\$/lf)	Project Cost (\$/lf)
8	410	574
10	450	630
12	490	686
16	670	938
20	790	1,106
24	950	1,330

\$/lf - cost per linear foot

Storage Tank Unit Costs

Unit costs for the construction of water storage tanks are shown in Table 7.3. The unit costs are for welded steel tanks and include costs for piping, coatings, electrical, and disinfection.

Table 7.3 Storage Tank Unit Costs

Tank Size (MG)	Construction Cost (\$)	Project Cost (\$)
2	6,582,000	9,214,800
3	8,340,000	11,676,000

Booster Pump Station Unit Costs

Unit costs for the construction of water and reclaimed water booster pump stations are shown in Table 7.4. The unit costs are for stations with 4 to 5 pumps and include costs for pressure relief, electrical, disinfection, and coatings. Costs for pump stations of other sizes were inferred from the unit costs shown in Table 7.4.

Table 7.4 Booster Pump Station Unit Costs

Firm Capacity (mgd)	Construction Cost (\$)	Project Cost (\$)
5	6,305,000	8,827,000
10	7,636,000	10,690,400
15	10,070,000	14,098,000
20	12,103,000	16,944,200

PRV Station Unit Costs

Unit costs for the construction of pressure reducing valve stations are shown in Table 7.5. The PRV station costs were taken from a recent construction project in the West Valley, where multiple PRVs were installed like those proposed in this report.

Table 7.5 PRV Station Unit Costs

PRV Diameter (in)	Construction Cost (\$)	Project Cost (\$)
8	631,000	883,000

Well Unit Costs

Unit costs for the construction of potable wells are shown in Table 7.6. Costs for wells of other sizes were inferred from the unit costs shown in Table 7.6.

Table 7.6 Well Unit Costs

Well Capacity (mgd)	Construction Cost (\$)	Project Cost (\$)
1	4,423,000	6,192,200
1.5	4,626,000	6,476,400
3	5,077,000	7,107,800

7.2.3.2 Wastewater System Unit Costs

Unit costs utilized for the proposed wastewater system infrastructure are described in the sections below.

Gravity Sewer Unit Costs

Unit costs for the construction of gravity sewer pipelines are shown in Table 7.7. The unit costs are based on an open cut construction method and assume "typical" field conditions with construction in stable soil at a depth ranging between 6 to 15 feet. Appurtenances (e.g., manholes) are included in the unit costs. The material for gravity pipeline projects is assumed to be vitrified clay.

Table 7.7 Gravity Sewer Unit Costs

Pipe Diameter (in)	Construction Cost (\$/lf)	Project Cost (\$/lf)
8	340	476
12	420	588
15	500	700
16	570	798
18	580	812
20	650	910
21	730	1,022
24	760	1,064

Force Main Unit Costs

The unit costs of the force main pipes are shown in Table 7.8. The pipe material for force mains is assumed to be ductile iron.

Table 7.8 Force Main Unit Costs

Pipe Diameter (in)	Construction Cost (\$/lf)	Project Cost (\$/lf)
6	930	1,302
8	1,020	1,428
10	1,040	1,456
12	1,100	1,540

Lift Station Unit Costs

Lift station unit costs were developed based on Carollo's cost database. Table 7.9 lists the lift station unit costs in terms of lift station firm capacity.

Table 7.9 Lift Station Unit Costs

Firm Capacity (mgd)	Construction Cost (\$)	Project Cost (\$)
1	1,592,000	2,228,000
3	3,349,000	4,688,000
3.5	3,391,000	4,747,000
5	3,528,000	4,939,000

7.2.3.3 Reclaimed Water Unit Costs

ASR Wells

Aquifer storage and recovery (ASR) wells unit cost was developed based on Carollo's cost database. Table 7.10 lists the ASR well unit cost in terms of ASR well firm capacity.

Table 7.10 ASR Well Unit Costs

Firm Capacity (mgd)	Construction Cost (\$)	Project Cost (\$)
1	7,339,000	10,359,000

Spreading Basin

The spreading basin unit cost was developed based on similar projects. Table 7.11 lists the spreading basin construction cost by acreage of the recharge basins.

Table 7.11 Spreading Basin Unit Costs

Basin Total Acreage (acres)	Construction Cost (\$)	Project Cost (\$)
5	285,250	400,000

Notes:

- (1) Spreading basins are sized with the assumed infiltration rate of 0.3 ft/day and only half the spreading basins' total acreage are available for recharge.

DPR Facility

DPR facility unit cost is based on DPR cost estimates for other communities. The DPR construction cost is the advanced treatment cost which is in addition to the wastewater treatment cost, and excludes brine management infrastructure costs, because brine management is assumed to be handled by Arizona Public Service (APS) in accordance with the City's agreement with APS. The DPR treatment construction cost is estimated at \$19 per gallon of treatment capacity. For this type of facility, the project cost is obtained by multiplying the construction cost by a multiplier of 1.3.

7.3 Capital Improvement Program

7.3.1 Water System CIP

A summary of the water capital improvement program is presented in Table 7.12. The water CIP is itemized in Table 7.13, Table 7.14, and Table 7.15 for planning periods 2030, 2035, and 2040 respectively. The CIP locations are presented in Figure 4.26. Detailed water CIPs are illustrated in maps in Appendix 7C.

Table 7.12 Water CIP Summary

Facility Type	Planning Period Project Costs (\$)			Total Cost (\$)
	2030 (\$)	2035 (\$)	2040 (\$)	
Altitude Valve	0	496,000	0	496,000
PRV	0	7,064,000	0	7,064,000
Pump Station	3,500,000	8,827,000	5,467,000	17,794,000
Storage Tank	9,067,000	9,215,000	0	18,282,000
Water Main	10,397,000	28,246,000	5,727,000	44,370,000
Water Supply Purchase	0	17,000,000	0	17,000,000
Well + Groundwater Treatment	13,407,000	26,659,000	0	40,066,000
Surface Water Treatment Expansion	85,570,000	0	0	85,570,000
Total	121,941,000	97,507,000	11,194,000	230,642,000

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Table 7.13 Water CIPs (FY 2025 - FY 2030)

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Planning Period	Unit Cost (\$ per ft/qty)	Construction Cost (\$)	Project Cost (\$)	Project Cost by Year					
										2025 (\$)	2026 (\$)	2027 (\$)	2028 (\$)	2029 (\$)	2030 (\$)
W-7.1	12 Inch Water Main	Serve future developments and improve system looping	Broadway Rd, from Estrella Pkwy to Bullard Ave	12	5,250	2030	490	2,573,000	3,602,000	360,000	3,242,000				
W-28	Surface Water Treatment Plant Expansion	Expand water treatment and storage capacity at the Surface Water Treatment Plant (5,250 gpm treatment, 4 MG storage and 8,000 gpm pumping capacity)	Goodyear Water Campus	9.5	1	2030		61,121,000	85,570,000			8,557,000	25,671,000	25,671,000	25,671,000
W-31	Well 18B Replacement	Replace failed well. Redrilling cost only	Well 18B	1.25	1	2030	1,719,000	1,719,000	2,407,000	241,000	2,166,000				
W-36	24 Inch Water Main	Improve transmission from the Surface Water Treatment Plant	From MC85 & North of SWTP to Estrella Pkwy and MC85	24	2,660	2030	950	2,527,000	3,538,000		354,000	3,184,000			
W-37	16 Inch Water Main	Improve looping to industrial sites south of airport	Litchfield Rd from El Cielo to Main St	16	750	2030	670	503,000	704,000	70,000	634,000				
W-41	1.5 MG Storage Tank. Cost split with Data Center Operators	Replace storage at Site 7 and Site 8	Site 18	1.5	1	2030	2,904,500	2,905,000	4,067,000					407,000	3,660,000
61-24-356	Site 10 Booster Tank Rehab	Project copied from City's CIP list	Site 10			2030			2,000,000				2,000,000		
61-21-117	Site 11 Reservoir Rehabilitation	Project copied from City's CIP list	Site 11			2030			3,000,000				3,000,000		
61-23-234	Site 13 and 23 Chlorination System Upgrades	Project copied from City's CIP list	Sites 13 and 23			2030			500,000			500,000			
61-25-458	Well 25 Equipping and Treatment	Project copied from City's CIP list	Well 25			2030			6,000,000				2,000,000	4,000,000	
61-25-460	Well 11 Re-Drill	Project copied from City's CIP list	Well 11			2030			2,500,000					2,500,000	
61-24-357	Site 11 Booster Station MCC Replacement	Project copied from City's CIP list	Site 11			2030			3,000,000				3,000,000		
61-20-001/60041	Water Main Replacement	Project copied from City's CIP list				2030			2,553,000			2,553,000			
	Well 12 Re-drill	Project copied from City's CIP list	Well 12			2030			2,500,000				2,500,000		
Total								71,348,000	121,941,000	671,000	6,396,000	14,794,000	38,171,000	32,578,000	29,331,000

Notes:
MCC - motor control center
(1) Project cost for SWTP expansion is escalated cost from the 2016 Master Plan.
(2) Project costs correspond to the ENR 20 Cities Construction Cost Index (CCI) of 13,532 for May 2024.

Table 7.14 Water CIPs (FY 2031 - FY 2035)

Project #	Description	Justification	Location	Diameter/Size (in/mgd)	Length/Qty (ft/#)	Planning Period	Unit Cost (\$ per ft/qty)	Construction Cost (\$)	Project Cost (\$)	Project Cost by Year				
										2031 (\$)	2032 (\$)	2033 (\$)	2034 (\$)	2035 (\$)
W-72	12 Inch Water Main	Serve future developments and improve system looping	Roeser Rd, from Estrella Pkwy to Bullard Ave	12	5250	2035	490	2,573,000	3,602,000				360,000	3,242,000
W-14	12 Inch Water Main	Serve future developments and improve system looping	Desert Trumpet Rd to Westar Dr	12	3,385	2035	490	1,658,000	2,321,000				232,000	2,089,000
W-211	575 mgd Booster Pump Station	Provide additional pumping capacity to Central Zone 2	Yuma Rd and Cotton Ln	5.75	1	2035	6,305,000	6,305,000	8,827,000	883,000	7,944,000			
W-212	2 MG Storage Tank	Provide additional storage capacity to Central Zone 2	Yuma Rd and Cotton Ln	2	1	2035	6,582,000	6,582,000	9,215,000	922,000	8,294,000			
W-213	24 Inch Water Main	Improve transmission capabilities from West Goodyear booster pump station	From Citrus Rd and Jefferson St to Van Buren St at RV Park	24	3,895	2035	950	3,700,000	5,180,000		518,000	4,662,000		
W-214	24 Inch Water Main	Improve transmission capabilities from West Goodyear booster pump station	From Citrus Rd and Yuma Rd to Yuma Rd and 175th Dr	24	2,409	2035	950	2,289,000	3,205,000		321,000	2,885,000		
W-215	10 Inch Altitude Valve	Manage flow into the West Goodyear storage tank	Van Buren St and Cotton Ln	10	1	2035	253,000	354,000	496,000	50,000	446,000			
W-216	2 mgd Well	Supply water to the West Goodyear Storage and Booster Pump Station	Yuma Rd and Cotton Ln	2	1	2035	4,851,500	4,852,000	6,793,000	679,000	6,114,000			
W-22	8 Inch PRV Station	Split Central Zone into two pressure zones	Yuma Rd and 173rd Ave	8	1	2035	631,000	631,000	883,000	88,000	795,000			
W-23	8 Inch PRV Station	Split Central Zone into two pressure zones	Sarival Ave and Yavapai St	8	1	2035	631,000	631,000	883,000	88,000	795,000			
W-24	8 Inch PRV Station	Split Central Zone into two pressure zones	Yuma Rd and 158th Dr	6	1	2035	631,000	631,000	883,000	88,000	795,000			
W-25	8 Inch PRV Station	Split Central Zone into two pressure zones	Yuma Rd and 157th Ave	8	1	2035	631,000	631,000	883,000	88,000	795,000			
W-26	8 Inch PRV Station	Split Central Zone into two pressure zones	Yuma Rd and Estrella Pkwy	8	1	2035	631,000	631,000	883,000	88,000	795,000			
W-27	8 Inch PRV Station	Split Central Zone into two pressure zones	Yuma Rd and Litchfield Rd	8	1	2035	631,000	631,000	883,000	88,000	795,000			
W-32	Ion Exchange Treatment for Adaman Well Water	Remove nitrate from Adaman well water	Site 21	2.25	1	2035	4,792,000	10,782,000	15,095,000			1,510,000	6,793,000	6,793,000
W-33	24 Inch Water Main	Improve transmission capabilities from the Surface Water Treatment Plant to western Goodyear	From County Rd 85 and Sarival Ave to Citrus Rd and Broadway Rd	24	7,530	2035	950	7,153,000	10,014,000				1,001,000	9,013,000
W-35	20 Inch Water Main	Replace undersized pipes to remove bottlenecks in pipeline	Central zone to Site 13 along Cotton Ln	20	3,548	2035	790	2,803,000	3,924,000		392,000	3,532,000		
W-38	8 Inch PRV Station	Split Central Zone into two pressure zones	Yuma Rd and Bullard Ave	8	1	2035	631,000	631,000	883,000	88,000	795,000			
W-39	8 Inch PRV Station	Split Central Zone into two pressure zones	Yuma Rd and Canyon Trails Blvd	8	1	2035	631,000	631,000	883,000	88,000	795,000			
W-42	PFAS Treatment for Wells 18 and 18B	Remove PFAS from Well 18 and 18B water	Well 18 and 18B	1.25	1	2035	3,408,000	3,408,000	4,771,000		407,000	3,660,000		
	Bartlett Dam Water Purchase	Project copied from City's CIP list				2035			17,000,000				17,000,000	
Total								57,507,000	97,507,000	3,238,000	30,796,000	16,249,000	25,386,000	21,137,000

Notes:
(1) Project cost for well ion exchange escalated from the 2019 Waterman Wash study.
(2) Project costs correspond to the ENR 20 Cities CCI of 13,532 for May 2024.

Table 7.15 Water CIPs (FY 2036 - FY 2040)

Project #	Description	Justification	Location	Diameter/Size (in/mgd)	Length/Qty (ft/#)	Planning Period	Unit Cost (\$ per ft/qty)	Construction Cost (\$)	Project Cost (\$)	Project Cost by Year				
										2036 (\$)	2037 (\$)	2038 (\$)	2039 (\$)	2040 (\$)
W-30	Site 13 (Zone 2) Pump Expansion	Provide additional pumping and fire flow capacity to South Zone 2	Site 13 (Zone 2) Pump Station	2.25	1	2040	3,905,000	3,905,000	5,467,000	547,000	4,920,000			
W-34	16-Inch Water Main	Parallels existing 16-inch. Improve transmission capabilities from Site 12	From Site 12 to Cotton Ln and County Rd 85	16	6,106	2040	670	4,091,000	5,727,000		573,000	5,154,000		
Total								7,996,000	11,194,000	547,000	5,493,000	5,154,000	0	0

Notes:
(1) Project costs correspond to the ENR 20 Cities CCI of 13,532 for May 2024.

7.3.2 Wastewater System CIP

A summary of the wastewater CIP is presented in Table 7.16. The wastewater CIP is itemized in Table 7.17, Table 7.18, and Table 7.19 for planning periods 2030, 2035, and 2040. Wastewater CIP locations are presented in Figure 5.9 in chapter 5 of the IWMP. Detailed wastewater CIPs are illustrated in maps in Appendix 7D.

Table 7.16 Wastewater CIP Summary

Facility Type	Planning Period Costs (\$)			Total Cost (\$)
	2030 (\$)	2035 (\$)	2040 (\$)	
Gravity and Pressure Pipelines	8,224,000	250,000	2,842,000	11,316,000
Lift Station	6,851,000	0	0	6,851,000
WRF	256,000,000	0	83,000,000	339,000,000
Sewer Service Relocation	6,000,000	0	0	6,000,000
Total	277,075,000	250,000	85,842,000	363,167,000

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Table 7.17 Wastewater CIPs (FY 2025 - FY 2030)

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Planning Period	Unit Cost (\$)	Construction Cost (\$)	Project Cost (\$)	Project Costs by Year					
										2025 (\$)	2026 (\$)	2027 (\$)	2028 (\$)	2029 (\$)	2030 (\$)
WW-1	Upsize gravity main along Auto Dr and 137th Ave	Pipe is at 90% capacity with the higher Wells Fargo lift station flows	Along Auto Dr from the force main connection to 175 ft south of the connection	12	1,214	2030	420	510,000	714,000	71,000	643,000				
WW-4	Expand the 157th Avenue WRF from 6.7 mgd to 10 mgd ⁽¹⁾	The projected 2028 average dry weather flow reaches the 80% expansion trigger for designing the treatment plant	157th WRF Site	3.3	1	2030	92,857,000	92,857,000	130,000,000	13,000,000	13,000,000	52,000,000	52,000,000		
WW-5	Expand the 157th Avenue WRF from 10 mgd to 12 mgd ⁽²⁾	The projected 2038 average dry weather flow reaches the 80% expansion trigger for designing the treatment plant	157th WRF Site	2	1	2040	39,286,000	39,286,000	55,000,000				5,500,000	24,750,000	24,750,000
WW-6	Expand the Rainbow Valley WRF from 0.8 mgd to 2.5 mgd ⁽³⁾	The projected 2030 average dry weather flow reaches the 80% expansion trigger for designing the treatment plant	Rainbow Valley WRF Site	1.7	1	2030	50,714,000	50,714,000	71,000,000	7,100,000	31,950,000	31,950,000			
61016	Central Avenue sewer line and Wells Fargo Lift Station upgrade	Expand capacity to handle flow from new developments upstream of the lift station	Wells Fargo Lift Station on Van Buren St						5,551,000		5,551,000				
61-23-245	Lum Lift Station Force Main	Rehabilitation of the pipeline The project was obtained from City's CIP projects	Lum Lift Station on Westar Dr						5,165,000				425,000	4,740,000	
61-23-223	Rainbow Valley Lift Station Force Main	Rehabilitation of the pipeline The project was obtained from City's CIP projects	Rainbow Valley Lift Station on Westar Dr						2,345,000				2,345,000		
61-24-352	Del Camino Lift Station Generator Replacement	Lift station generator needs replacement The project was obtained from City's CIP projects	Del Camino Lift Station on Via Villat St						650,000				650,000		
61-24-359	Wells Fargo Lift Station Generator Replacement	Lift station generator needs replacement The project was obtained from City's CIP projects	Wells Fargo Lift Station on Van Buren St						650,000				650,000		
New	Historic Goodyear Sewer Service Relocation	Existing sewer system improvement obtained from City's CIP projects	Master Plan Sewer Service Area						6,000,000					6,000,000	
Total								183,367,000	277,075,000	20,171,000	51,144,000	83,950,000	61,570,000	35,490,000	24,750,000

Notes:
(1) The project cost for the 157th WRF expansion is based in the Goodyear August, 2024 CIP.
(2) The project cost for the 157th WRF expansion is based on Goodyear's August 2022 IIP.
(3) The project costs for the treatment plant expansions in WW-6 is based on the Rainbow Valley WRF expansion cost in the Goodyear 2022 Infrastructure Improvement Plan (IIP).
(4) Project costs are based on the ENR 20 cities CCI index of 13,532 for May 2024.

Table 7.18 Wastewater CIPs (FY 2031 - FY 2035)

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Planning Period	Unit Cost (\$)	Construction Cost (\$)	Project Cost (\$)	Project Costs by Year				
										FY 2031 (\$)	FY 2032 (\$)	FY 2033 (\$)	FY 2034 (\$)	FY 2035 (\$)
WW-2	Upsize gravity main along 181st Dr and Pueblo Ave to the Las Brisas Lift Station	Pipe is surcharging under 2033 peak wet weather flow	Las Brisas Lift Station	12	425	2035	420	179,000	250,000				25,000	225,000
Total								179,000	250,000	0	0	0	25,000	225,000

Notes:
(1) Project costs are based on the ENR 20 cities CCI index of 13,532 for May 2024

Table 7.19 Wastewater CIPs (FY 2036 - FY 2040)

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Planning Period	Unit Cost (\$)	Construction Cost (\$)	Project Cost (\$)	Project Costs by Year				
										FY 2036 (\$)	FY 2037 (\$)	FY 2038 (\$)	FY 2039 (\$)	FY 2040 (\$)
WW-3	Construct parallel 18-inch gravity main along McDowell Rd from Citrus Rd to the Perryville Prison	Pipe is surcharging under 2038 peak wet weather flow	157th WRF Service Area	18	3,500	2040	580	2,030,000	2,842,000	284,000	2,558,000			
WW-7	Expand the Rainbow Valley WRF from 2 mgd to 4 mgd ⁽¹⁾	The projected 2040 average dry weather flow reaches the 80% expansion trigger for designing the treatment plant	Rainbow Valley WRF Site	2	1	2040	59,286,000	59,286,000	83,000,000			8,300,000	37,350,000	37,350,000
Total								61,316,000	85,842,000	284,000	2,558,000	8,300,000	37,350,000	37,350,000

Notes:
(1) The project costs for the treatment plant expansions in WW-8 are based on the Rainbow Valley WRF expansion cost in the Goodyear 2022 IIP.
(2) Project costs are based on the ENR 20 cities CCI index of 13,532 for May 2024.

7.3.3 Reclaimed Water System CIP

A summary of the reclaimed water CIPs are presented in Table 7.20. The reclaimed water CIP is itemized in Table 7.21, Table 7.22, and Table 7.23 for planning years 2030, 2035, and 2040 respectively. Reclaimed water CIPs are presented in Figures 6.4 and 6.5 in Chapter 6 of the IWMP. Detailed reclaimed water CIPs are illustrated in maps in Appendix 7E.

Table 7.20 Reclaimed Water CIP Summary

Facility Type	Planning Period Costs (\$)			Total Cost (\$)
	2030 (\$)	2035 (\$)	2040 (\$)	
Pipeline	17,356,000	0	0	17,356,000
Pump Station	3,361,000	0	6,497,000	9,858,000
ASR Wells	20,718,000	10,359,000	10,359,000	41,436,000
Spreading Basin	559,000	1,997,000	2,396,000	4,952,000
Total	41,994,000	12,356,000	19,252,000	73,602,000

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Table 7.21 Reclaimed Water CIP (FY 2025 - FY 2030)

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Planning Period	Unit Cost (\$)	Construction Cost (\$)	Total Project Cost (\$)	Project Costs by Year					
										2025 (\$)	2026 (\$)	2027 (\$)	2028 (\$)	2029 (\$)	2030 (\$)
RW-1	16-inch pipeline to the SAT Site and the beautification of the site	Deliver more flow into the site	WPA 2, SAT Site	16	640	2030	1,490	2,383,000	3,336,000	334,000	3,002,000				
RW-2	Pipeline to BWCDD	Deliver flow from 157th WRF to BWCDD	WPA 2, 157th WRF Service Area	12	5,120	2030	1,100	5,632,000	7,885,000	789,000	7,096,000				
RW-3	First ASR Well in WPA 2	Provide additional recharge capacity	WPA 2, 157th WRF Service Area	1	1	2030	7,399,000	7,399,000	10,359,000	1,035,000	4,662,000	4,662,000			
RW-4	Second ASR Well in WPA 2	Provide additional recharge capacity	WPA 2, 157th WRF Service Area	1	1	2030	7,399,000	7,399,000	10,359,000		1,035,000	4,662,000	4,662,000		
RW-5.1	1 mgd pump station at Rainbow Valley WRF	Pump water to spreading basin	WPA 4, Rainbow Valley WRF Service Area	1	1	2030	2,401,000	2,401,000	3,361,000				337,000	1,512,000	1,512,000
RW-5.2	16-inch pipeline from Rainbow Valley WRF to the spreading basin	Deliver flow to the spreading basin	WPA 4, Rainbow Valley WRF Service Area	16	6,540	2030	670	4,382,000	6,135,000					613,000	5,522,000
RW-5.3	5-acre spreading basin south of Santa Mia	Provide recharge capacity for Rainbow Valley WRF flows	WPA 4, Rainbow Valley WRF Service Area	5-acre	1	2030	399,311	399,000	559,000				56,000	252,000	252,000
RW-5.4	(Option) First ASR Well in WPA 4	Provide additional recharge capacity.	WPA 4, Rainbow Valley WRF Service Area	1	1	2030	7,399,000	7,399,000	10,359,000						
RW-5.5	(Option) A second ASR well in WPA 4	Provide additional recharge capacity	WPA 4, Rainbow Valley WRF Service Area	1	1	2040	7,399,000	7,399,000	10,359,000						
Total								29,995,000	41,994,000	2,158,000	15,795,000	9,324,000	5,054,000	2,377,000	7,286,000

Notes:
(1) Project costs are based on the ENR 20 cities CCI of 13,533 for May 2024.

Table 7.22 Reclaimed Water CIP (FY 2031 - FY 2035)

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/Qty (ft/#)	Planning Period	Unit Cost (\$)	Construction Cost (\$)	Total Project Cost (\$)	Project Costs by Year				
										2031 (\$)	2032 (\$)	2033 (\$)	2034 (\$)	2035 (\$)
RW-6	Third ASR Well in WPA 2	Provide additional recharge capacity	WPA 2, 157th WRF Service Area	1	1	2035	\$7,399,000	7,399,000	10,359,000	1,035,000	4,662,000	4,662,000		
RW-7	Rainbow Valley 25-acre spreading basin expansion	Provide recharge capacity for Rainbow Valley WRF	WPA 4, Rainbow Valley WRF Service Area	25-acre	1	2035	\$3,423,000	1,426,000	1,997,000			199,000	899,000	899,000
Total								8,825,000	12,356,000	1,035,000	4,662,000	4,861,000	899,000	899,000

Notes:
(1) Project costs are based on the ENR 20 cities CCI of 13,533 for May 2024

Table 7.23 Reclaimed Water CIP (FY 2036 - FY 2040)

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/Qty (ft/#)	Planning Period	Unit Cost (\$)	Construction Cost (\$)	Total Project Cost (\$)	Project Costs by Year				
										2036 (\$)	2037 (\$)	2038 (\$)	2039 (\$)	2040 (\$)
RW-8	Fourth ASR Well in WPA 2	Provide additional recharge capacity	WPA 2, 157th WRF Service Area	1	1	2035	\$7,399,000	7,399,000	10,359,000	1,035,000	4,662,000	4,662,000		
RW-9	Rainbow Valley 30-acre spreading basin expansion	Provide recharge capacity for Rainbow Valley WRF	WPA 4, Rainbow Valley WRF Service Area	30-acre	1	2040	3,423,000	1,711,000	2,396,000	240,000	1,078,000	1,078,000		
RW-10	3 mgd pump station expansion at Rainbow Valley WRF	Pump water to spreading basin	WPA 4, Rainbow Valley WRF Service Area	3	1	2040	4,641,000	4,641,000	6,497,000			649,000	2,924,000	2,924,000
Total								13,751,000	19,252,000	1,275,000	5,740,000	6,389,000	2,924,000	2,924,000

Notes:
(1) Project costs are based on the ENR 20 cities CCI of 13,533 for May 2024.

7.4 Developer Funded Projects

7.4.1 Water System

The water development projects are listed in Table 7.24 and shown in Figure 4.27.

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Table 7.24 Water Developer Funded Projects

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/ Qty (ft/ #)	Planning Phase	Unit Cost (\$ per ft/qty)	Construction Costs (\$)	Project Cost (\$)	2030 (\$)	2035 (\$)	2040 (\$)
W-8	12-Inch Water Main	Serve future developments	South of MC 85, from Cotton Ln to SWTP	12	9,944	2030	490	4,872,000	6,821,000	6,821,000		
W-9	12-Inch Water Main	Serve future developments	Southeast of Buckeye Canal Rd and Cotton Ln	12	9,827	2030	490	4,815,000	6,741,000	6,741,000		
W-10	12-Inch Water Main	Serve future developments	Southwest of Buckeye Canal Rd and Cotton Ln	12	8,063	2030	490	3,951,000	5,531,000	5,531,000		
W-11	12-Inch Water Main	Serve future developments	Van Buren St to Yuma Rd and Perryville Rd to Citrus Rd	12	19,949	2030	490	9,775,000	13,685,000	13,685,000		
W-12	12-Inch Water Main	Serve future developments	Yuma Rd to Lower Buckeye Rd, east of Perryville Rd	12	7,930	2030	490	3,886,000	5,440,000	5,440,000		
W-13	12-Inch Water Main	Serve future developments	North of San Gabriel Dr, west of Cotton Ln	12	12,119	2030	490	5,938,000	8,313,000	8,313,000		
W-15	12-Inch Water Main	Serve future developments	Estrella Mountain Ranch Development Area	12	23,137	2030	490	11,337,000	15,872,000	15,872,000		
W-161	12-Inch Water Main	Serve future developments	Terrasante	12	13,272	2035	490	6,503,000	9,104,000		9,104,000	
W-162	16-Inch Water Main	Serve future developments	Terrasante	16	6,557	2035	670	4,393,000	6,150,000		6,150,000	
W-163	24-Inch Water Main	Serve future developments	Terrasante	24	630	2035	950	599,000	839,000		839,000	
W-171	56 mgd Pump Station	Serve future developments	Terrasante Booster Pump Station	5.6	1	2035	6,305,000	6,305,000	8,827,000		8,827,000	
W-172	2 MG Storage Tank	Serve future developments	Terrasante Tank	2	1	2035	6,582,000	6,582,000	9,215,000		9,215,000	
W-173	2 mgd Well	Serve future developments	Terrasante Well	2	1	2035	4,852,000	4,852,000	6,793,000		6,793,000	
W-201	56 mgd Pump Station	Serve future developments	Rainbow Valley Booster Pump Station	5.6	1	2040	6,305,000	6,305,000	8,827,000		8,827,000	
W-202	2 MG Storage Tank	Serve future developments	Rainbow Valley Tank	2	1	2040	6,582,000	6,582,000	9,215,000		9,215,000	
W-203	2 mgd Well	Serve future developments	Rainbow Valley Well	2	1	2040	4,852,000	4,852,000	6,793,000		6,793,000	
W-191	12-Inch Water Main	Serve future developments	Rainbow Valley	12	14,544	2040	490	7,127,000	9,978,000		9,978,000	
W-192	16-Inch Water Main	Serve future developments	Rainbow Valley	16	10,650	2040	670	7,136,000	9,990,000		9,990,000	
W-181	12-Inch Water Main	Serve future developments	Estrella Highlands	12	15,888	2040	490	7,785,000	10,899,000			10,899,000
W-182	16-Inch Water Main	Serve future developments	Estrella Highlands	16	13,205	2040	670	8,847,000	12,386,000			12,386,000
W-401	2 mgd Well	Serve future developments	Estrella Highlands Well	2	1	2040	4,852,000	4,852,000	6,793,000			6,793,000
W-402	2 MG Storage Tank	Serve future developments	Estrella Highlands Storage Tanks	2	1	2040	6,582,000	6,582,000	9,215,000			9,215,000
W-403	56 mgd Pump Station	Serve future developments	Estrella Highlands Booster Pump Station	5.6	1	2040	6,305,000	6,305,000	8,827,000			8,827,000
Total								140,181,000	196,254,000	62,403,000	85,731,000	48,120,000

7.4.2 Wastewater System

The wastewater development projects are summarized in Table 7.25 and presented in Figure 5.6.

Table 7.25 Wastewater Development Projects

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Unit Cost (\$)	Construction Cost (\$)	Project Cost (\$)	2030 (\$)	2035 (\$)	2040 (\$)
P-3-1	12-inch gravity main	Serve future developments	Along West Van Buren St to Roosevelt Canal	12	3,113	420	1,307,000	1,830,000	1,830,000		
P-3-2	12-inch gravity main	Serve future developments	Along South Citrus Rd from West Yuma Rd to West Adam St	12	4,623	420	1,942,000	2,719,000	2,719,000		
P-3-3	12-inch gravity main	Serve future developments	Along West Hadley St from South Citrus Rd to South 185 Ave and along South 181st Ave from Lilac St to West Hadley St	12	4,970	420	2,087,000	2,922,000	2,922,000		
P-3-4	12-inch gravity main	Serve future developments	Along West Harrison St from South Citrus Rd to 183rd Ave	12	2,162	420	908,000	1,271,000	1,271,000		
P-3-5	12-inch gravity main	Serve future developments	Along South 181st Ave from West Harrison St to West Jefferson St and along West Jefferson St from 181st Ave to 183rd Ave	12	2,206	420	927,000	1,298,000	1,298,000		
P-3-6	12-inch gravity main	Serve future developments	Along West Jefferson St from North Citrus Road to North 181st Ave	12	986	420	414,000	580,000	580,000		
P-3-7	12-inch gravity main	Serve future developments	Along North 183rd Ave from West Hadley St to Adam St and along West Harrison St from 183rd Ave to 185th Ave	12	4,193	420	1,761,000	2,465,000		2,465,000	
P-3-8	12-inch gravity main	Serve future developments	Along West Jefferson St from 183rd Ave to 185th Ave	12	944	420	396,000	554,000		554,000	
P-3-9	12-inch gravity main	Serve future developments	Along South 185th Ave from West Hadley St to West Jefferson St	12	2,585	420	1,086,000	1,520,000		1,520,000	
P-4-10	12-inch gravity main	Serve future developments	Along West Lower Buckeye Rd from South Citrus Rd to South 185th Ave	12	3,652	420	1,534,000	2,148,000	2,148,000		
P-4-11	12-inch gravity main	Serve future developments	Along South 185th Ave from West Lower Buckeye Rd to West Durango St	12	2,483	420	1,043,000	1,460,000	1,460,000		
P-4-12	12-inch gravity main	Serve future developments	Along South 185th Ave from West Durango St to West Yuma Rd	12	2,642	420	1,110,000	1,554,000	1,554,000		

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Unit Cost (\$)	Construction Cost (\$)	Project Cost (\$)	2030 (\$)	2035 (\$)	2040 (\$)
P-4-13	12-inch gravity main	Serve future developments	Along West Watkins St and along West Durango St from South 185th Ave to 183rd Ave	12	2,644	420	1,110,000	1,554,000	1,554,000		
P-5-14	12-inch gravity main	Serve future developments	Along Wier Ave from South Cotton Ln to 159th Ave	12	7,618	420	3,200,000	4,480,000	4,480,000		
P-5-15	12-inch gravity main	Serve future developments	Along South Cotton Ln from Wier Ave to Lakin Park Lift Station	12	960	420	403,000	564,000	564,000		
P-5-16	12-inch gravity main	Serve future developments	Along 167th Ave and Sarival Ave from Wier Ave to County Road 85	12	1,995	420	838,000	1,173,000	1,173,000		
P-8-17	12-inch gravity main	Serve future developments	King Ranch	12	15,133	420	6,356,000	8,898,000	8,898,000		
P-8-18	900 gpm Lift Station	Serve future developments	In King Ranch 1,500 ft west of Cotton Ln and 4,100 ft south of Gila River	1.3	1	2,028,000	2,028,000	2,839,000	2,839,000		
P-8-19	12-inch force main	Serve future developments	From future King Ranch Lift Station to South Cotton Ln and Dunlap Rd	12	13,800	1,100	15,180,000	21,252,000	21,252,000		
P-9-20	8-inch gravity main	Serve future developments	Along 184th Ln to West Cassia Way and to the gravity main parallel to the Rainbow Valley LS force main	8	2,689	340	914,000	1,280,000	1,280,000		
P-6-21	12-inch force main	Serve future developments	Along Roeser Rd from South Bullard Ave to South Estrella Pkwy	12	5,303	420	2,227,000	3,118,000		3,118,000	
P-6-22	12-inch force main	Serve future developments	Along 150th Dr from West Broadway Rd to Roeser Rd	12	2,311	420	971,000	1,359,000		1,359,000	
P-6-23	600 gpm Lift Station	Serve future developments	Estrella Pkwy and Roeser Rd	0.86	1	1,454,000	1,454,000	2,036,000		2,036,000	
P-6-24	8-inch force main	Serve future developments	Estrella Pkwy to Romley Rd	8	1,930	1,020	1,969,000	2,757,000		2,757,000	
P-7-25	12-inch gravity main	Serve future developments	Development north of Gila River on Southern Ave and Cotton Ln	12	16,966	420	7,126,000	9,976,000		9,976,000	
P-7-26	600 gpm Lift Station	Serve future developments	Southern Ave and Cotton Ln	0.86	1	1,454,000	1,454,000	2,036,000		2,036,000	
P-7-27	8-inch force main	Serve future developments	From future Lift Station on Southern Ave and Cotton Lane to Lakin Lift Station	8	3,430	1,020	3,499,000	4,899,000		4,899,000	

Project #	Description	Justification	Location	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Unit Cost (\$)	Construction Cost (\$)	Project Cost (\$)	2030 (\$)	2035 (\$)	2040 (\$)
P-10-28	12-inch gravity main	Serve future developments	Southeast Estrella	12	29,693	420	12,471,000	17,459,000		17,459,000	
P-11-29	12-inch gravity main	Serve future developments	Terrasante	12	27,390	420	11,504,000	16,106,000		16,106,000	
P-12-30	1,500 gpm Lift Station	Serve future developments	187th Ave and Maplewood Rd	2.2	1	2,210,000	2,210,000	3,094,000	310,000	2,784,000	
P-12-31	8-inch force main	Serve future developments	From future Lift Station on 187th Ave and Maplewood Rd to Rainbow Valley Rd and Willis Rd	12	7,450	1,100	8,195,000	11,473,000		11,473,000	
P-13-32	12-inch gravity main	Serve future developments	Estrella Highlands	12	26,444	420	11,106,000	15,548,000			15,548,000
P-14-33	12-inch gravity main	Serve future developments	Along 187th Ave from Maplewood Rd to Willis Rd	12	15,504	420	6,512,000	9,117,000			9,117,000
P-1-34	Arroyo Ranch Lift Station	Serve future developments	North Estrella on Ardmore Rd	0.216	1	635,000	635,000	889,000			889,000
P-2-35	12-inch gravity main	Serve future developments	Along West Osborn Rd, west of North Citrus Rd	12	3,925	420	1,649,000	2,309,000			2,309,000
P-2-36	12-inch gravity main	Serve future developments	Along West Earll Dr, west of North Citrus Rd	12	3,925	420	1,649,000	2,309,000			2,309,000
P-2-37	12-inch gravity main	Serve future developments	Along West Thomas Rd from West of North Citrus Rd	12	3,925	420	1,649,000	2,309,000			2,309,000
P-2-38	12-inch gravity main	Serve future developments	Along West Virginia Ave from West of North Citrus Rd	12	3,925	420	1,649,000	2,309,000			2,309,000
P-2-39	12-inch gravity main	Serve future developments	Along West Encanto Blvd and south along 185th Ave from West of North Citrus Rd	12	5,320	420	2,234,000	3,128,000			3,128,000
Total							124,707,000	174,592,000	58,132,000	78,542,000	37,918,000

Notes:

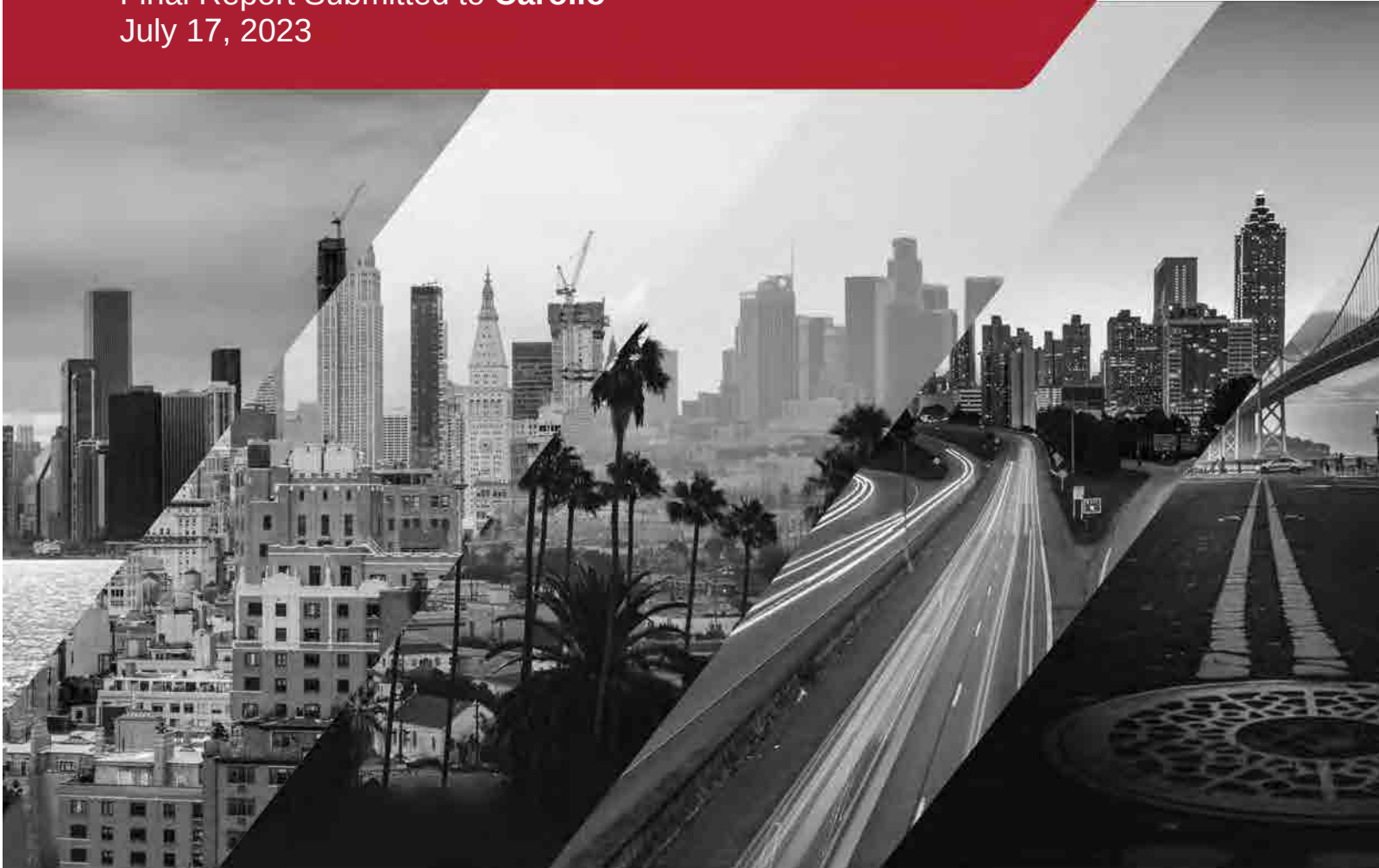
- (1) The lift station cost is derived by proportioning the cost of lift stations with a similar size.
- (2) Project costs are based on the ENR 20 cities CCI index of 13,532 for May 2024.

APPENDIX 5A

WASTEWATER FLOW MONITORING TEST REPORT

Dry Weather Sewer Flow Monitoring, Goodyear AZ, 2023

Final Report Submitted to **Carollo**
July 17, 2023



ADS ENVIRONMENTAL
SERVICES



July 17, 2023

Richard A. Humpherys, PE*

Project Manager / Vice President

Carollo Engineers

4600 East Washington St. / Phoenix, AZ 85034

602-882-7904

rhumpherys@carollo.com / carollo.com



SUBJECT: Dry Weather Sewer Flow Monitoring, Goodyear AZ, 2023

Dear Mr. Humpherys,

ADS is pleased to submit the report for the project reference above completed on behalf of Carollo. The metering was conducted at sixteen (16) locations. The study was conducted during the period of Sunday, 11 June 2023 to Tuesday, 27 June 2023.

The report contains depth, velocity, and quantity hydrographs as well as daily long tables for the metering period. An Excel file containing depth, quantity, and velocity entities for the monitoring location in 5-minute format has been provided.

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, you may contact the Project Manager, Paul Mitchell at 714.379.9778 xt.223 (O) or 714.920.5518 (M).

It has been our pleasure to be of service to you in the performance of this project. Thank you for choosing ADS products and services to meet your flow monitoring needs.

Sincerely,

ADS ENVIRONMENTAL SERVICES

Justin Hatch
Data Analyst

Sunday, 11 June 2023 to Tuesday, 27 June 2023



Dry Weather Sewer Flow Monitoring, Goodyear AZ, 2023

Prepared For:

Richard A. Humpherys, PE*
Project Manager / Vice President
Carollo Engineers
4600 East Washington St. / Phoenix, AZ 85034
602-882-7904
rhumpherys@carollo.com / carollo.com



Prepared By:



ADS, LLC
4820 Mercury Street, Suite C
San Diego, CA 92111

Scope and Methodology

Introduction

Carollo entered into an agreement with ADS Environmental Services to conduct flow monitoring at (16) sixteen locations in the Goodyear Arizona Sanitary Collection System. The study was scheduled for a period of (14) fourteen days. Data from Sunday, 11 June 2023 to Tuesday, 27 June 2023 is included in this report in order to provide at least 14 full days of data at each location. Once in place, the flow monitoring equipment was used to measure depth, velocity, and to quantify flows. Data obtained from the study will be used to confirm dry weather flows in selected sewer tributaries for planning purposes.

Project Scope

The scope of this study involved using a flow monitor to quantify wastewater flow at the designated locations for the 14-day time period. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring sites for adequate hydraulic conditions
- Flow monitor installations
- Flow monitor confirmations and data collections
- Flow data analysis

Equipment installation was completed on June 10, 2023. The monitoring began on June 11, 2023 and was completed on June 27, 2023. Upon completion of the study, equipment was removed from the system.

Flow Monitoring Equipment



The **ADS Triton+** monitor was selected for this project. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS Triton+ monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings. The monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals.

The Triton+ monitor features cross-checking using multiple technologies in each sensor for continuous running of comparisons and tolerances. The Triton+ monitor can support two (2) sets of sensors. The sensor option used for this project was:

The Peak Combo Sensor installed at the bottom of the pipe includes three types of data acquisition technologies.

The ***up looking ultrasonic depth*** uses sound waves from two independent transceivers to measure the distance from the sensor upward toward the flow surface; applying the speed of sound in the water and the temperature measured by

sensor to calculate depth.

The **pressure depth** is calculated by using a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube.

To obtain **peak velocity**, the sensor sends an ultrasonic signal at an angle upward through the widest cross-section of the oncoming flow. The signal is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity.

Installation

Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed.

In pipes up to 42 inches in diameter, the sensors were mounted on expandable stainless steel rings, inserted at least a foot upstream into influent pipes and tightened against the inside walls of the pipes. Influent pipe installations reduce the influences of turbulence and backwater often caused by changes in channel geometry in manholes.





Data Collection, Confirmation, and Quality Assurance

Data collection was done remotely via wireless connect on a weekly basis via ADS Field Representatives. During the monitoring period, field crews visit each monitoring location to verify proper monitor operation and document field conditions. The following quality assurance steps are taken to assure the integrity of the collected data:

Measure power supplies: monitors were powered by dry cell battery packs. Voltages were recorded and battery packs replaced, as necessary. Separate batteries provided back-up power to memory allowing primary batteries to be replaced without loss of data.

Clock synchronization: Field crews synchronized monitor clocks to master clocks.

Confirm depth and velocity readings: Field crews descended into meter manholes to manually measure depths and velocities and compare them meter readings to confirm that they agreed. They also measured silt levels, if any, in the inverts of the pipes. Silt areas were subtracted from flow areas to compute true areas of flow.

Confirm average velocities through cross-sectional velocity profiles: Since ADS velocity sensors measure peak velocity, field crews collected cross-sectional velocity profiles in order to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

Upload and Review Data: Data collected from the monitors were uploaded and reviewed by a Data Analyst for completeness, outliers and deviations in the flow patterns, which indicate system anomalies or equipment failure.

Flow Quantification Methods

There are two main equations used to measure open channel flow: the **Continuity Equation** and the **Manning Equation**. The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in most sanitary sewers. The Continuity Equation was used exclusively for this study.

Continuity Equation

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow.

Data Analysis and Presentation

Data Analysis

A flow monitor is typically programmed to collect data at 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the ultrasonic depth, (2) the peak velocity and (3) the pressure depth. The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data.

Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which depth sensor entity will be used to calculate the final depth information. Silt and/or debris are often present in sewer lines. When present, silt levels are measured at each site visit. They are reviewed by the data analyst and representative silt levels established. Silt reduces the cross sectional area of the flow where as debris causes depth to become deeper and slower. Calculated flow should remain consistent in both hydraulic conditions. Debris may result in reduced line capacity.

Occasionally the velocity sensor's performance may be compromised resulting in invalid readings sporadically during the monitoring period. This is generally caused by excessive debris (silt) blocking the sensor's crystals, shallow flows ($\sim < 1"$) that may drop below the top of the sensor or very clear flows lacking the particles needed to measure rate. In order to use the Continuity equation to quantify the flow during these periods, a Data Analyst and/or Engineer will use the site's historical pipe curve (depth vs. velocity) data along with valid field confirmations to reconstitute and replace the false velocity recordings with expected velocity readings for a given historical depth along the curve.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hydrographs. Hydrographs are based on 15 minute averaging. Tables are provided in daily average format. These tables show the flow rate for each day, along with the daily minimum and maximums, the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the tables and hydrographs.

DFINAL - Final calculated depth measurement (in inches)

QFINAL - Final calculated flow rate (in MGD)

VFINAL - Final calculated flow velocity (in feet per second)

REPORT TOTAL - Total volume of flow recorded for the indicated time period (in MG)

FM_01

Site Commentary

SITE INFORMATION

Pipe	Elliptical (11.88 in H x 11.88 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned downstream of site FM_07 and upstream of site FM_16. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	3.29	1.77	0.208
Minimum	2.15	1.19	0.073
Maximum	4.82	2.39	0.435
Min Time	06/25/2023 6:45:00 AM	06/25/2023 6:45:00 AM	06/25/2023 6:45:00 AM
Max Time	06/26/2023 12:00:00 PM	06/16/2023 11:30:00 AM	06/26/2023 12:00:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

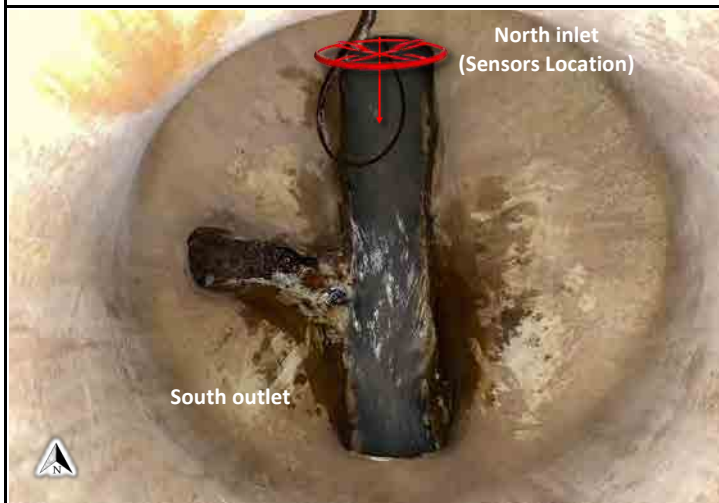


GoodYear.Carollo.TFM.AZ23**Site Name****Flow Monitoring
Site Report****FM_01**

Site Address /Location:	4204 S Bullard Ave, Goodyear, AZ 85338		Monitor Series	Location Type
Site Access Details:	External Traffic Control Required	Latitude:	TRITON+	Temporary
		Longitude:	Pipe Size (H x W)	Pipe Shape
			11.88"x 11.88"	Circular



Manhole #	System Characteristics
N/A	Residential/Commercial
Access	Traffic
Drive	Medium

**Installation Information**

Installation Date:	Installation Type:
Tuesday, June 6, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Confirmation Time:	Pipe Size (HxW)
11:47:00 PM	11.88"x 11.88"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
3.63"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.14	0"
Silt (in)	Silt Type
0"	

Hydraulic Comments:

Smooth flow with low depth and moderate velocity

Manhole / Pipe Information:

Manhole Depth (Approx. FT):	Manhole Configuration
6.11	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
PVC	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

External Traffic Control Required

ADS Project Name: GoodYear.Carollo.TFM.AZ23

ADS Project Number: 22930.11.325

Hydrograph Report

FM_01



Scattergraph Report

FM_01

Flow Monitor

FM_01

Pipe Height

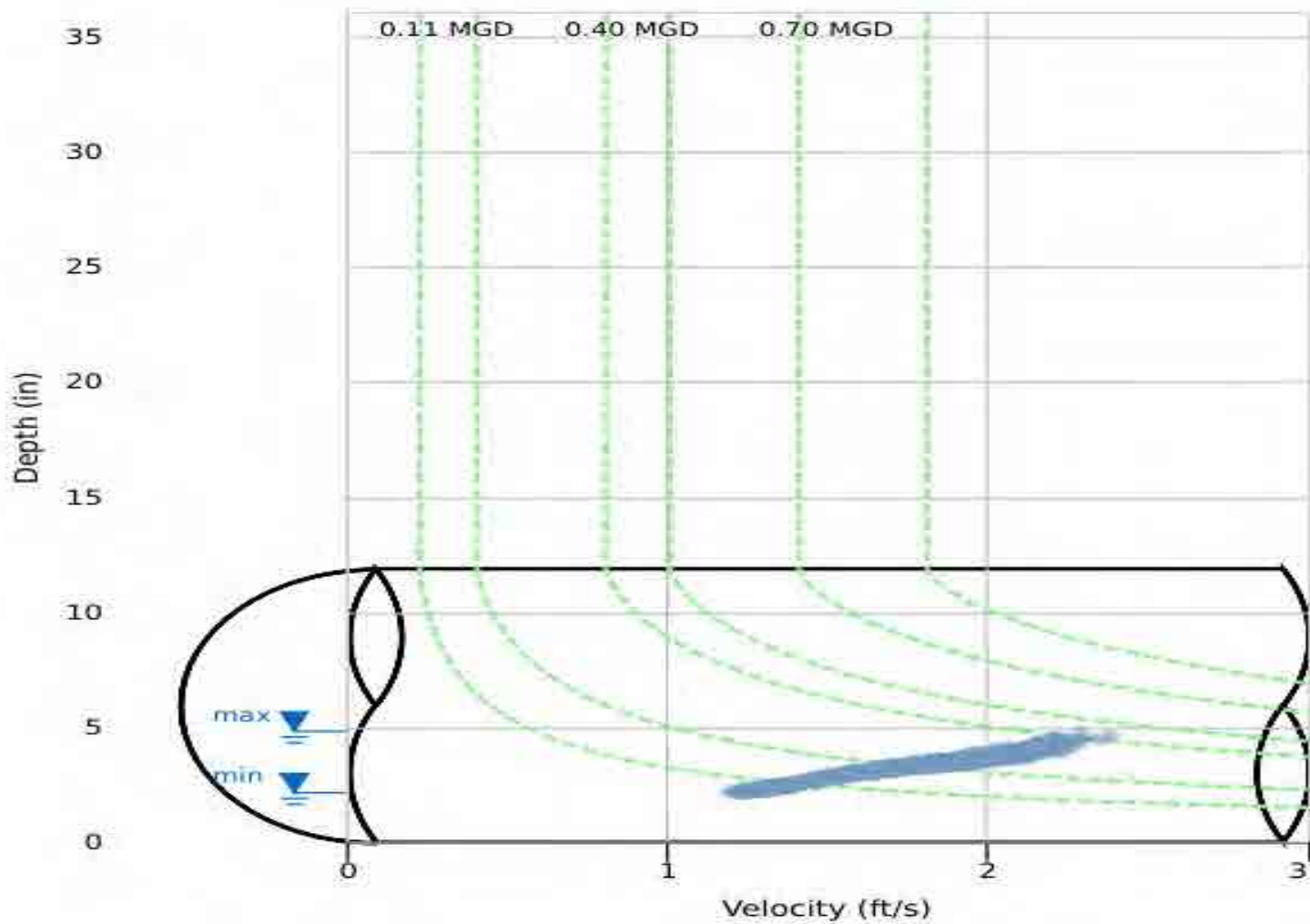
11.88
in

Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL - VFINAL
- Iso-Qth
- Min-Max Depth



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_01Pipe: Elliptical (11.88 in H x 11.88 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	06:45	2.23	13:00	3.62	3.00	06:20	1.26	12:55	2.04	1.65	06:50	0.082	12:55	0.260	0.168	0.168	
06/12/2023	05:30	2.17	13:40	4.29	3.34	05:20	1.21	13:45	2.32	1.85	05:20	0.076	13:45	0.376	0.223	0.223	
06/13/2023	06:05	2.18	15:10	4.14	3.40	06:10	1.21	15:05	2.35	1.88	06:10	0.076	15:05	0.362	0.232	0.232	
06/14/2023	05:45	2.20	11:40	4.53	3.48	05:45	1.25	11:40	2.43	1.86	05:45	0.079	11:40	0.423	0.239	0.239	
06/15/2023	05:10	2.49	16:30	4.38	3.45	04:15	1.34	16:20	2.30	1.85	05:10	0.102	16:20	0.383	0.229	0.229	
06/16/2023	05:35	2.31	11:35	4.67	3.38	06:00	1.22	11:35	2.43	1.81	06:00	0.083	11:35	0.441	0.221	0.221	
06/17/2023	07:15	2.33	00:00	3.82	3.23	07:05	1.27	00:05	2.07	1.76	07:10	0.089	00:00	0.284	0.195	0.195	
06/18/2023	07:10	2.18	12:20	3.53	3.01	07:30	1.21	12:40	1.99	1.64	07:30	0.076	12:40	0.244	0.167	0.167	
06/19/2023	05:45	2.20	15:35	4.24	3.29	05:50	1.22	15:50	2.28	1.80	05:50	0.077	15:50	0.360	0.211	0.211	
06/20/2023	05:20	2.24	14:45	4.20	3.36	05:10	1.24	11:50	2.26	1.82	05:20	0.081	14:30	0.348	0.219	0.219	
06/21/2023	04:15	2.35	15:55	4.28	3.43	05:10	1.28	16:05	2.23	1.82	05:10	0.090	15:55	0.356	0.225	0.225	
06/22/2023	05:40	2.24	16:05	4.08	3.33	05:25	1.25	15:45	2.20	1.77	05:25	0.082	15:45	0.328	0.211	0.211	
06/23/2023	05:35	2.24	19:50	3.93	3.30	05:40	1.22	18:55	2.22	1.78	05:40	0.079	15:25	0.312	0.208	0.208	
06/24/2023	06:20	2.22	00:00	3.81	3.20	06:15	1.25	00:35	2.04	1.71	06:15	0.081	00:00	0.279	0.188	0.188	
06/25/2023	06:40	2.15	13:45	3.71	3.05	06:25	1.17	14:05	2.00	1.62	06:50	0.072	14:05	0.255	0.170	0.170	
06/26/2023	05:50	2.25	12:05	4.83	3.36	05:25	1.21	12:10	2.34	1.79	06:15	0.081	12:10	0.444	0.217	0.202	
06/27/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			3.309
Average	3.29	1.77	0.208

FM_02

Site Commentary

SITE INFORMATION

Pipe	Elliptical (11.88 in H x 11.88 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned upstream of site FM_16. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	2.27	1.77	0.121
Minimum	1.61	0.92	0.037
Maximum	2.85	2.19	0.190
Min Time	06/18/2023 5:45:00 AM	06/18/2023 5:45:00 AM	06/18/2023 5:45:00 AM
Max Time	06/25/2023 9:45:00 PM	06/25/2023 12:00:00 PM	06/25/2023 9:45:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



GoodYear.Carollo.TFM.AZ23**Site Name****Flow Monitoring
Site Report****FM_02**

Site Address /Location:	3900 Estrella Pkwy, Goodyear, AZ 85338			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	External Traffic Control Required	Latitude:	33.4109769	Pipe Size (H x W)	Pipe Shape
		Longitude:	-112.3923757°	11.88"x 11.88"	Circular



Manhole #	System Characteristics
MH86D-201	Residential/Commercial
Access	Traffic
Drive	Medium

**Installation Information**

Installation Date:	Installation Type:
Tuesday, June 6, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Confirmation Time:	Pipe Size (HxW)
10:39:00 PM	11.88"x 11.88"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
2.50"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.21	0"
Silt (in)	Silt Type
0"	

Hydraulic Comments:

Smooth flow with low depth and moderate velocity

Manhole / Pipe Information:

Manhole Depth (Approx. FT):	Manhole Configuration
14.34	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
PVC	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

External Traffic Control Required

ADS Project Name: GoodYear.Carollo.TFM.AZ23

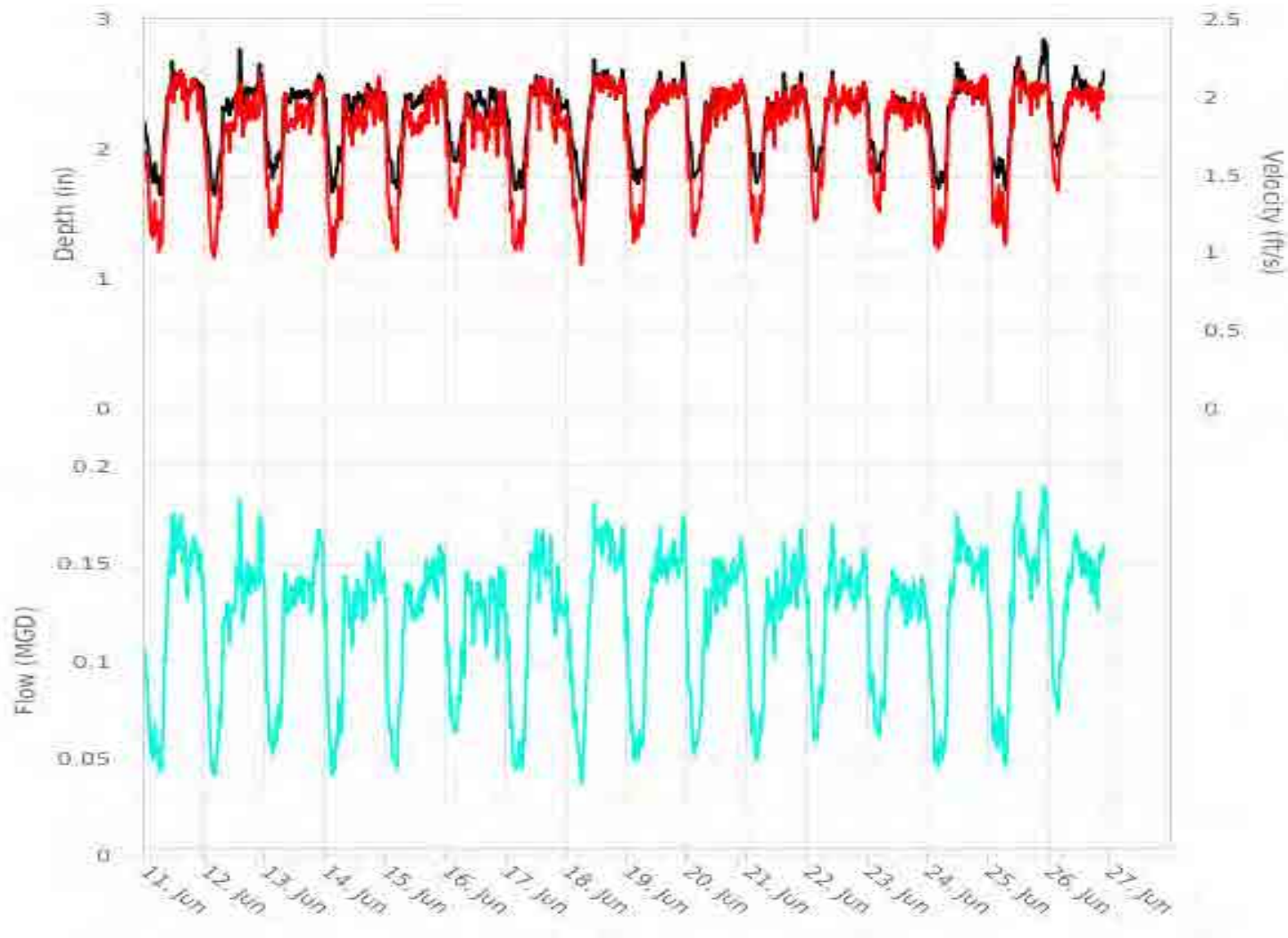
ADS Project Number: 22930.11.325

Hydrograph Report

FM_02

Flow Monitor
FM_02
Pipe Height 11.88 in
Report Period
06/11/2023 To 06/27/2023
Legend
— DFINAL — QFINAL — VFINAL

ABS ENVIRONMENTAL SERVICES



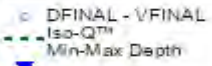
Scattergraph Report

FM_02

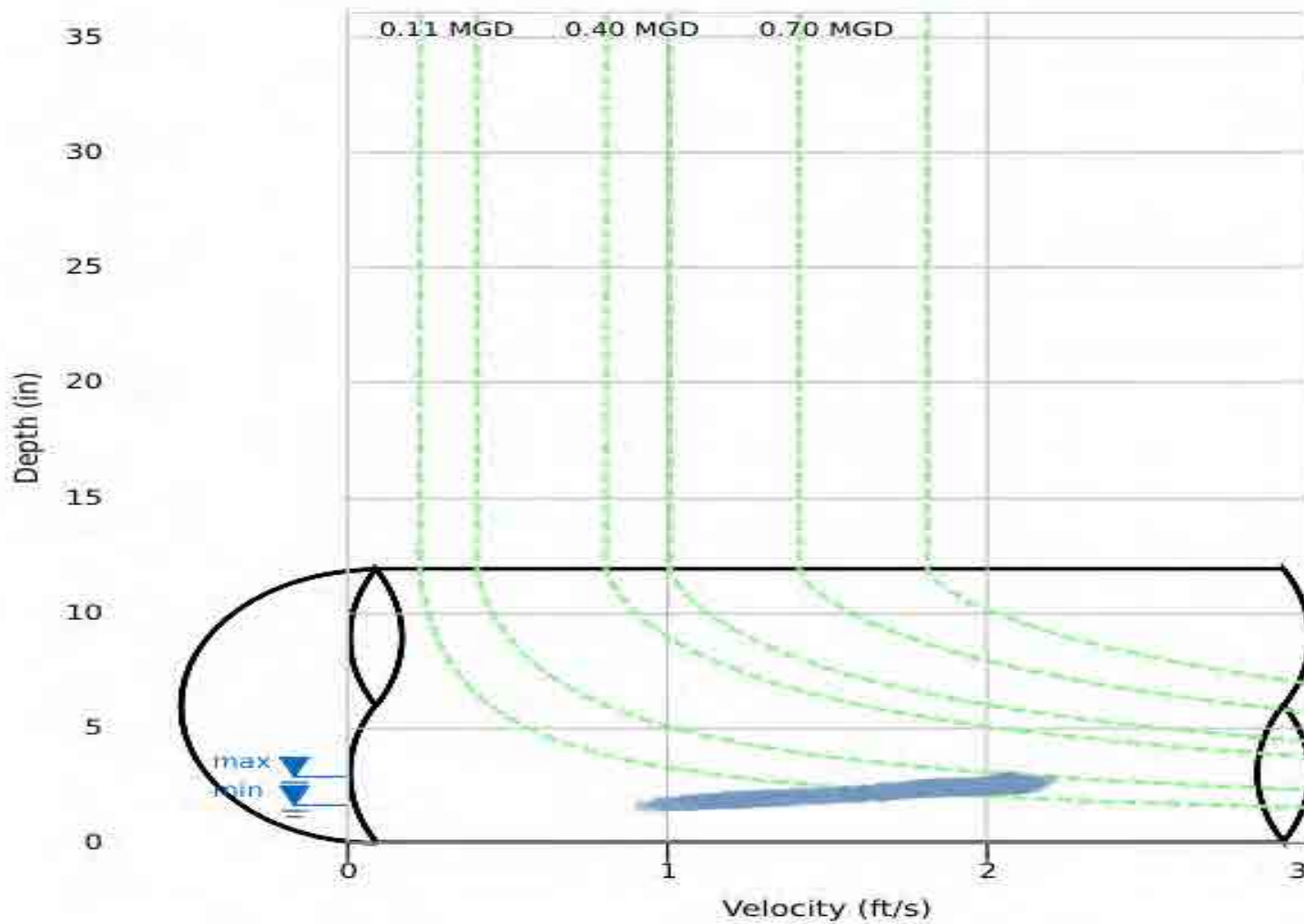
Flow Monitor
FM_02

Pipe Height
11.88
in

Report Period
06/11/2023
To
06/27/2023

Legend

 DFINAL - VFINAL
 Iso-Q75
 Min-Max Depth

ADS ENVIRONMENTAL
SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_02Pipe: Elliptical (11.88 in H x 11.88 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	06:05	1.64	11:05	2.70	2.27	05:55	0.98	14:40	2.19	1.76	05:55	0.041	14:35	0.178	0.122	0.122	
06/12/2023	03:55	1.64	13:55	3.32	2.27	03:50	0.96	22:30	2.16	1.71	03:50	0.040	13:55	0.237	0.118	0.118	
06/13/2023	03:05	1.77	21:25	2.59	2.28	03:00	1.08	21:30	2.14	1.74	03:00	0.050	21:30	0.171	0.119	0.119	
06/14/2023	02:35	1.66	16:30	2.51	2.25	02:35	0.97	21:00	2.17	1.71	02:35	0.041	21:00	0.166	0.115	0.115	
06/15/2023	04:25	1.69	21:25	2.49	2.27	04:20	1.00	21:30	2.16	1.74	04:20	0.044	21:30	0.164	0.118	0.118	
06/16/2023	03:00	1.90	18:10	2.48	2.27	04:05	1.20	21:20	2.08	1.72	04:05	0.062	08:30	0.150	0.116	0.116	
06/17/2023	03:50	1.68	12:00	2.58	2.23	03:50	0.98	14:55	2.17	1.71	03:50	0.042	12:00	0.169	0.115	0.115	
06/18/2023	05:55	1.60	11:05	2.71	2.30	05:45	0.90	16:00	2.20	1.80	05:45	0.036	11:05	0.182	0.126	0.126	
06/19/2023	04:10	1.72	22:25	2.69	2.27	02:50	1.04	13:00	2.13	1.79	04:20	0.047	22:15	0.177	0.123	0.123	
06/20/2023	02:50	1.77	21:10	2.52	2.26	02:55	1.08	21:35	2.13	1.79	02:55	0.050	21:30	0.163	0.121	0.121	
06/21/2023	03:40	1.73	14:35	2.60	2.24	03:15	1.07	21:15	2.13	1.77	03:40	0.048	21:15	0.172	0.118	0.118	
06/22/2023	03:40	1.82	09:50	2.61	2.27	02:50	1.20	09:35	2.14	1.84	03:00	0.058	09:50	0.170	0.124	0.124	
06/23/2023	03:20	1.82	09:50	2.43	2.23	04:30	1.22	09:50	2.08	1.79	04:30	0.059	09:50	0.152	0.117	0.117	
06/24/2023	04:05	1.68	11:15	2.69	2.25	04:05	0.99	22:05	2.17	1.81	04:05	0.043	11:15	0.179	0.123	0.123	
06/25/2023	06:50	1.68	21:50	2.88	2.30	06:40	1.02	12:05	2.19	1.80	06:40	0.044	21:55	0.194	0.127	0.127	
06/26/2023	03:40	1.93	10:35	2.66	2.36	03:40	1.37	15:50	2.10	1.89	03:40	0.072	10:50	0.168	0.134	0.122	
06/27/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			1.925
Average	2.27	1.77	0.121

FM_03

Site Commentary

SITE INFORMATION

Pipe	Elliptical (14 in H x 14 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned upstream of site FM_16. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	2.46	1.19	0.108
Minimum	1.24	0.59	0.019
Maximum	4.73	2.22	0.452
Min Time	06/25/2023 5:15:00 AM	06/22/2023 3:45:00 AM	06/16/2023 4:15:00 AM
Max Time	06/11/2023 4:15:00 AM	06/11/2023 4:00:00 AM	06/11/2023 4:00:00 AM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



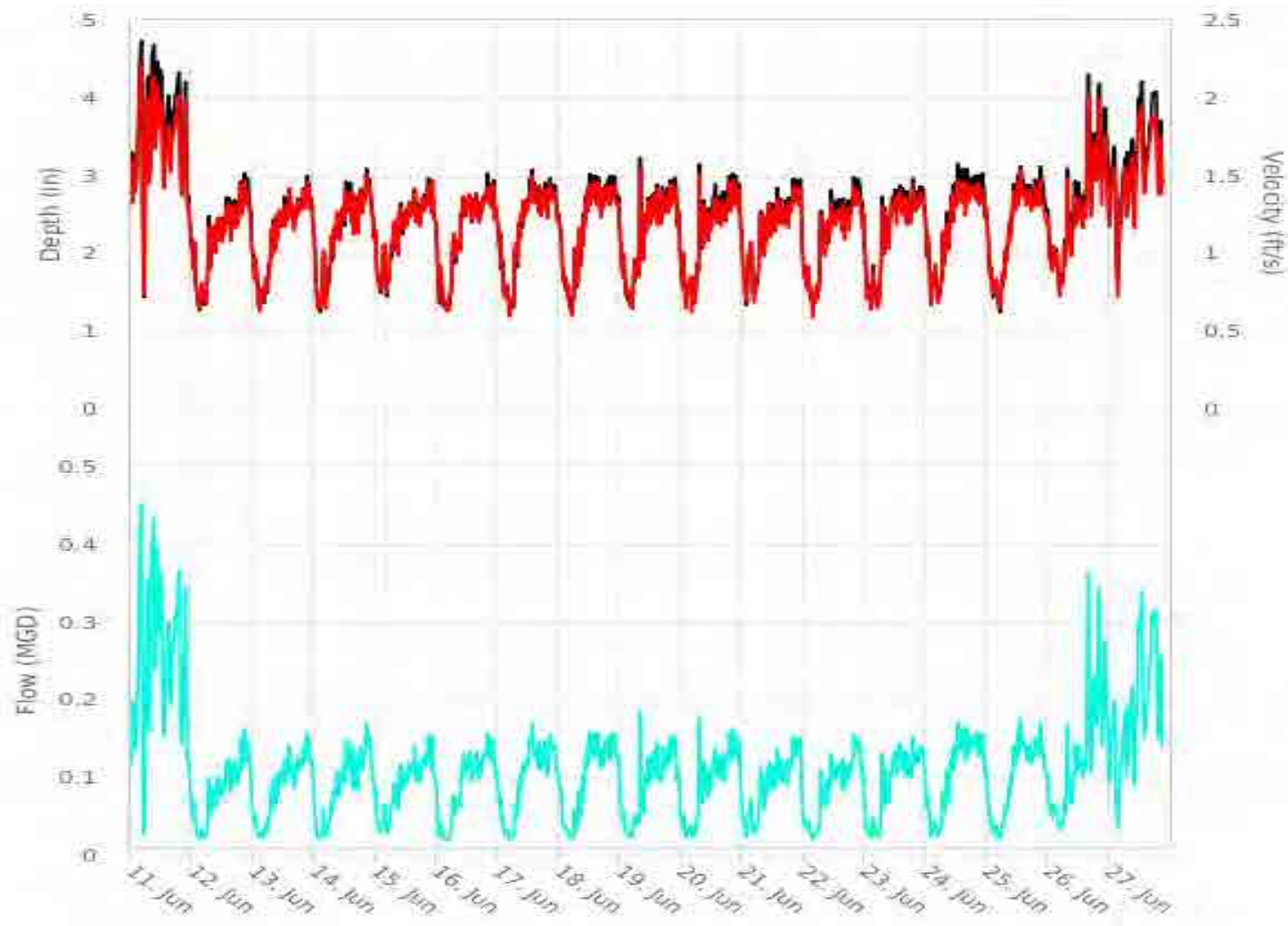
GoodYear.Carollo.TFM.AZ23					Site Name FM_03		
Flow Monitoring Site Report							
Site Address /Location:		1200 N Bullard Ave, Goodyear, AZ 85338		Monitor Series TRITON+		Location Type Temporary	
Site Access Details:		External Traffic Control Required		Latitude: Longitude:		Pipe Size (H x W) 14.00"x 14.00"	
				33.4603441 -112.3834607°		Pipe Shape Circular	
				Manhole # MH57B-304		System Characteristics Residential/Commercial	
				Access Drive		Traffic Medium	
 North inlet (Sensors Location) South Outlet				Installation Information			
				Installation Date: Wednesday, June 7, 2023		Installation Type: Doppler Standard Ring and Crank	
Monitoring Location (Sensors): Upstream 0-5 FT		Sensors / Devices: Peak Combo (CS4)		Monitor Location: Manhole		Pressure Sensor Range (psi) 0 - 5 psi	
Installation Confirmation:				Confirmation Time: 8:57:00 AM		Pipe Size (HxW) 14.00"x 14.00"	
Depth of Flow (Wet DOF) (in) 2.25"		Downlooker Physical Offset (in) NA		Range (Air DOF) (in) -		Measurement Confidence (in) 0.25"	
Peak Velocity (fps) 1.25		Silt (in) 0"		Velocity Sensor Offset (in) 0"		Silt Type	
Hydraulic Comments: Smooth flow with low depth and low velocity				Manhole / Pipe Information:			
Manhole Depth (Approx. FT): 10.79		Manhole Material: Concrete		Manhole Opening Diameter (in) 26"		Manhole Configuration Single	
Manhole Cover Unbolted		Active Drop Connections No		Manhole Diameter (Approx.): 54"		Manhole Condition: Good	
Pipe Material PVC		Pipe Condition: Good		Manhole Frame Normal		Air Quality: Normal	
Communication Information:				Communication Type Wireless		Antenna Location Manhole Pick / Vent Hole	
Additional Site Info. / Comments: External Traffic Control Required							
ADS Project Name:		GoodYear.Carollo.TFM.AZ23					
ADS Project Number:		22930.11.325					

Hydrograph Report

FM_03

Flow Monitor FM_03
Pipe Height 14.00 in
Report Period 06/11/2023 To 06/27/2023
Legend — DFINAL — QFINAL — VFINAL

ABS ENVIRONMENTAL SERVICES



Scattergraph Report

FM_03

Flow Monitor

FM_03

Pipe Height
14.00
in

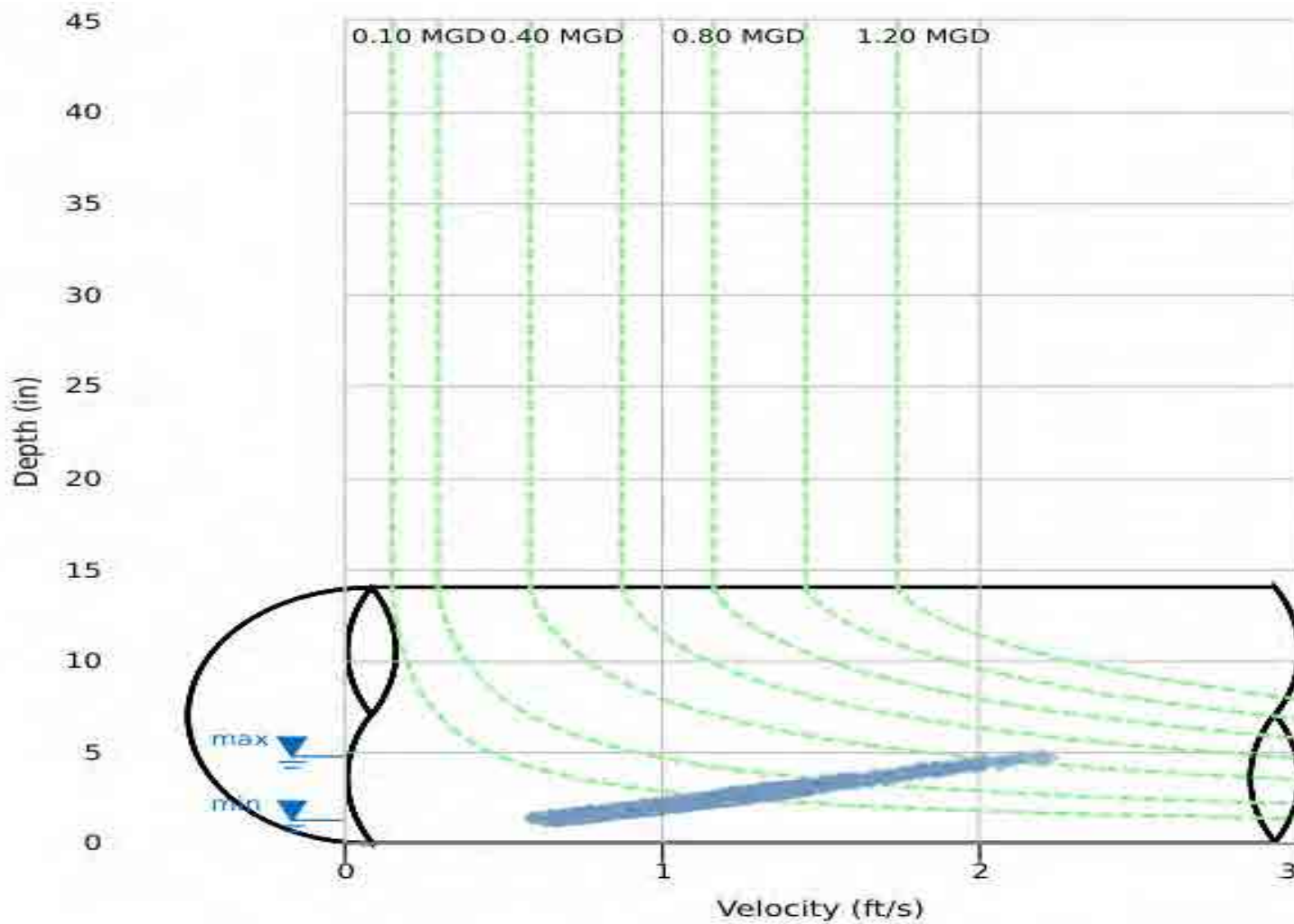
Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL - VFINAL
- Iso-Qth
- Min-Max Depth

ABS ENVIRONMENTAL
SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_03Pipe: Elliptical (14 in H x 14 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	05:25	1.27	04:15	4.76	3.57	05:25	0.66	04:10	2.25	1.68	05:25	0.021	04:10	0.461	0.247	0.247	
06/12/2023	03:10	1.24	20:35	3.05	2.22	03:15	0.61	20:40	1.49	1.09	03:15	0.018	20:35	0.164	0.082	0.082	
06/13/2023	02:30	1.27	21:40	3.03	2.27	02:50	0.62	14:25	1.49	1.12	02:30	0.020	21:40	0.160	0.087	0.087	
06/14/2023	02:25	1.23	20:40	3.15	2.27	02:45	0.61	20:40	1.56	1.13	02:45	0.020	20:40	0.182	0.089	0.089	
06/15/2023	04:35	1.40	20:55	3.11	2.31	01:55	0.71	20:55	1.54	1.15	04:35	0.027	20:55	0.176	0.090	0.090	
06/16/2023	04:25	1.26	20:00	3.06	2.26	04:20	0.61	22:25	1.50	1.13	04:20	0.019	20:00	0.166	0.089	0.089	
06/17/2023	06:20	1.29	13:40	3.16	2.35	04:50	0.58	13:45	1.54	1.16	04:50	0.019	13:45	0.180	0.096	0.096	
06/18/2023	04:30	1.28	12:15	3.10	2.38	05:10	0.59	12:15	1.50	1.16	05:15	0.020	12:15	0.171	0.098	0.098	
06/19/2023	04:30	1.34	08:15	3.46	2.30	05:15	0.60	08:15	1.65	1.12	04:25	0.021	08:15	0.219	0.090	0.090	
06/20/2023	04:30	1.37	07:20	3.33	2.31	04:20	0.61	07:20	1.59	1.12	04:25	0.022	07:20	0.200	0.090	0.090	
06/21/2023	02:05	1.28	07:25	3.47	2.30	02:10	0.66	07:25	1.59	1.13	02:05	0.022	07:25	0.212	0.089	0.089	
06/22/2023	04:10	1.29	21:45	3.00	2.28	03:45	0.57	20:05	1.46	1.10	03:45	0.019	20:05	0.158	0.087	0.087	
06/23/2023	03:05	1.25	07:05	3.19	2.33	05:40	0.60	19:00	1.48	1.12	05:40	0.021	07:05	0.174	0.092	0.092	
06/24/2023	02:15	1.32	08:40	3.43	2.46	02:20	0.65	08:40	1.58	1.17	02:15	0.022	08:40	0.207	0.104	0.104	
06/25/2023	05:15	1.23	21:20	3.14	2.40	05:35	0.63	13:35	1.57	1.16	05:15	0.020	13:35	0.181	0.100	0.100	
06/26/2023	04:50	1.57	16:10	4.37	2.69	04:45	0.70	16:15	2.07	1.26	04:50	0.030	16:15	0.381	0.130	0.130	
06/27/2023	03:40	1.66	13:00	4.22	3.19	03:40	0.68	12:55	2.00	1.50	03:40	0.031	12:55	0.350	0.187	0.167	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			1.826
Average	2.46	1.19	0.108

FM_04

Site Commentary

SITE INFORMATION

Pipe	Elliptical (14.5 in H x 14.5 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were experienced during the study. Backwater conditions were observed on 11 June 2023, 12 June 2023, 17 June 2023, and 19 June 2023.

This site was positioned upstream of site FM_06. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	0.69	3.40	0.048
Minimum	0.47	0.38	0.003
Maximum	1.03	6.06	0.101
Min Time	06/16/2023 5:00:00 AM	06/16/2023 3:00:00 AM	06/16/2023 3:00:00 AM
Max Time	06/17/2023 1:15:00 PM	06/15/2023 5:15:00 PM	06/17/2023 1:15:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

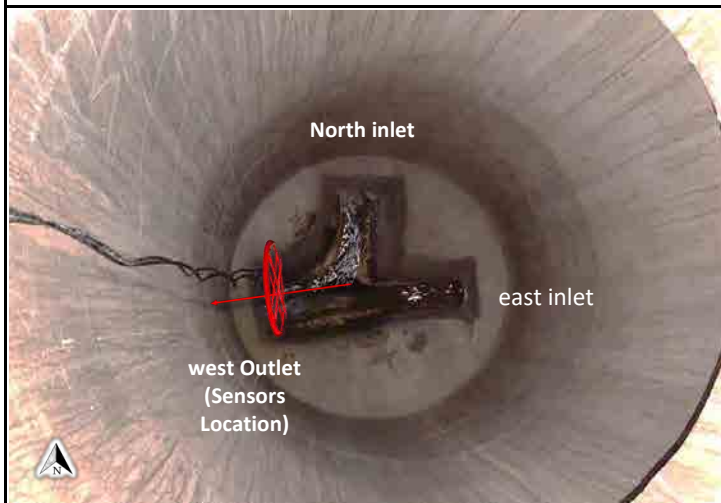


GoodYear.Carollo.TFM.AZ23**Site Name****Flow Monitoring
Site Report****FM_04**

Site Address /Location:	17037 W Yuma Rd, Goodyear, AZ 85338		Monitor Series	Location Type
Site Access Details:	External Traffic Control Required	Latitude: 33.4357617 Longitude: -112.425959°	TRITON+ Pipe Size (H x W) 14.50"x 14.50"	Temporary Pipe Shape Circular



Manhole #	System Characteristics
MH65C-301	Residential/Commercial
Access	Traffic
Drive	Medium

**Installation Information**

Installation Date:	Installation Type:
Thursday, June 8, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4), Smart Depth (CS5)	0 - 5 psi

Installation Confirmation:

Confirmation Time:	Pipe Size (HxW)
8:57:00 AM	14.50"x 14.50"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
1.13"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
3.58	0"
Silt (in)	Silt Type
0"	

Hydraulic Comments:

Smooth flow with low depth and moderate velocity

Manhole / Pipe Information:

Manhole Depth (Approx. FT):	Manhole Configuration
17	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
PVC	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

External Traffic Control Required/ reverse installation

ADS Project Name: GoodYear.Carollo.TFM.AZ23

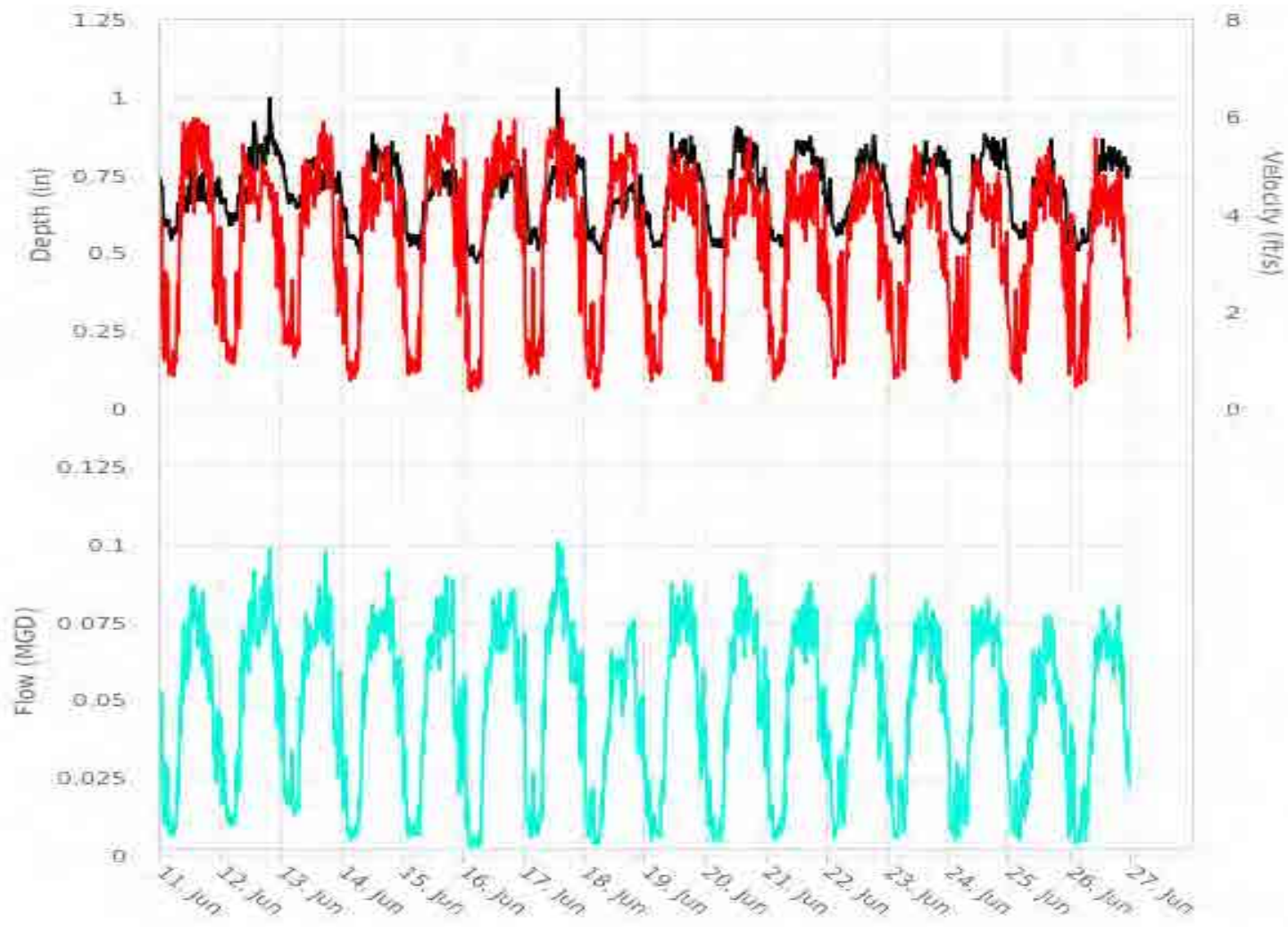
ADS Project Number: 22930.11.325

Hydrograph Report

FM_04

Flow Monitor FM_04
Pipe Height 14.50 in
Report Period 06/11/2023 To 06/27/2023
Legend — DFINAL — QFINAL — VFINAL

ABS ENVIRONMENTAL SERVICES



Scattergraph Report

FM_04

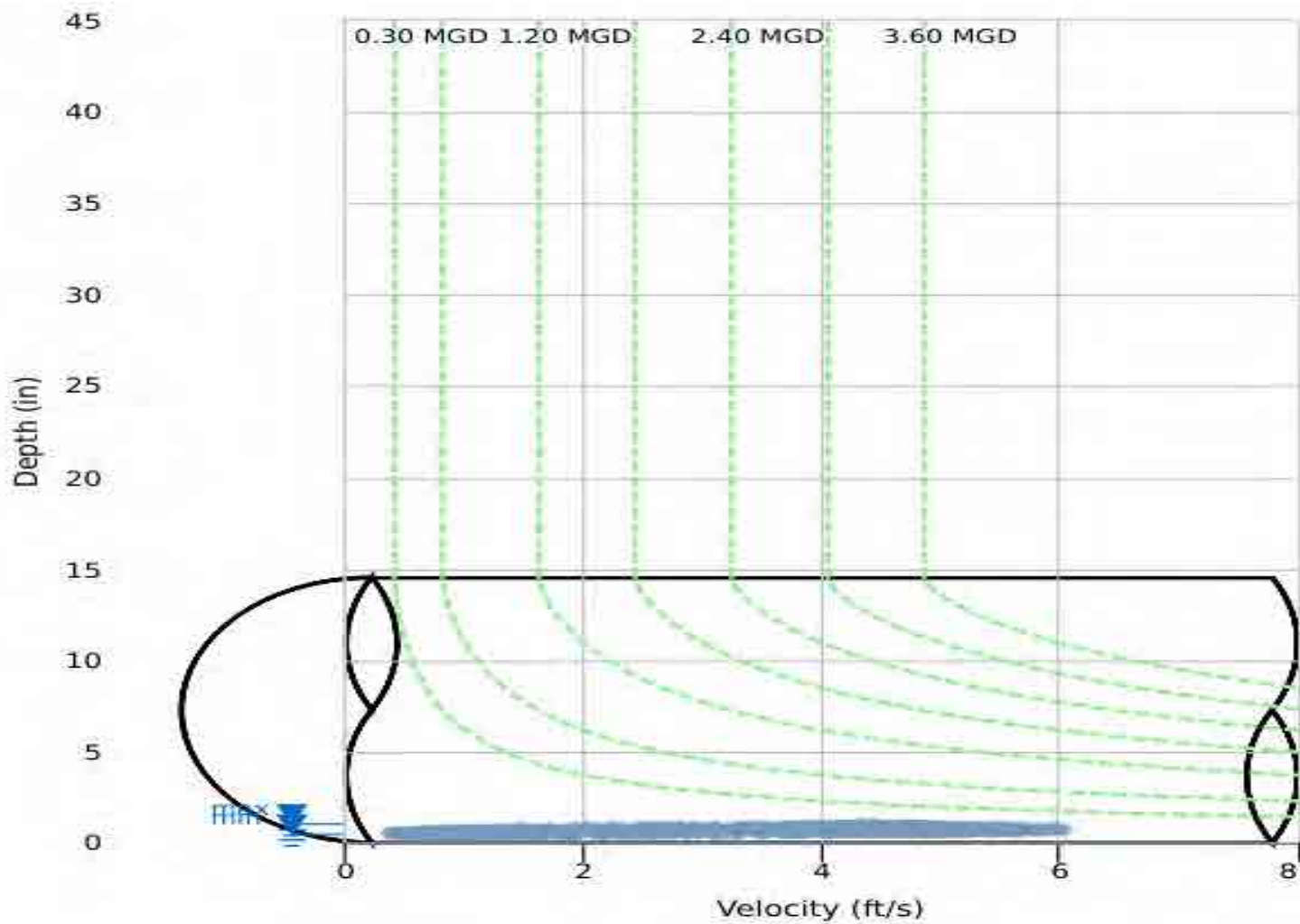
Flow Monitor
FM_04

Pipe Height
14.50
in

Report Period
06/11/2023
To
06/27/2023

Legend
□ DFINAL - VFINAL
--- Iso-Qth
▲ Min-Max Depth

ADS ENVIRONMENTAL
SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_04Pipe: Elliptical (14.5 in H x 14.5 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	04:20	0.54	13:30	0.93	0.67	04:50	0.49	16:55	6.27	3.69	04:50	0.004	16:55	0.091	0.047	0.047	
06/12/2023	03:35	0.58	19:10	1.23	0.76	06:05	0.75	08:50	5.68	3.45	06:05	0.008	19:10	0.119	0.054	0.054	
06/13/2023	05:40	0.64	17:30	0.85	0.73	05:20	0.99	16:30	6.14	3.61	05:45	0.012	17:40	0.101	0.052	0.052	
06/14/2023	07:10	0.49	12:00	0.90	0.70	04:15	0.47	18:15	5.95	3.41	04:15	0.004	18:15	0.101	0.049	0.049	
06/15/2023	06:40	0.48	13:20	0.81	0.65	02:20	0.47	17:15	6.29	3.64	02:20	0.004	13:20	0.094	0.047	0.047	
06/16/2023	04:55	0.46	11:35	0.82	0.65	03:50	0.31	20:10	6.12	3.70	07:00	0.002	18:20	0.090	0.049	0.049	
06/17/2023	05:35	0.50	13:10	1.04	0.72	05:50	0.52	12:45	6.15	3.62	05:50	0.004	13:25	0.106	0.053	0.053	
06/18/2023	06:20	0.48	22:00	0.81	0.62	03:55	0.33	10:15	5.84	3.39	03:55	0.003	19:25	0.081	0.040	0.040	
06/19/2023	03:25	0.51	10:20	1.07	0.71	02:20	0.38	11:35	5.98	3.30	02:20	0.003	10:20	0.101	0.048	0.048	
06/20/2023	02:30	0.52	12:20	0.94	0.71	04:00	0.29	17:20	5.98	3.26	04:00	0.003	13:30	0.098	0.048	0.048	
06/21/2023	05:25	0.52	17:20	0.90	0.71	03:45	0.37	10:35	5.63	3.22	03:45	0.003	17:20	0.101	0.048	0.048	
06/22/2023	03:35	0.55	18:10	0.89	0.71	03:15	0.45	14:20	5.49	3.30	03:15	0.004	18:10	0.091	0.047	0.047	
06/23/2023	04:15	0.52	14:25	0.87	0.71	04:00	0.45	12:15	5.77	3.33	04:00	0.004	20:25	0.089	0.048	0.048	
06/24/2023	04:35	0.52	09:20	0.93	0.72	01:30	0.48	13:20	5.67	3.19	01:30	0.005	09:25	0.095	0.047	0.047	
06/25/2023	23:40	0.51	16:15	0.88	0.65	23:40	0.49	09:05	5.56	3.19	23:40	0.004	14:00	0.079	0.040	0.040	
06/26/2023	02:35	0.51	12:50	0.89	0.70	06:10	0.32	09:45	5.69	3.13	06:10	0.003	13:10	0.086	0.045	0.043	
06/27/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			0.761
Average	0.69	3.40	0.048

FM_05

Site Commentary

SITE INFORMATION

Pipe	Elliptical (30.5 in H x 30 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned downstream of site FM_13 and upstream of site FM_15. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	7.62	2.83	1.832
Minimum	4.70	1.84	0.584
Maximum	11.08	3.71	3.911
Min Time	06/11/2023 6:00:00 AM	06/11/2023 6:45:00 AM	06/11/2023 6:45:00 AM
Max Time	06/23/2023 12:30:00 PM	06/23/2023 1:30:00 PM	06/23/2023 1:30:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

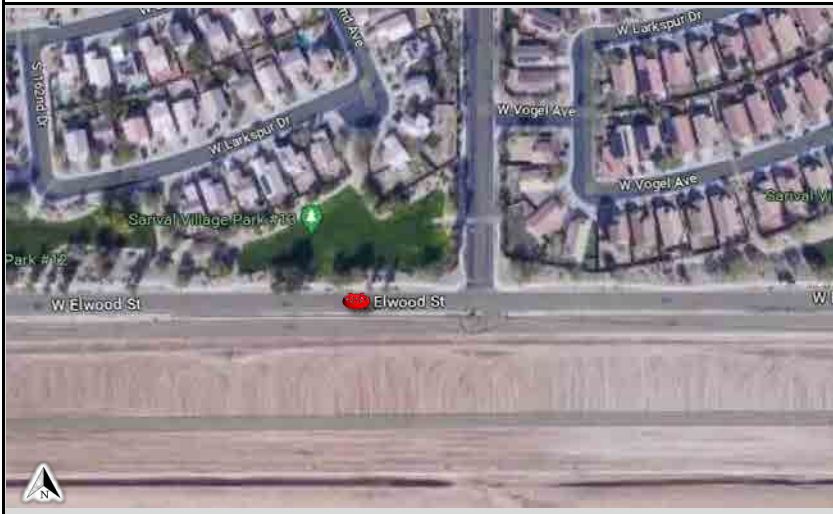
Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

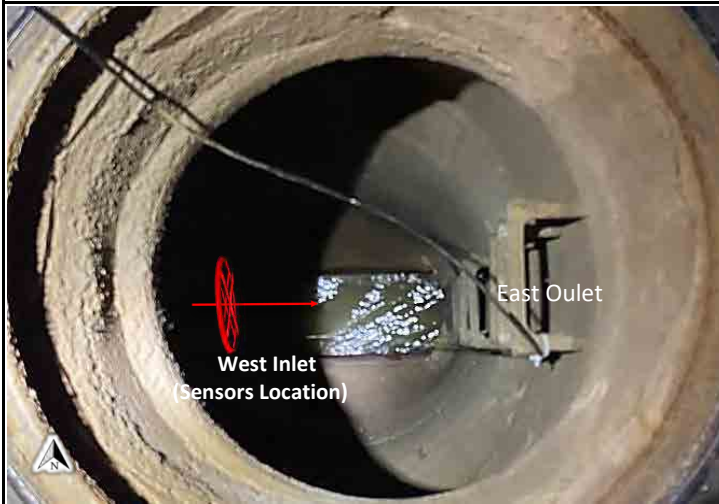


GoodYear.Carollo.TFM.AZ23**Site Name****Flow Monitoring
Site Report****FM_05**

Site Address /Location:	16099 W Vogel Ave, Goodyear, AZ 85338		Monitor Series	Location Type
Site Access Details:	External Traffic Control Required	Latitude:	TRITON+	Temporary
		Longitude:	Pipe Size (H x W)	Pipe Shape
			30.50"x 30.00"	Elliptical



Manhole #	System Characteristics
MH86A-301	Residential/Commercial
Access	Traffic
Drive	Medium

**Installation Information**

Installation Date:	Installation Type:
Thursday, June 8, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Confirmation Time:	Pipe Size (HxW)
7:58:00 PM	30.50"x 30.00"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
7.88"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.86	0"
Silt (in)	Silt Type
0"	

Hydraulic Comments:

Smooth flow with medium depth and low velocity

Manhole / Pipe Information:

Manhole Depth (Approx. FT):	Manhole Configuration
18.07	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Vitrified Clay Pipe	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

External Traffic Control Required

ADS Project Name: GoodYear.Carollo.TFM.AZ23

ADS Project Number: 22930.11.325

Hydrograph Report
FM_05

Flow Monitor

FM_05

Pipe Height
30.50
in

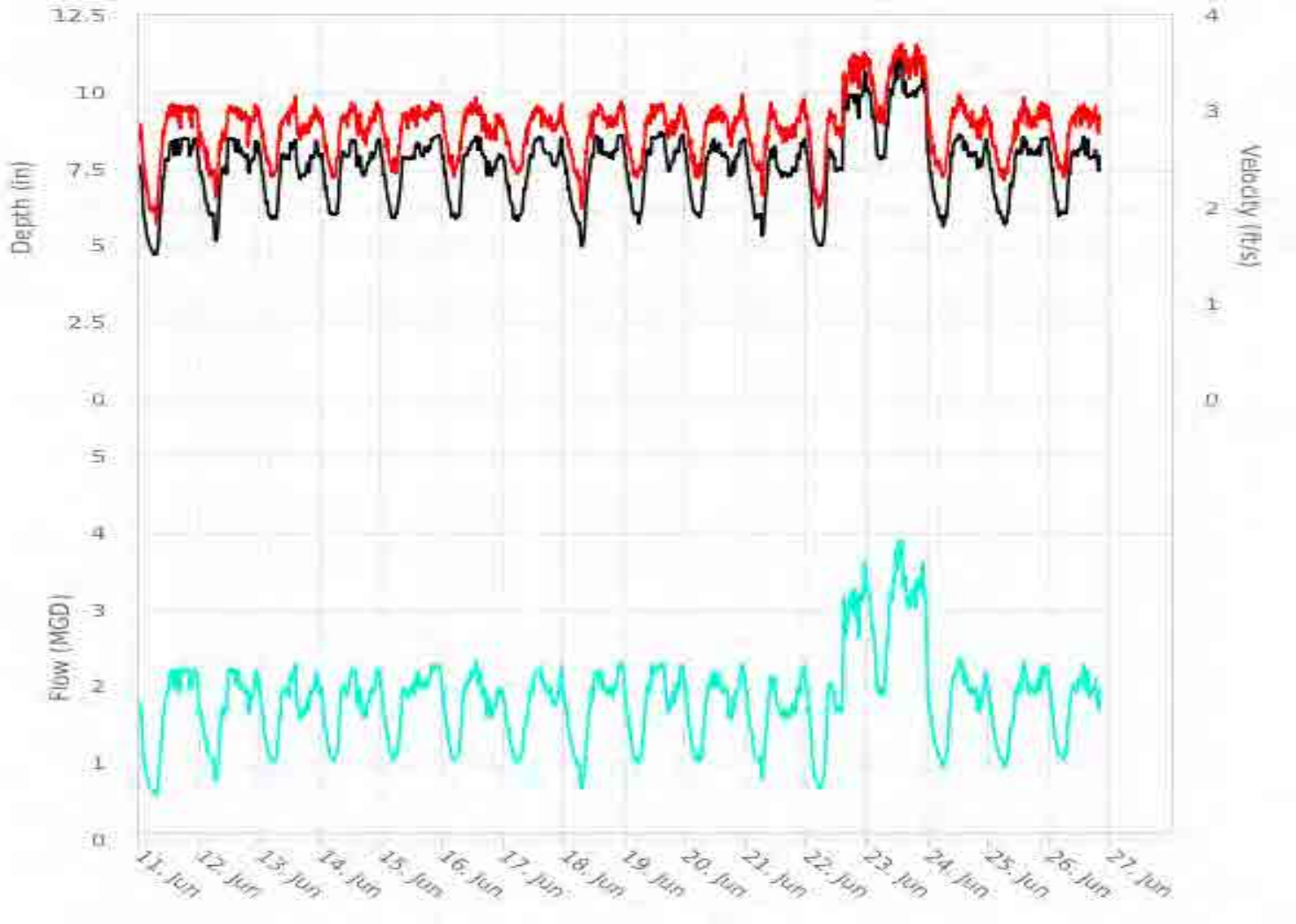
Report Period

06/11/2023
To
06/27/2023

Legend

— DFINAL
— QFINAL
— VFINAL

ABS ENVIRONMENTAL
SERVICES



Scattergraph Report
FM_05

Flow Monitor

FM_05

Pipe Height
30.50
in

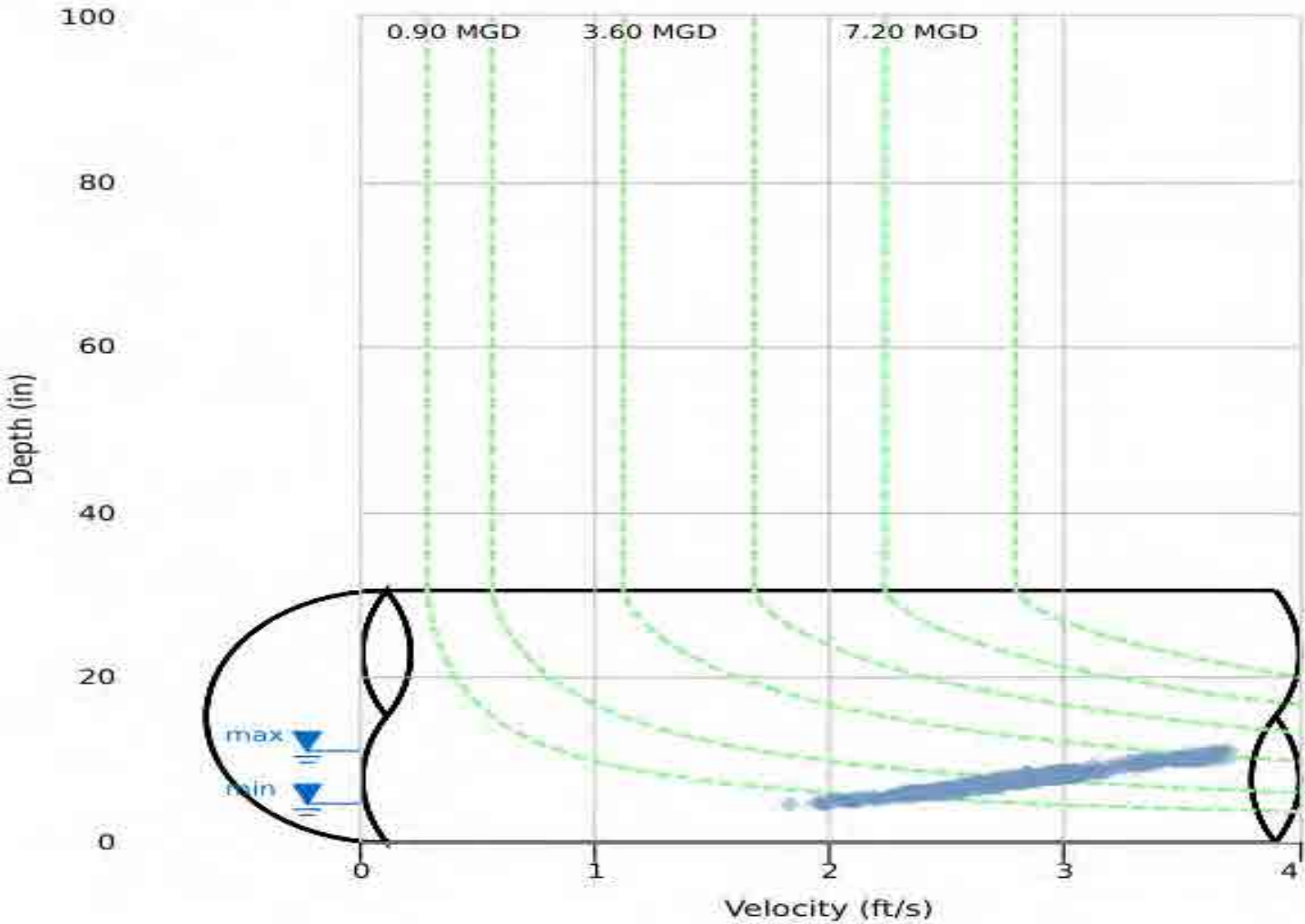
Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL - VFINAL
- Iso-QTH
- Min-Max Depth





Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_05Pipe: Elliptical (30.5 in H x 30 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	06:15	4.69	16:50	8.55	7.18	06:50	1.74	14:15	3.15	2.69	06:50	0.555	17:35	2.270	1.634	1.634	
06/12/2023	06:40	5.15	11:55	8.55	7.40	06:25	2.06	12:20	3.15	2.76	06:25	0.745	12:20	2.319	1.705	1.705	
06/13/2023	04:35	5.86	13:45	8.45	7.37	05:25	2.25	13:55	3.19	2.79	05:25	0.987	13:55	2.321	1.699	1.699	
06/14/2023	04:55	5.97	13:25	8.50	7.51	05:05	2.28	22:00	3.13	2.80	04:55	1.018	12:05	2.276	1.751	1.751	
06/15/2023	05:05	5.88	22:25	8.61	7.62	04:15	2.32	19:45	3.15	2.85	04:55	1.033	19:45	2.323	1.823	1.823	
06/16/2023	05:00	5.86	13:25	8.58	7.48	04:35	2.24	13:20	3.20	2.81	04:35	1.008	13:20	2.371	1.745	1.745	
06/17/2023	05:35	5.80	14:05	8.57	7.44	06:55	2.22	22:55	3.16	2.78	05:40	0.991	22:55	2.335	1.717	1.717	
06/18/2023	07:05	4.96	21:50	8.63	7.39	06:45	1.98	13:50	3.17	2.75	07:00	0.684	22:35	2.329	1.700	1.700	
06/19/2023	05:40	5.68	14:05	8.73	7.65	05:05	2.26	10:40	3.16	2.80	05:35	0.983	15:00	2.339	1.800	1.800	
06/20/2023	05:25	5.86	11:25	8.52	7.53	06:30	2.25	22:20	3.20	2.80	05:30	1.008	22:20	2.317	1.760	1.760	
06/21/2023	06:25	5.29	23:20	8.49	7.26	06:40	2.08	09:35	3.16	2.76	06:35	0.787	22:30	2.285	1.648	1.648	
06/22/2023	04:40	4.97	22:55	10.72	7.98	04:30	1.98	18:20	3.66	2.92	04:35	0.682	22:50	3.681	2.088	2.088	
06/23/2023	05:00	7.78	12:30	11.15	9.65	23:50	2.72	13:40	3.79	3.38	23:50	1.832	13:40	3.986	2.989	2.989	
06/24/2023	06:00	5.57	12:00	8.64	7.52	05:30	2.29	12:10	3.22	2.80	06:00	0.926	12:10	2.403	1.763	1.763	
06/25/2023	06:00	5.64	13:35	8.59	7.49	05:35	2.25	13:40	3.22	2.78	06:05	0.948	13:40	2.372	1.742	1.742	
06/26/2023	03:40	5.94	13:35	8.57	7.46	05:25	2.24	18:10	3.11	2.79	03:20	1.015	13:40	2.293	1.733	1.426	
06/27/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			28.989
Average	7.62	2.83	1.832

FM_06

Site Commentary

SITE INFORMATION

Pipe	Elliptical (54 in H x 53.5 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned downstream of sites FM_04 and FM_14 and upstream of site FM_16. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	6.41	2.76	1.920
Minimum	3.66	1.91	0.586
Maximum	10.91	3.27	4.568
Min Time	06/13/2023 5:15:00 AM	06/13/2023 5:00:00 AM	06/13/2023 5:00:00 AM
Max Time	06/13/2023 10:45:00 AM	06/13/2023 11:15:00 AM	06/13/2023 11:30:00 AM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

GoodYear.Carollo.TFM.AZ23**Site Name****Flow Monitoring
Site Report****FM_06**

Site Address /Location:	15775 W Elwood St, Goodyear, AZ 85338		Monitor Series	Location Type
Site Access Details:	External Traffic Control Required	Latitude:	TRITON+	Temporary
		Longitude:	Pipe Size (H x W) 54.00"x 53.50"	Pipe Shape Elliptical



Manhole #	System Characteristics
MH86C-203	Residential/Commercial
Access	Traffic
Drive	Light

**Installation Information**

Installation Date:	Installation Type:
Monday, June 5, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Confirmation Time:	Pipe Size (HxW)
9:23:00 PM	54.00"x 53.50"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
6.75"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
3.58	0"
Silt (in)	Silt Type
0"	

Hydraulic Comments:

Smooth flow with medium depth and low velocity

Manhole / Pipe Information:

Manhole Depth (Approx. FT):	Manhole Configuration
30.45	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Concrete	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

External Traffic Control Required

ADS Project Name: GoodYear.Carollo.TFM.AZ23

ADS Project Number: 22930.11.325

Hydrograph Report
FM_06

Flow Monitor

FM_06

Pipe Height
54.00
in

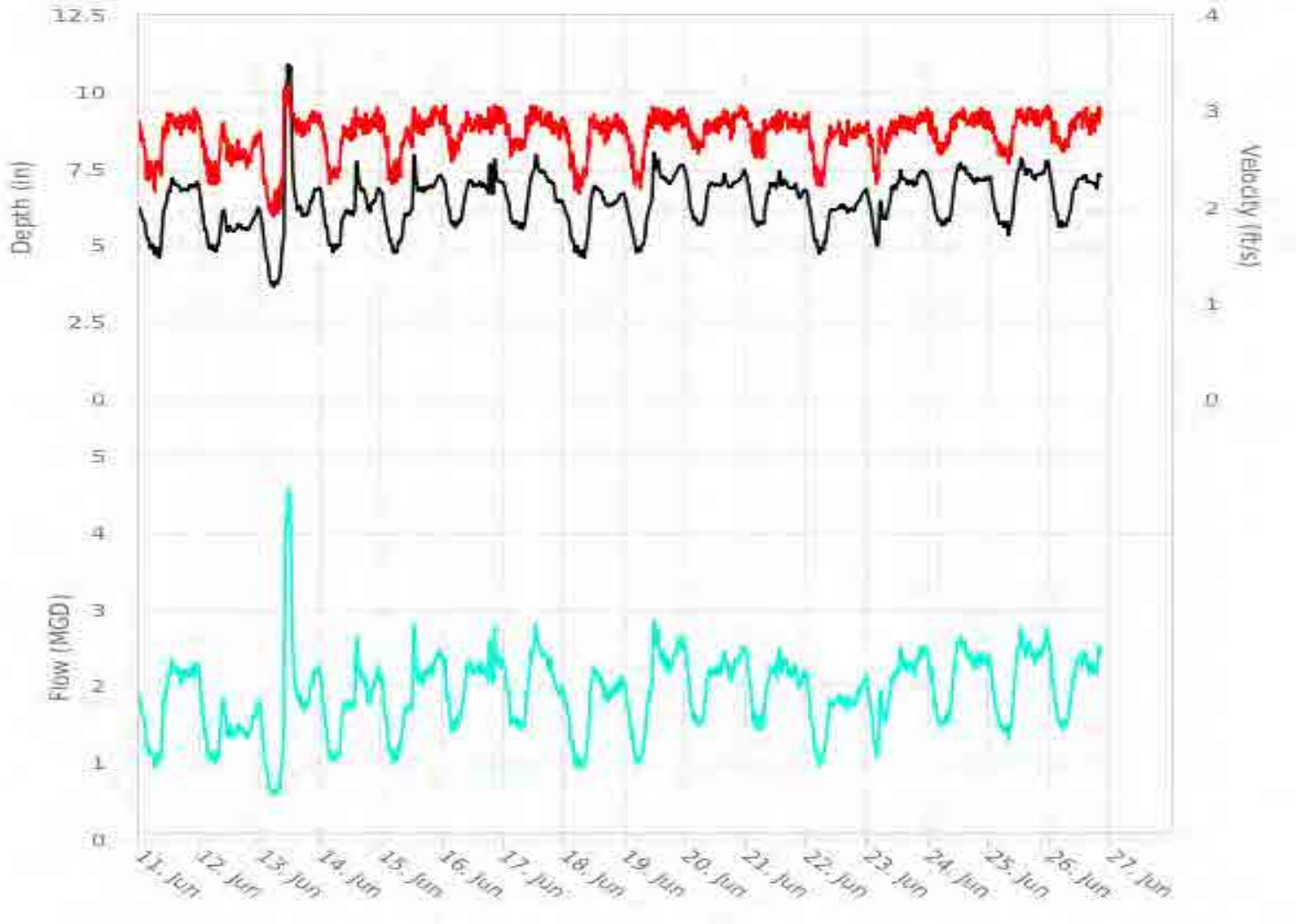
Report Period

06/11/2023
To
06/27/2023

Legend

— DFINAL
— QFINAL
— VFINAL

ABS ENVIRONMENTAL
SERVICES



Scattergraph Report
FM_06

Flow Monitor

FM_06

Pipe Height
54.00
in

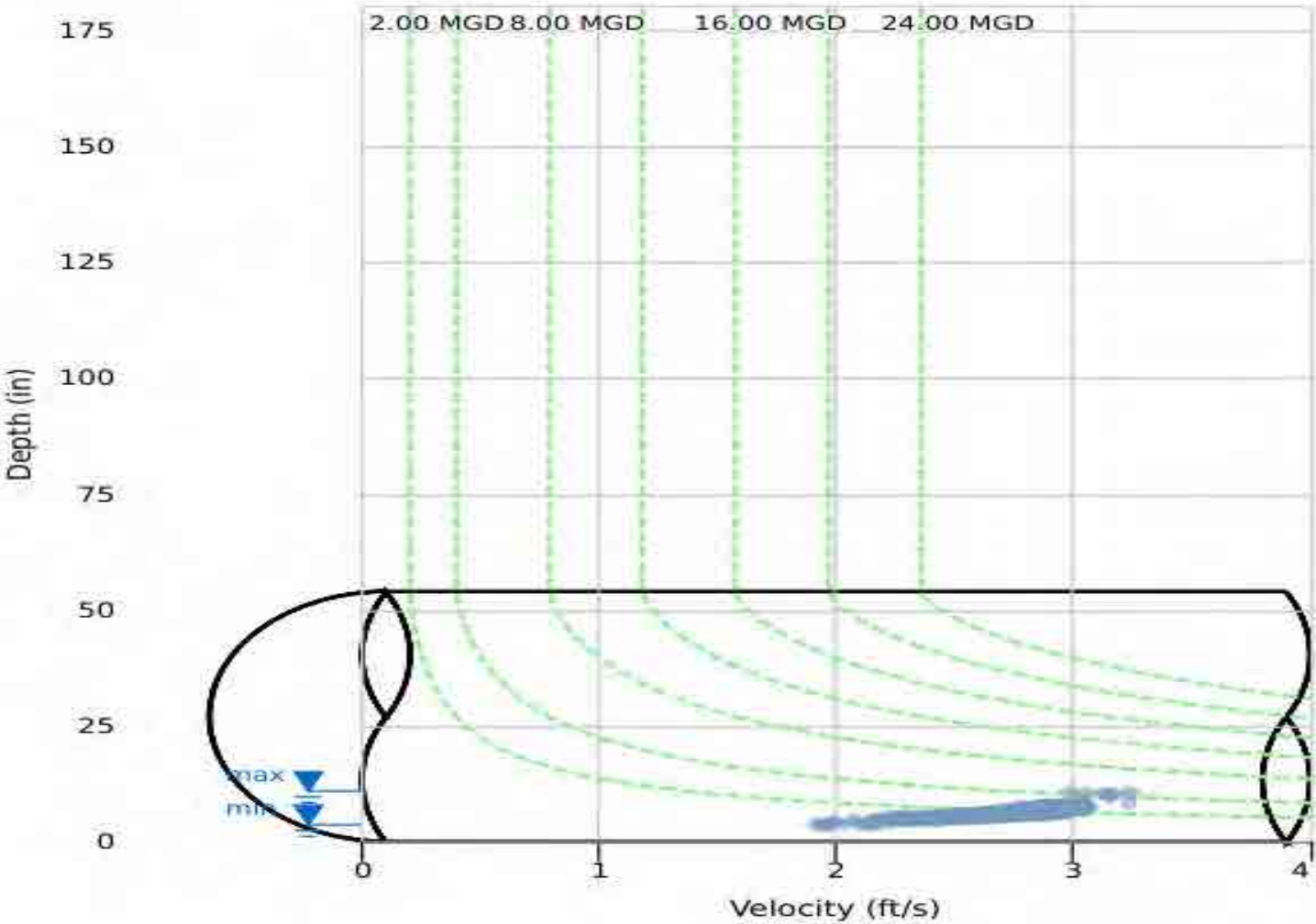
Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL - VFINAL
- Iso-Qth
- Min-Max Depth





Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_06Pipe: Elliptical (54 in H x 53.5 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	08:05	4.57	13:15	7.26	6.22	06:20	2.13	11:40	3.10	2.73	06:20	0.922	13:15	2.417	1.818	1.818	
06/12/2023	06:20	4.78	00:00	6.78	5.60	03:40	2.15	00:05	2.96	2.57	06:20	0.967	00:05	2.174	1.445	1.445	
06/13/2023	05:20	3.65	11:40	11.14	6.14	05:10	1.82	11:25	3.36	2.65	05:10	0.554	11:40	4.749	1.836	1.836	
06/14/2023	04:50	4.77	14:00	7.76	6.10	03:25	2.18	13:40	3.13	2.73	04:40	0.996	13:55	2.707	1.760	1.760	
06/15/2023	04:35	4.75	12:55	7.97	6.29	04:25	2.17	21:10	3.09	2.74	04:45	0.967	12:40	2.844	1.856	1.856	
06/16/2023	05:00	5.55	20:35	7.87	6.71	04:20	2.40	01:05	3.11	2.84	04:20	1.375	20:35	2.825	2.084	2.084	
06/17/2023	07:50	5.52	12:55	7.98	6.64	03:05	2.46	12:45	3.12	2.82	06:30	1.403	13:05	2.859	2.044	2.044	
06/18/2023	08:00	4.59	12:20	6.98	6.00	06:05	2.13	11:50	3.05	2.69	06:05	0.929	11:50	2.316	1.695	1.695	
06/19/2023	04:35	4.75	11:35	8.07	6.56	04:10	2.12	11:05	3.08	2.77	04:45	0.941	11:35	2.930	1.998	1.998	
06/20/2023	05:05	5.65	23:10	7.50	6.74	05:25	2.47	22:10	3.13	2.85	05:25	1.441	22:10	2.575	2.098	2.098	
06/21/2023	04:30	5.58	13:00	7.44	6.65	03:55	2.42	19:10	3.08	2.83	03:55	1.406	13:15	2.572	2.046	2.046	
06/22/2023	05:00	4.71	23:30	6.90	5.99	04:45	2.16	20:40	3.07	2.68	05:00	0.942	00:20	2.197	1.676	1.676	
06/23/2023	03:50	4.96	13:15	7.49	6.68	03:35	2.22	23:40	3.08	2.79	03:35	1.064	20:45	2.562	2.038	2.038	
06/24/2023	06:35	5.55	12:45	7.71	6.81	04:40	2.47	13:55	3.14	2.84	06:35	1.429	12:50	2.690	2.131	2.131	
06/25/2023	07:50	5.33	12:40	7.88	6.83	07:35	2.36	11:10	3.12	2.84	07:35	1.253	12:40	2.839	2.150	2.150	
06/26/2023	03:50	5.59	00:00	7.43	6.65	04:45	2.45	20:00	3.13	2.84	04:45	1.401	20:00	2.555	2.058	1.729	
06/27/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			30.405
Average	6.41	2.76	1.919

FM_07

Site Commentary

SITE INFORMATION

Pipe	Elliptical (12 in H x 12 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned upstream of site FM_01. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	2.95	1.24	0.127
Minimum	1.87	0.68	0.035
Maximum	5.32	1.77	0.388
Min Time	06/23/2023 3:45:00 AM	06/22/2023 3:30:00 AM	06/22/2023 3:30:00 AM
Max Time	06/26/2023 10:45:00 AM	06/26/2023 10:30:00 AM	06/26/2023 10:30:00 AM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



GoodYear.Carollo.TFM.AZ23				Site Name	
Flow Monitoring Site Report				FM_07	

Site Address /Location:	1300 S Litchfield Rd, Goodyear, AZ 85338		Monitor Series	TRITON+		Location Type	Temporary	
Site Access Details:	External Traffic Control Required	Latitude:	33.4329212	Pipe Size (H x W)	12.00"x 12.00"	Pipe Shape	Circular	
		Longitude:	-112.358208°					



Manhole #	System Characteristics
MH79A-101	Residential/Commercial
Access	Traffic
Drive	Light





Installation Information	
Installation Date:	Installation Type:
Wednesday, June 7, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Confirmation Time:	Pipe Size (HxW)
7:41:00 PM	12.00"x 12.00"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
4.00 "	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
1.56	0"
Silt (in)	Silt Type
0"	
Hydraulic Comments:	
Smooth flow with medium depth and low velocity	
Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
8.71	Single
Manhole Material:	Manhole Condition:
Brick	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Vitrified Clay Pipe	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	
External Traffic Control Required	

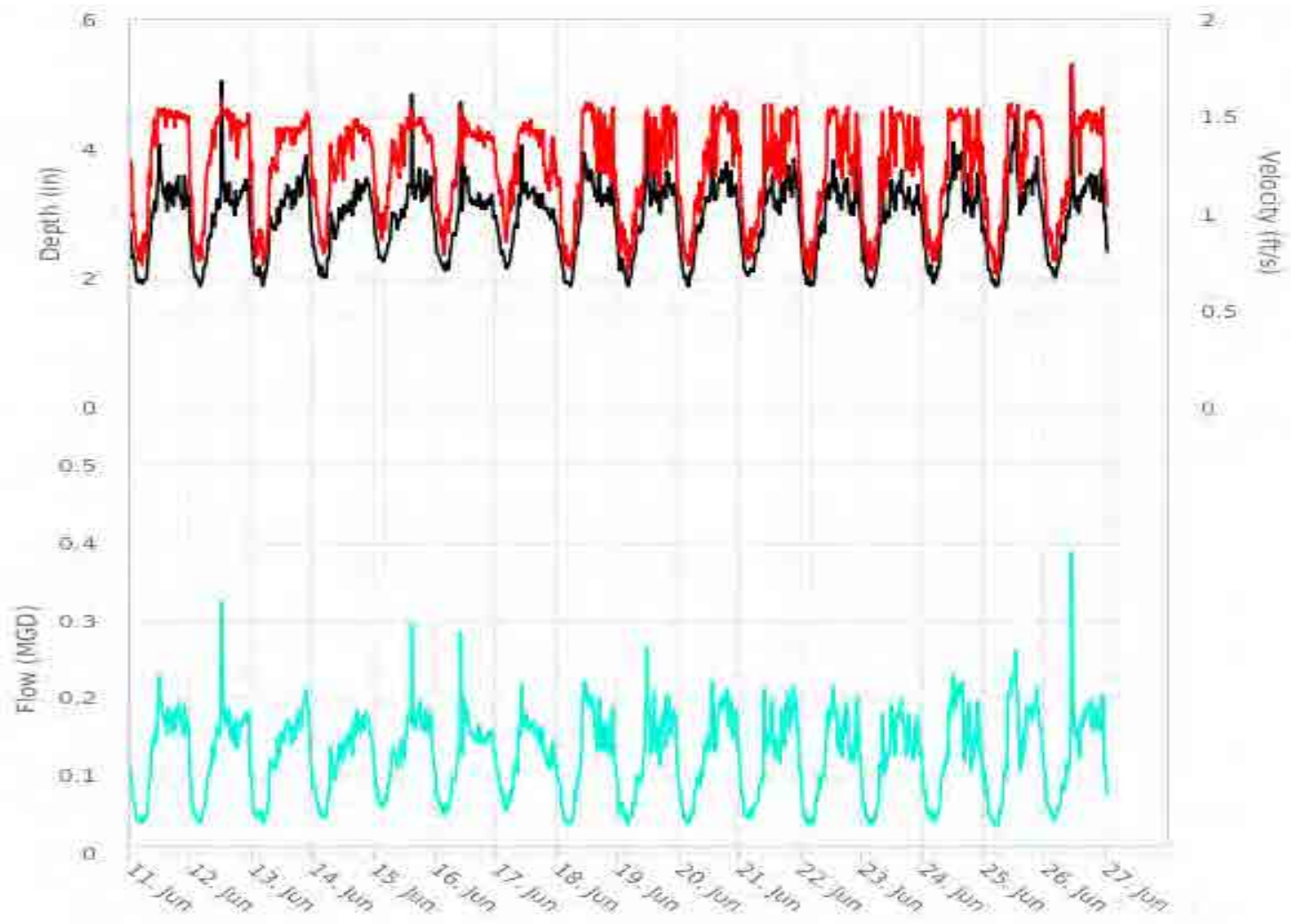
ADS Project Name:	GoodYear.Carollo.TFM.AZ23
ADS Project Number:	22930.11.325

Hydrograph Report

FM_07

Flow Monitor FM_07
Pipe Height 12.00 in
Report Period 06/11/2023 To 06/27/2023
Legend — DFINAL — QFINAL — VFINAL

ABS ENVIRONMENTAL SERVICES



Scattergraph Report
FM_07

Flow Monitor

FM_07

Pipe Height
12.00
in

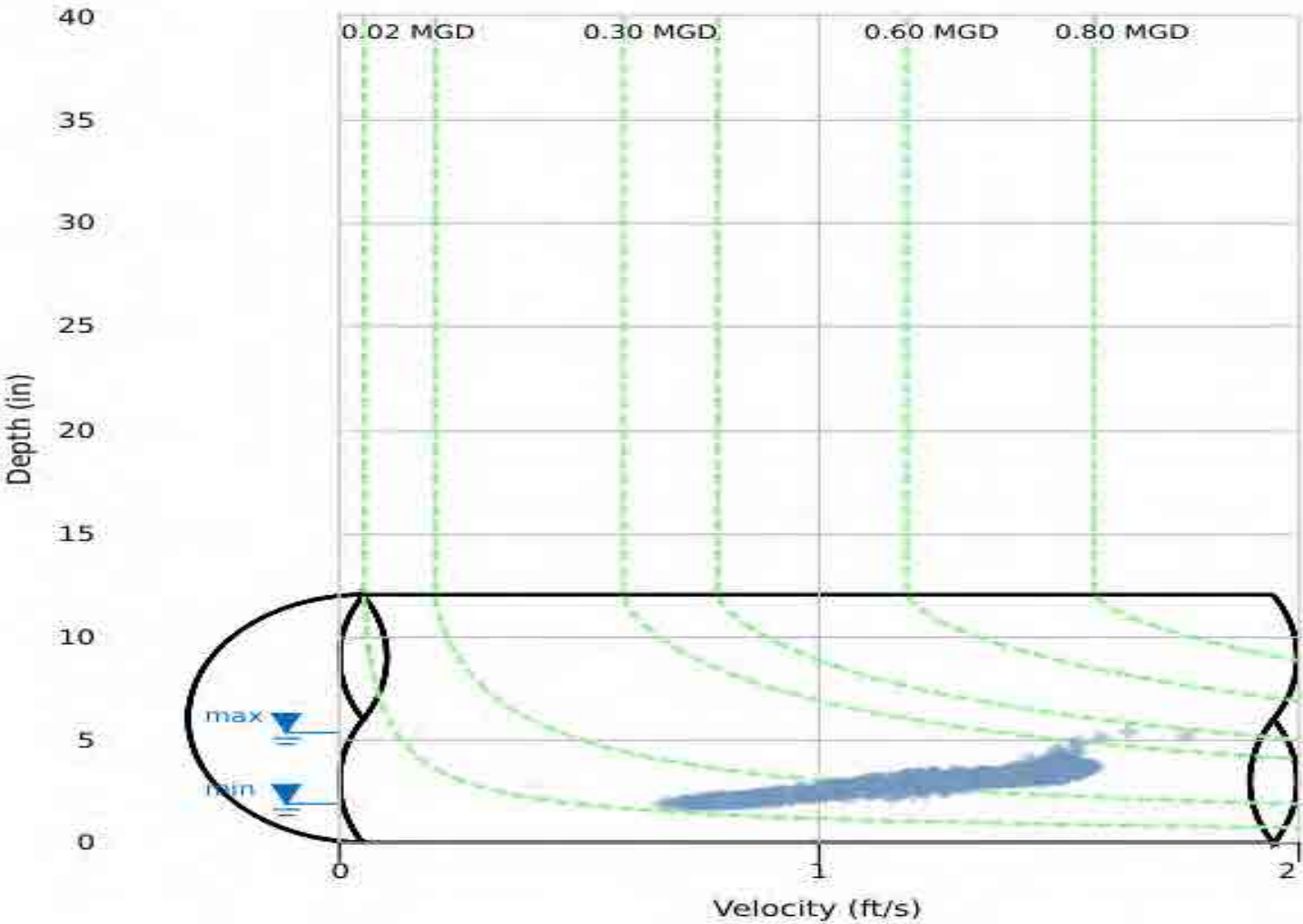
Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL - VFINAL
- Iso-QTM
- Min-Max Depth





Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_07Pipe: Elliptical (12 in H x 12 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	04:50	1.92	11:35	4.09	2.92	04:45	0.69	15:35	1.56	1.29	04:45	0.037	11:35	0.232	0.132	0.132	
06/12/2023	03:30	1.88	12:05	5.20	2.90	02:40	0.74	12:05	1.60	1.30	03:50	0.039	12:05	0.338	0.130	0.130	
06/13/2023	04:05	1.87	21:15	3.94	2.91	04:20	0.72	21:30	1.55	1.23	04:20	0.037	21:15	0.213	0.124	0.124	
06/14/2023	03:50	2.00	21:00	3.56	2.87	03:35	0.76	17:15	1.50	1.25	03:35	0.043	17:10	0.186	0.122	0.122	
06/15/2023	03:50	2.25	14:45	5.07	3.03	03:00	0.86	14:40	1.56	1.29	03:30	0.059	14:45	0.317	0.135	0.135	
06/16/2023	03:50	2.12	10:05	4.90	2.93	03:20	0.75	10:00	1.55	1.26	03:20	0.047	10:05	0.301	0.126	0.126	
06/17/2023	04:20	2.15	10:05	4.09	2.96	03:40	0.79	13:45	1.50	1.26	03:40	0.052	10:05	0.221	0.127	0.127	
06/18/2023	05:15	1.88	10:40	3.95	2.95	04:45	0.68	11:15	1.58	1.21	04:45	0.036	10:40	0.224	0.126	0.126	
06/19/2023	03:55	1.87	11:30	4.62	2.93	03:45	0.65	11:25	1.58	1.19	03:45	0.033	11:30	0.280	0.123	0.123	
06/20/2023	03:45	1.87	13:05	3.96	2.98	03:45	0.70	18:40	1.60	1.23	03:45	0.035	13:10	0.224	0.129	0.129	
06/21/2023	03:05	2.03	09:40	4.02	2.96	02:20	0.71	09:35	1.61	1.21	02:20	0.042	09:45	0.232	0.125	0.125	
06/22/2023	03:25	1.87	12:45	3.90	2.91	03:35	0.64	18:25	1.56	1.20	03:35	0.033	12:45	0.220	0.121	0.121	
06/23/2023	03:55	1.86	15:30	3.70	2.88	05:15	0.68	11:15	1.56	1.21	03:45	0.035	15:30	0.202	0.120	0.120	
06/24/2023	04:25	1.92	11:55	4.25	2.99	03:25	0.73	21:55	1.56	1.22	04:10	0.040	11:50	0.242	0.129	0.129	
06/25/2023	04:55	1.87	12:20	4.55	3.04	05:30	0.64	13:30	1.59	1.24	05:30	0.033	12:20	0.266	0.135	0.135	
06/26/2023	03:50	2.01	10:40	6.15	3.01	04:30	0.70	10:40	1.90	1.25	04:25	0.040	10:40	0.498	0.133	0.133	
06/27/2023	00:30	2.42	00:00	2.94	2.64	00:25	0.93	00:00	1.31	1.11	00:25	0.069	00:00	0.126	0.093	0.002	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			2.038
Average	2.95	1.24	0.127

FM_08

Site Commentary

SITE INFORMATION

Pipe	Elliptical (22.5 in H x 22.5 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned upstream of site FM_16. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	6.24	1.26	0.514
Minimum	5.54	1.07	0.371
Maximum	8.30	1.61	0.945
Min Time	06/19/2023 7:30:00 AM	06/16/2023 7:45:00 AM	06/15/2023 11:00:00 PM
Max Time	06/12/2023 3:15:00 PM	06/13/2023 11:45:00 AM	06/12/2023 2:15:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



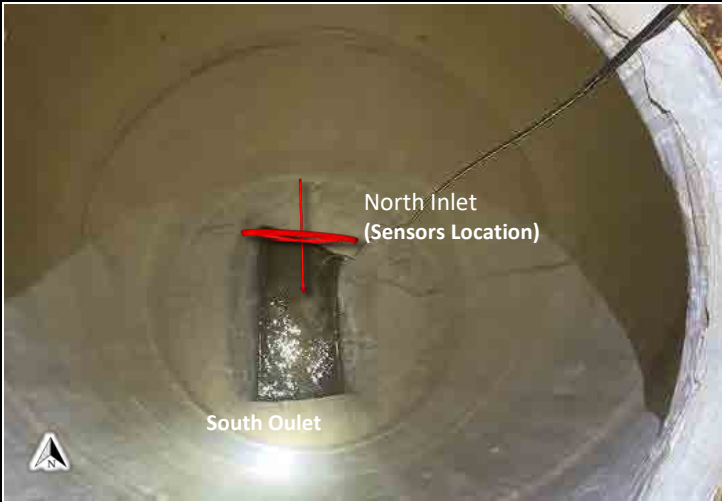
GoodYear.Carollo.TFM.AZ23				Site Name	
Flow Monitoring Site Report				FM_08	

Site Address /Location:	Between W Lower Buckeye Pkwy and S Bullard Ave		Monitor Series	TRITON+		Location Type	Temporary	
Site Access Details:	External Traffic Control Required	Latitude:	33.4283388	Pipe Size (H x W)	22.50"x 22.50"	Pipe Shape	Circular	
		Longitude:	-112.3832062"					



Manhole #	System Characteristics
MH77B-308	Residential/Commercial
Access	Traffic
Drive	Light





Installation Information	
Installation Date:	Installation Type:
Monday, June 5, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Confirmation Time:	Pipe Size (HxW)
11:37:00 PM	22.50"x 22.50"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
6.75 "	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
1.51	0"
Silt (in)	Silt Type
0"	
Hydraulic Comments:	
Smooth flow with medium depth and low velocity	
Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
17.77	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Concrete	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	
External Traffic Control Required	



ADS Project Name:	GoodYear.Carollo.TFM.AZ23
ADS Project Number:	22930.11.325

Hydrograph Report
FM_08

Flow Monitor

FM_08

Pipe Height
22.50
in

Report Period

06/11/2023
To
06/27/2023

Legend

— DFINAL
— QFINAL
— VFINAL

ABS ENVIRONMENTAL
SERVICES

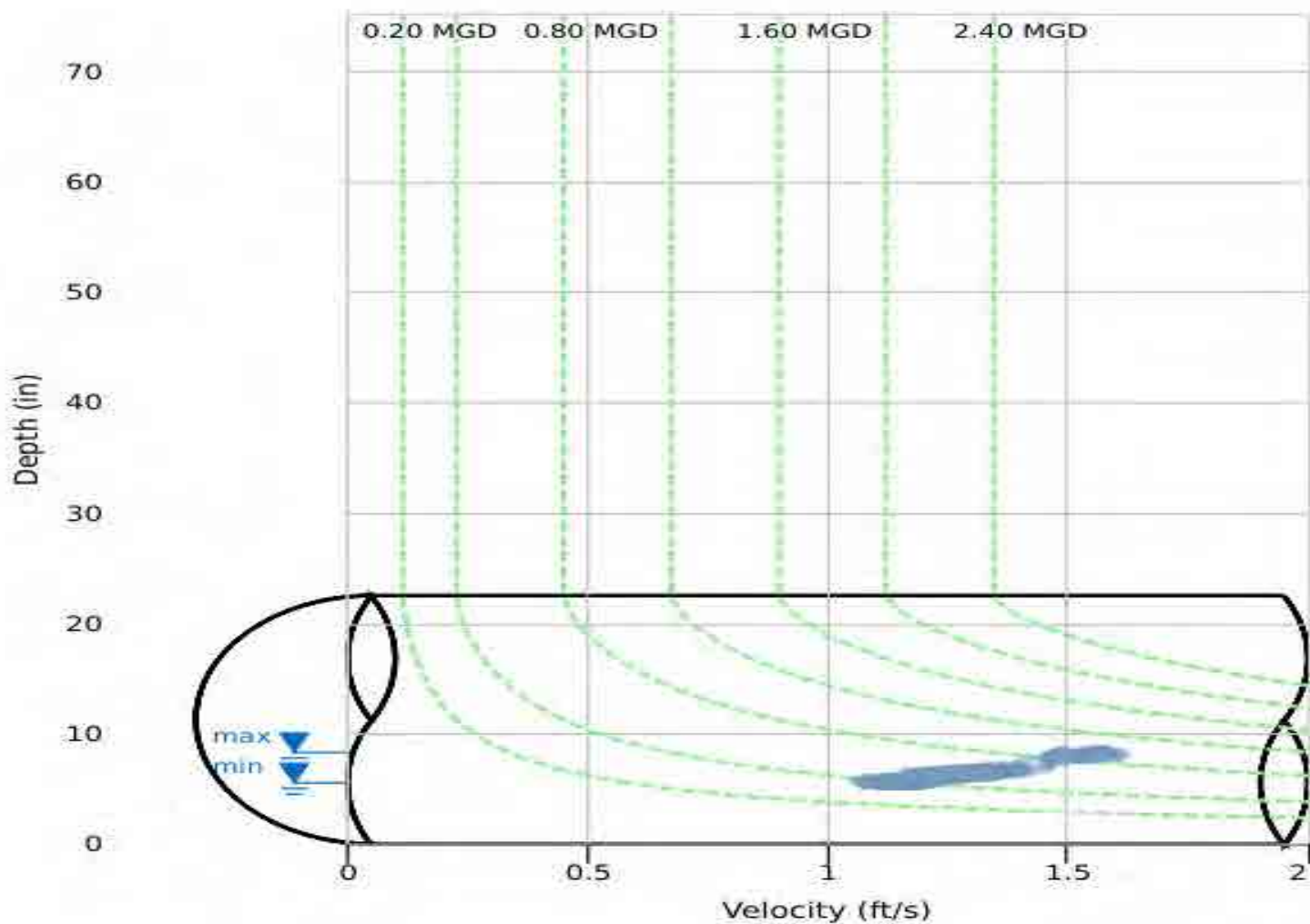


Scattergraph Report

FM_08

Flow Monitor
FM_08
Pipe Height 22.50 in
Report Period
06/11/2023 To 06/27/2023
Legend
DFINAL - VFINAL Iso-Q TH Min-Max Depth

ABS ENVIRONMENTAL SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_08Pipe: Elliptical (22.5 in H x 22.5 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	08:45	6.48	04:50	6.75	6.54	12:00	1.23	04:35	1.43	1.34	14:25	0.531	04:35	0.631	0.578	0.578	
06/12/2023	04:15	6.53	14:25	8.30	7.44	05:25	1.25	15:30	1.62	1.45	05:25	0.539	15:30	0.965	0.755	0.755	
06/13/2023	21:10	5.60	12:25	8.24	7.09	18:50	1.11	09:50	1.63	1.39	21:05	0.386	13:55	0.951	0.689	0.689	
06/14/2023	04:45	5.56	14:45	6.49	5.88	20:45	1.07	15:55	1.37	1.19	06:45	0.370	14:40	0.580	0.445	0.445	
06/15/2023	07:10	5.58	10:50	6.57	5.90	23:10	1.04	10:35	1.38	1.19	23:10	0.359	10:40	0.593	0.447	0.447	
06/16/2023	05:00	5.55	14:35	6.45	5.85	02:00	1.03	14:30	1.36	1.18	02:00	0.361	14:35	0.576	0.437	0.437	
06/17/2023	21:35	5.56	02:20	5.84	5.63	07:25	1.06	02:20	1.24	1.16	07:25	0.373	02:20	0.458	0.407	0.407	
06/18/2023	08:45	5.53	00:00	5.73	5.63	05:05	1.08	11:00	1.25	1.17	08:15	0.374	11:00	0.440	0.409	0.409	
06/19/2023	07:30	5.54	14:55	6.95	6.04	02:00	1.06	14:50	1.43	1.23	02:00	0.368	14:50	0.664	0.476	0.476	
06/20/2023	07:15	5.87	15:20	6.53	6.26	07:00	1.14	18:00	1.34	1.24	07:10	0.422	18:00	0.570	0.505	0.505	
06/21/2023	08:15	5.92	11:50	6.74	6.32	08:05	1.13	11:40	1.38	1.27	08:05	0.428	11:40	0.618	0.521	0.521	
06/22/2023	07:30	5.92	14:40	7.62	6.33	05:40	1.15	14:40	1.55	1.27	07:40	0.436	14:40	0.824	0.524	0.524	
06/23/2023	00:15	5.98	11:20	6.70	6.28	08:30	1.16	11:10	1.40	1.25	00:10	0.446	11:10	0.614	0.511	0.511	
06/24/2023	07:30	5.93	18:10	6.47	6.26	03:40	1.15	17:55	1.35	1.24	03:40	0.446	17:55	0.572	0.504	0.504	
06/25/2023	05:35	5.95	22:25	6.39	6.19	06:35	1.13	17:35	1.37	1.24	06:35	0.432	18:40	0.563	0.496	0.496	
06/26/2023	00:00	6.15	00:00	6.15	6.15	00:05	1.16	00:00	1.23	1.20	00:05	0.457	00:00	0.488	0.475	0.005	
06/27/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			7.710
Average	6.24	1.26	0.514

FM_09

Site Commentary

SITE INFORMATION

Pipe	Elliptical (24 in H x 24 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned downstream of site FM_10 and upstream of site FM_13. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	4.63	1.60	0.455
Minimum	2.71	1.04	0.135
Maximum	5.79	1.88	0.702
Min Time	06/13/2023 4:45:00 AM	06/16/2023 4:45:00 AM	06/20/2023 4:30:00 AM
Max Time	06/18/2023 11:45:00 AM	06/11/2023 1:15:00 PM	06/18/2023 11:45:00 AM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



GoodYear.Carollo.TFM.AZ23				Site Name	
Flow Monitoring Site Report		FM_09			

Site Address /Location:	W Mc Dowell Rd and Clubhouse Dr		Monitor Series	Location Type	
			TRITON+	Temporary	
Site Access Details:	External Traffic Control Required	Latitude: 33.4647726	Pipe Size (H x W)	Pipe Shape	
		Longitude: -112.4182181	24.00"x 24.00"	Circular	



Manhole #	System Characteristics
MH45C-401	Residential
Access	Traffic
Drive	None





Installation Information	
Installation Date:	Installation Type:
Wednesday, June 7, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Confirmation Time:	Pipe Size (HxW)
10:00:00 PM	24.00"x 24.00"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
5.25"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
1.96	0"
Silt (in)	Silt Type
0"	
Hydraulic Comments:	
Smooth flow with medium depth and slow velocity	
Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
12.64	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Vitrified Clay Pipe	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	
No TC required	



ADS Project Name:	GoodYear.Carollo.TFM.AZ23
ADS Project Number:	22930.11.325

Hydrograph Report
FM_09

Flow Monitor

FM_09

Pipe Height
24.00
in

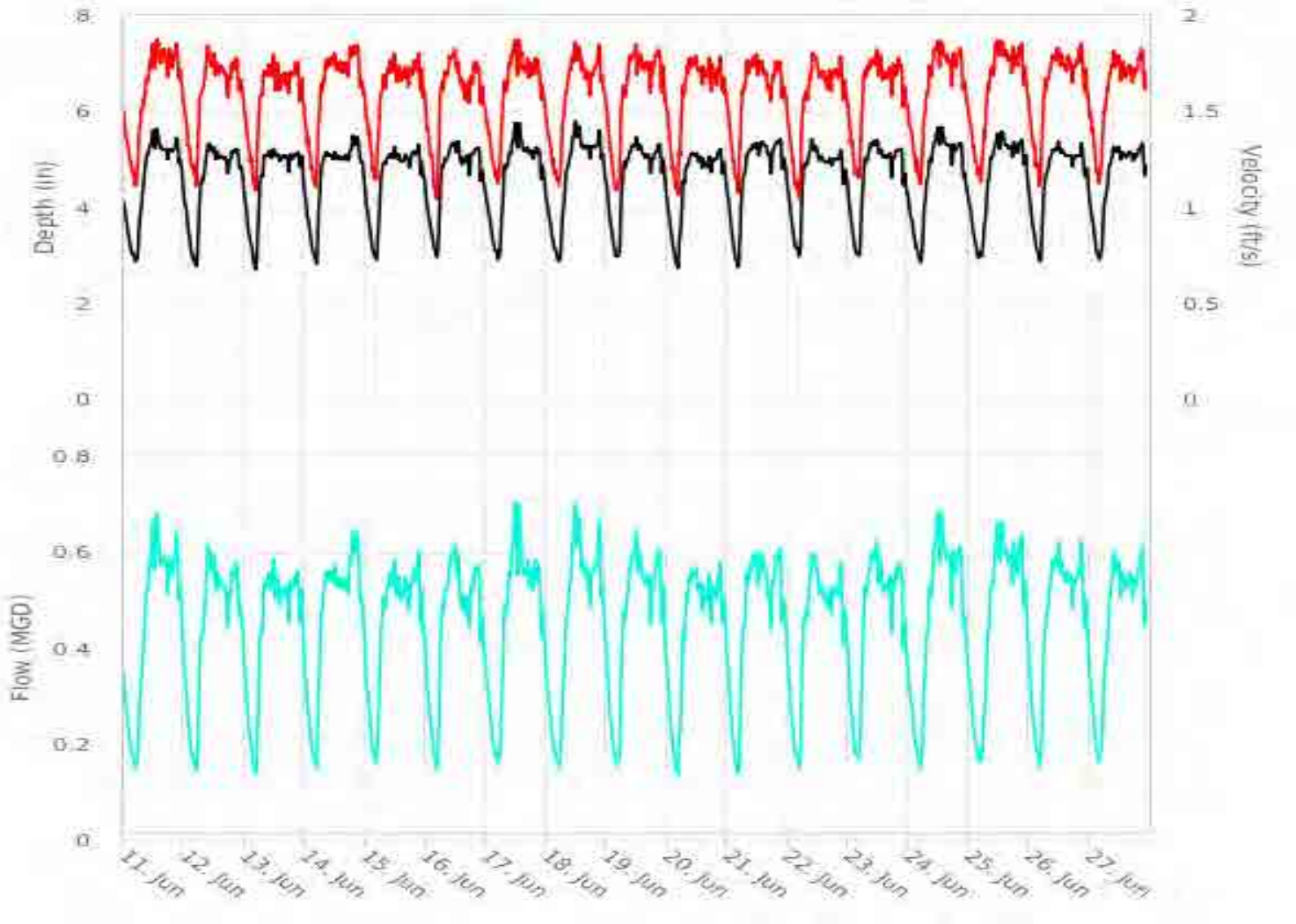
Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL
- QFINAL
- VFINAL

ABS ENVIRONMENTAL
SERVICES



Scattergraph Report

FM_09

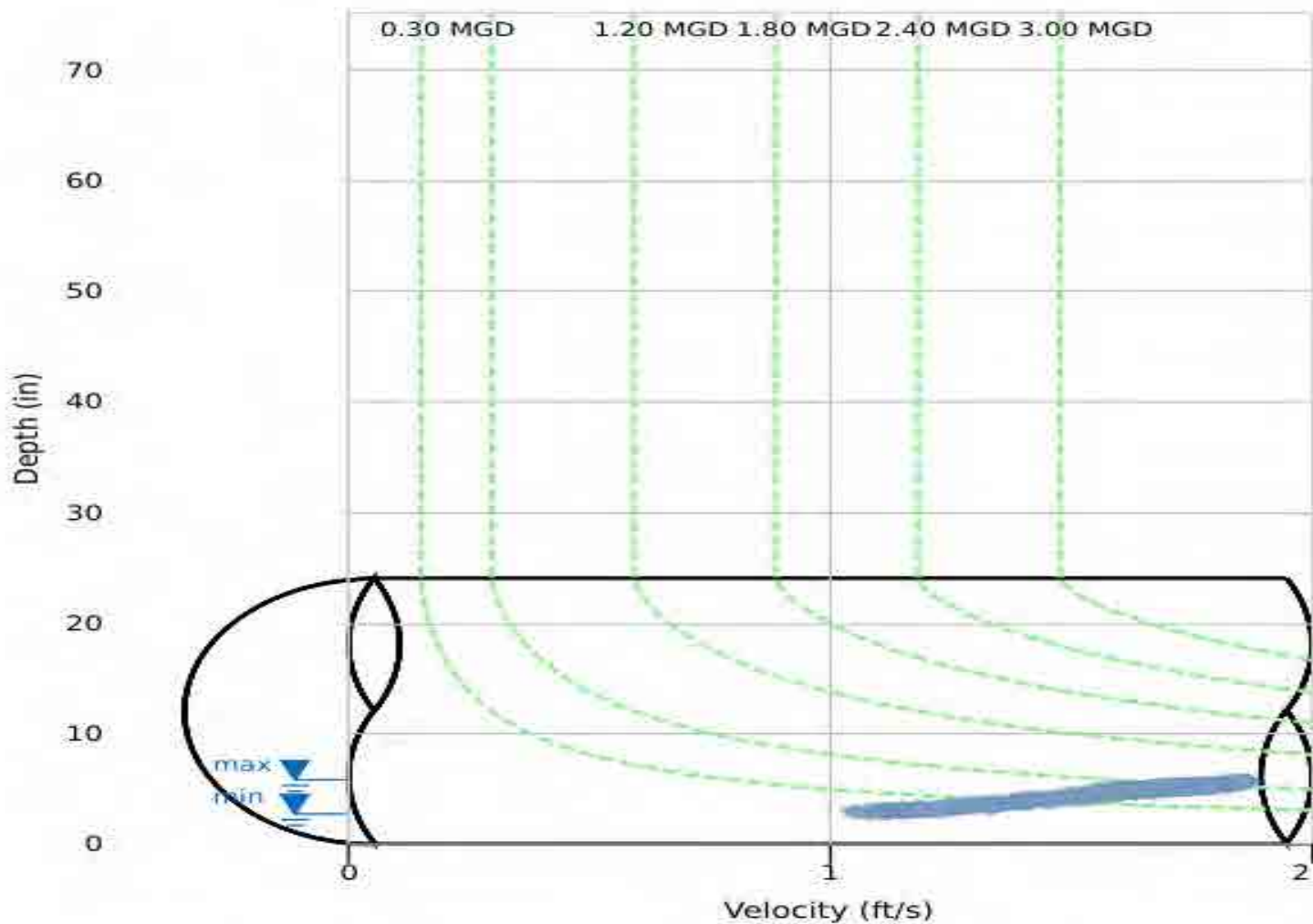
Flow Monitor
FM_09

Pipe Height
24.00
in

Report Period
06/11/2023
To
06/27/2023

Legend
 □ DFINAL - VFINAL
 --- Iso-Qth
 ▽ Min-Max Depth

ABS ENVIRONMENTAL SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_09Pipe: Elliptical (24 in H x 24 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	04:40	2.86	13:10	5.67	4.61	05:15	1.09	13:25	1.89	1.60	05:15	0.151	13:05	0.686	0.458	0.458	
06/12/2023	04:45	2.77	09:50	5.34	4.56	04:45	1.09	09:35	1.85	1.60	04:45	0.142	09:50	0.623	0.445	0.445	
06/13/2023	04:40	2.70	11:55	5.24	4.59	04:40	1.08	11:45	1.82	1.58	04:40	0.136	11:45	0.591	0.442	0.442	
06/14/2023	04:50	2.81	19:20	5.51	4.67	04:30	1.08	18:00	1.87	1.62	04:50	0.148	21:00	0.651	0.465	0.465	
06/15/2023	04:35	2.90	21:20	5.32	4.61	04:15	1.10	11:30	1.82	1.60	04:15	0.156	21:20	0.606	0.450	0.450	
06/16/2023	04:45	2.95	13:05	5.41	4.65	04:40	1.04	11:55	1.84	1.58	04:45	0.149	11:55	0.624	0.450	0.450	
06/17/2023	04:55	2.91	11:55	5.78	4.65	04:40	1.12	13:15	1.92	1.59	04:55	0.157	13:15	0.719	0.459	0.459	
06/18/2023	05:05	2.86	11:50	5.80	4.67	05:00	1.08	11:55	1.89	1.58	05:00	0.149	11:55	0.715	0.460	0.460	
06/19/2023	03:50	2.97	11:50	5.47	4.66	04:30	1.08	11:40	1.86	1.60	04:30	0.157	11:50	0.648	0.461	0.461	
06/20/2023	04:35	2.72	21:30	5.24	4.53	04:35	1.05	16:55	1.83	1.59	04:35	0.133	21:20	0.587	0.438	0.438	
06/21/2023	04:35	2.75	21:25	5.44	4.71	04:25	1.06	11:50	1.83	1.59	04:25	0.137	11:50	0.611	0.463	0.463	
06/22/2023	04:45	2.98	09:50	5.43	4.63	04:40	1.04	10:15	1.85	1.56	04:45	0.151	10:15	0.609	0.444	0.444	
06/23/2023	04:50	2.97	10:25	5.41	4.66	04:15	1.15	11:50	1.85	1.60	04:50	0.167	11:50	0.633	0.459	0.459	
06/24/2023	05:05	2.85	12:00	5.72	4.65	04:35	1.11	12:00	1.92	1.61	05:05	0.152	12:00	0.712	0.465	0.465	
06/25/2023	04:00	2.94	13:40	5.59	4.64	05:05	1.10	11:25	1.89	1.62	05:05	0.160	13:35	0.670	0.467	0.467	
06/26/2023	04:45	2.86	11:50	5.38	4.63	04:15	1.09	21:10	1.86	1.63	04:50	0.152	21:10	0.626	0.462	0.462	
06/27/2023	04:20	2.91	21:10	5.35	4.59	04:10	1.11	20:15	1.84	1.60	04:10	0.157	21:05	0.619	0.450	0.421	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			7.708
Average	4.63	1.60	0.455

FM_10

Site Commentary

SITE INFORMATION

Pipe	Round (17.13 in H)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned upstream of site FM_09. A review of flow balancing indicated no problems.

A meter issue at this site caused its start to be delayed until 14 June 2023.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	3.22	1.35	0.188
Minimum	2.13	0.86	0.065
Maximum	4.15	1.69	0.335
Min Time	06/14/2023 2:30:00 AM	06/24/2023 5:45:00 AM	06/25/2023 5:45:00 AM
Max Time	06/27/2023 10:00:00 PM	06/20/2023 3:00:00 PM	06/20/2023 3:00:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

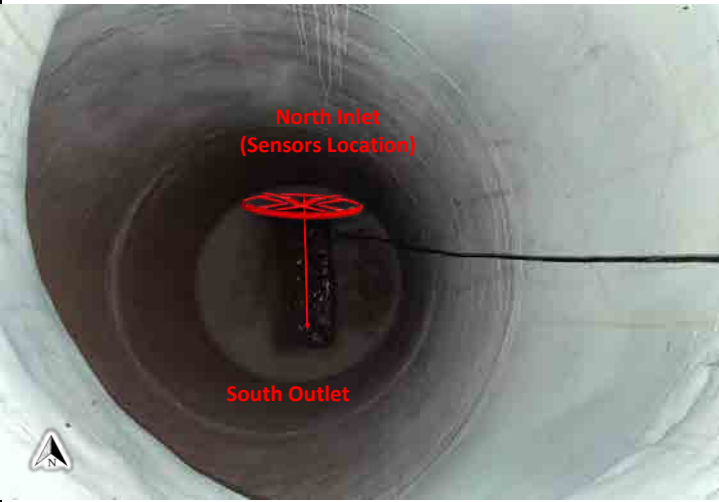
GoodYear.Carollo.TFM.AZ23				Site Name	
Flow Monitoring Site Report		FM_10			

Site Address /Location:	N Citrus Rd, about 575 ft south of Indian School Rd		Monitor Series	TRITON+		Location Type	Temporary		
Site Access Details:	No Traffic Control required	Latitude:	33.4499679	Pipe Size (H x W)	17.13"x 17.13"		Pipe Shape	Circular	
		Longitude:	-112.372242						



Manhole #	MH34A-102	System Characteristics	Residential
Access	Drive	Traffic	None





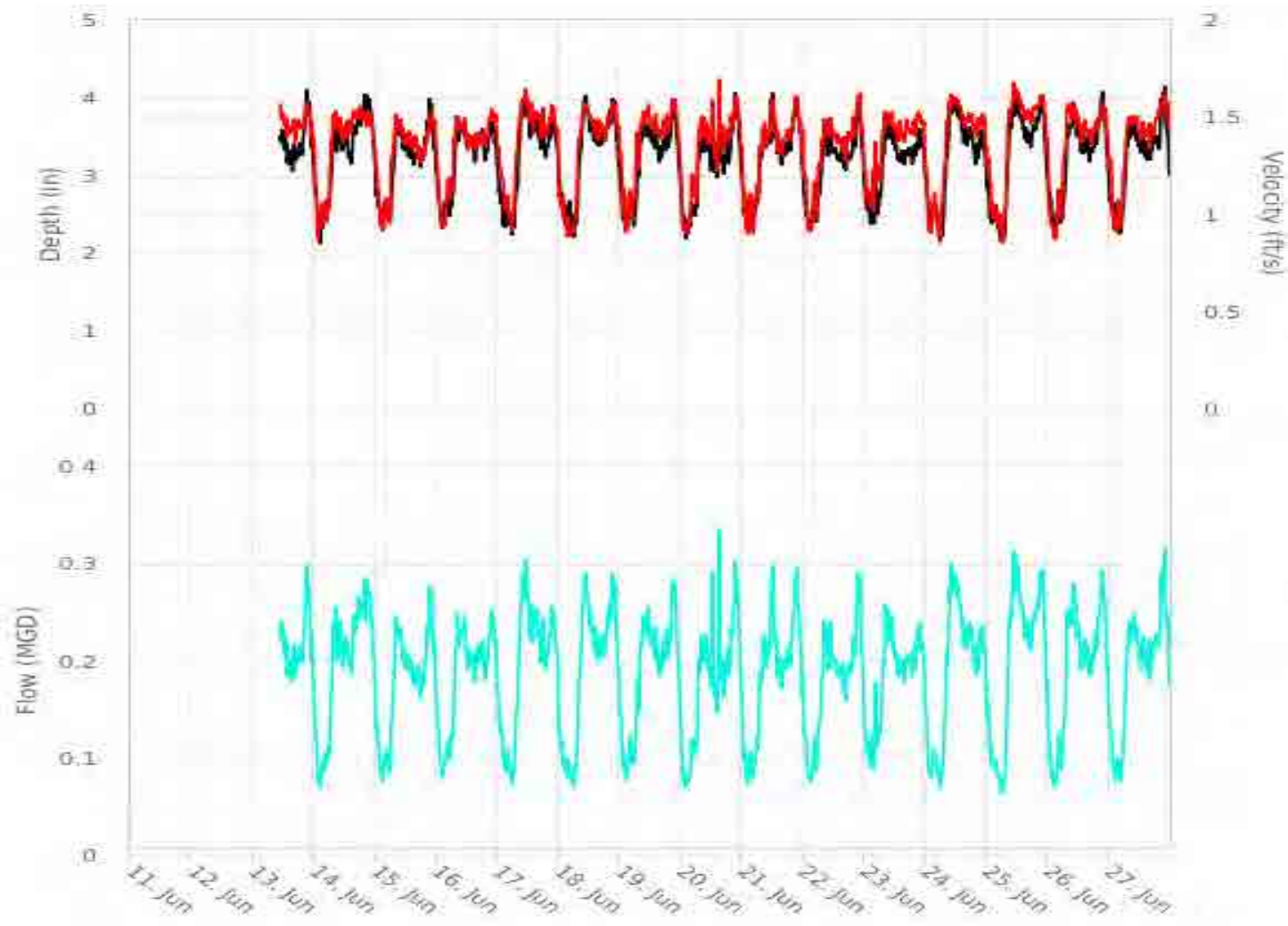
Installation Information	
Installation Date:	Thursday, June 8, 2023
Monitoring Location (Sensors):	Upstream 0-5 FT
Sensors / Devices:	Peak Combo (CS4)
Installation Type:	Doppler Standard Ring and Crank
Monitor Location:	Manhole
Pressure Sensor Range (psi)	0 - 5 psi
Installation Confirmation:	
Confirmation Time:	10:00:00 AM
Depth of Flow (Wet DOF) (in)	3.48"
Downlooker Physical Offset (in)	NA
Peak Velocity (fps)	1.53
Silt (in)	0"
Pipe Size (HxW)	17.13"x 17.13"
Range (Air DOF) (in)	-
Measurement Confidence (in)	0.25"
Velocity Sensor Offset (in)	0"
Silt Type	
Hydraulic Comments:	
Smooth flow with medium depth and moderate velocity	
Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	16.3
Manhole Material:	Concrete
Manhole Opening Diameter (in)	26"
Manhole Cover	Unbolted
Active Drop Connections	No
Pipe Material	PVC
Manhole Configuration	Single
Manhole Condition:	Good
Manhole Diameter (Approx.):	54"
Manhole Frame	Normal
Air Quality:	Normal
Pipe Condition:	Good
Communication Information:	
Communication Type	Wireless
Antenna Location	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	
No TC required	



ADS Project Name:	GoodYear.Carollo.TFM.AZ23
ADS Project Number:	22930.11.325

Hydrograph Report

FM_10



Scattergraph Report

FM_10

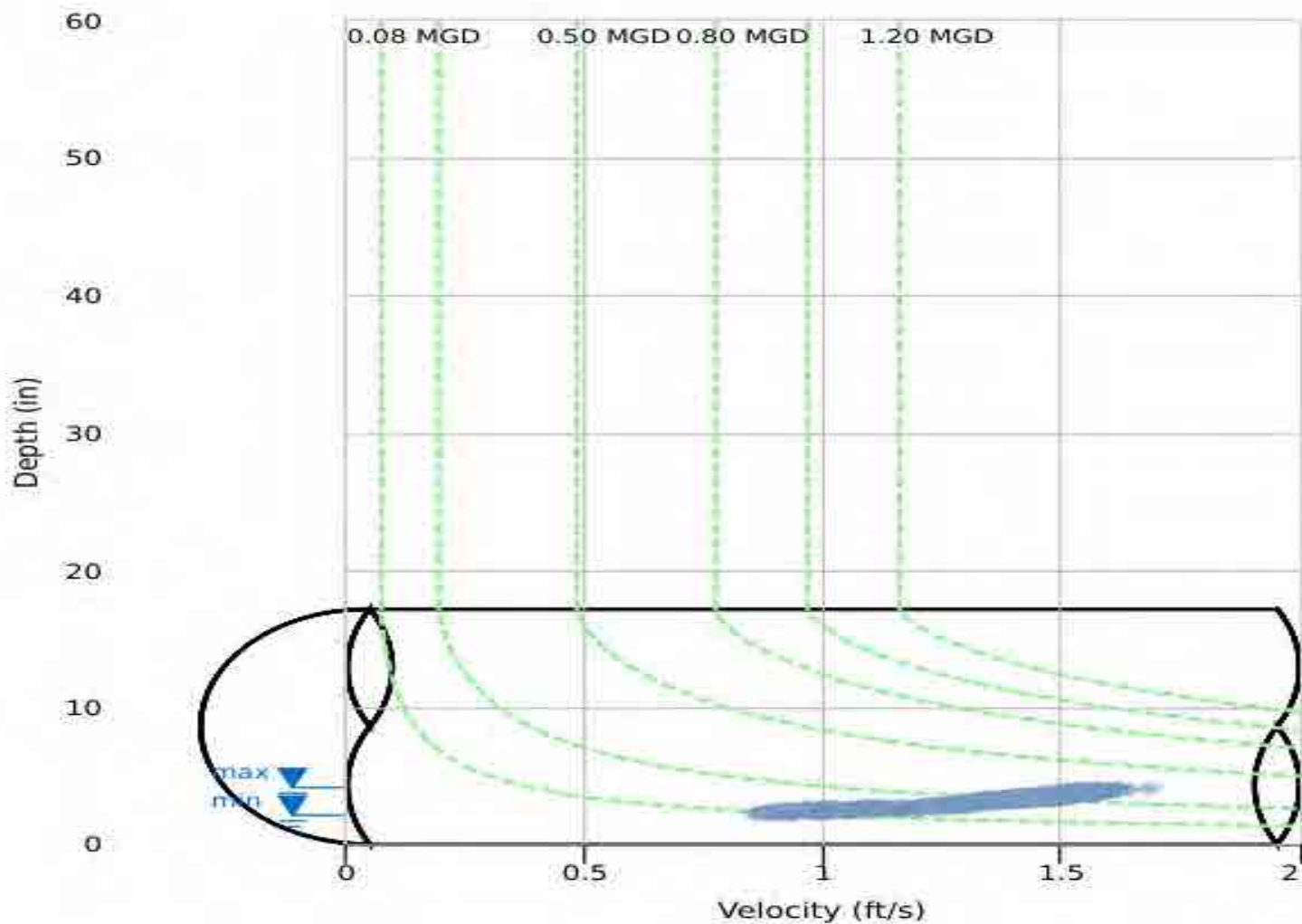
Flow Monitor
FM_10

Pipe Height
17.13
in

Report Period
06/11/2023
To
06/27/2023

Legend
□ DFINAL - VFINAL
--- Iso-Qth
▼ Min-Max Depth

ABS ENVIRONMENTAL
SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_10Pipe: Round (17.13 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
06/12/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
06/13/2023	15:40	3.01	21:05	4.17	3.43	14:10	1.31	21:05	1.59	1.47	14:10	0.169	21:05	0.310	0.217	0.118	
06/14/2023	02:40	2.10	19:50	4.06	3.29	01:45	0.86	18:00	1.57	1.35	02:40	0.065	19:50	0.287	0.194	0.194	
06/15/2023	03:25	2.29	21:30	4.01	3.18	02:45	0.91	22:10	1.54	1.31	03:25	0.076	21:35	0.280	0.178	0.178	
06/16/2023	02:20	2.30	08:15	3.81	3.21	02:10	0.93	21:55	1.55	1.33	02:20	0.078	21:55	0.257	0.183	0.183	
06/17/2023	05:55	2.21	11:25	4.06	3.24	05:05	0.91	09:40	1.67	1.38	05:55	0.072	11:20	0.312	0.194	0.194	
06/18/2023	06:00	2.20	10:30	4.04	3.25	05:55	0.86	21:15	1.63	1.32	06:10	0.068	21:15	0.298	0.189	0.189	
06/19/2023	02:55	2.30	21:40	3.99	3.20	02:50	0.90	20:40	1.62	1.36	02:55	0.075	21:40	0.296	0.187	0.187	
06/20/2023	02:10	2.15	12:25	5.10	3.12	01:55	0.89	12:25	2.06	1.32	02:10	0.070	12:25	0.532	0.177	0.177	
06/21/2023	02:35	2.18	11:25	4.14	3.23	02:25	0.87	21:30	1.63	1.33	02:25	0.069	11:55	0.306	0.186	0.186	
06/22/2023	02:55	2.25	21:45	3.98	3.14	02:50	0.88	21:40	1.65	1.33	02:50	0.072	21:45	0.299	0.177	0.177	
06/23/2023	03:00	2.29	08:20	3.78	3.15	03:55	0.92	08:25	1.56	1.37	04:05	0.079	08:25	0.264	0.182	0.182	
06/24/2023	05:35	2.10	10:05	4.06	3.20	05:50	0.85	10:05	1.64	1.35	05:35	0.066	10:05	0.308	0.189	0.189	
06/25/2023	06:00	2.09	10:50	4.10	3.25	05:45	0.84	10:45	1.68	1.37	06:00	0.064	10:50	0.319	0.198	0.198	
06/26/2023	02:45	2.23	21:25	4.18	3.25	03:20	0.86	21:20	1.64	1.35	02:45	0.069	21:25	0.319	0.192	0.192	
06/27/2023	04:20	2.23	22:05	4.17	3.24	03:30	0.88	22:00	1.64	1.37	05:05	0.074	22:05	0.319	0.192	0.191	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			2.737
Average	3.22	1.35	0.188

FM_11

Site Commentary

SITE INFORMATION

Pipe	Elliptical (18 in H x 18 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned upstream of site FM_16. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	4.17	1.41	0.292
Minimum	3.12	0.89	0.119
Maximum	5.27	1.87	0.517
Min Time	06/20/2023 4:00:00 AM	06/20/2023 3:45:00 AM	06/20/2023 4:00:00 AM
Max Time	06/21/2023 2:30:00 PM	06/21/2023 2:15:00 PM	06/21/2023 2:15:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



GoodYear.Carollo.TFM.AZ23				Site Name FM_11	
Flow Monitoring Site Report					

Site Address /Location:	14480-14624 W Van Buren St, Goodyear, AZ 85338		Monitor Series	TRITON+		Location Type	Temporary	
Site Access Details:	Traffic Control required	Latitude:	33.4499679	Pipe Size (H x W)	18.00"x 18.00"		Pipe Shape	Circular
		Longitude:	-112.372242					



Manhole #	MH58C-302
Access	Drive
System Characteristics	Industrial
	Traffic
	Medium





Installation Information	
Installation Date:	Wednesday, June 7, 2023
Monitoring Location (Sensors):	Upstream 0-5 FT
Sensors / Devices:	Peak Combo (CS4)
Installation Type:	Doppler Standard Ring and Crank
Monitor Location:	Manhole
Pressure Sensor Range (psi)	0 - 5 psi
Installation Confirmation:	
Confirmation Time:	8:00:00 AM
Depth of Flow (Wet DOF) (in)	4.50"
Downlooker Physical Offset (in)	NA
Peak Velocity (fps)	1.73
Silt (in)	0"
Pipe Size (HxW)	18.00"x 18.00"
Range (Air DOF) (in)	-
Measurement Confidence (in)	0.25"
Velocity Sensor Offset (in)	0"
Silt Type	
Hydraulic Comments:	
Smooth flow with medium depth and moderate velocity	
Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	15.06
Manhole Material:	Concrete
Manhole Opening Diameter (in)	26"
Manhole Cover	Unbolted
Active Drop Connections	No
Pipe Material	Vitrified Clay Pipe
Manhole Configuration	Single
Manhole Condition:	Good
Manhole Diameter (Approx.):	54"
Manhole Frame	Normal
Air Quality:	Normal
Pipe Condition:	Good
Communication Information:	
Communication Type	Wireless
Antenna Location	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	
TC required	



ADS Project Name:	GoodYear.Carollo.TFM.AZ23
ADS Project Number:	22930.11.325

Hydrograph Report
FM_11

Flow Monitor

FM_11

Pipe Height
18.00
in

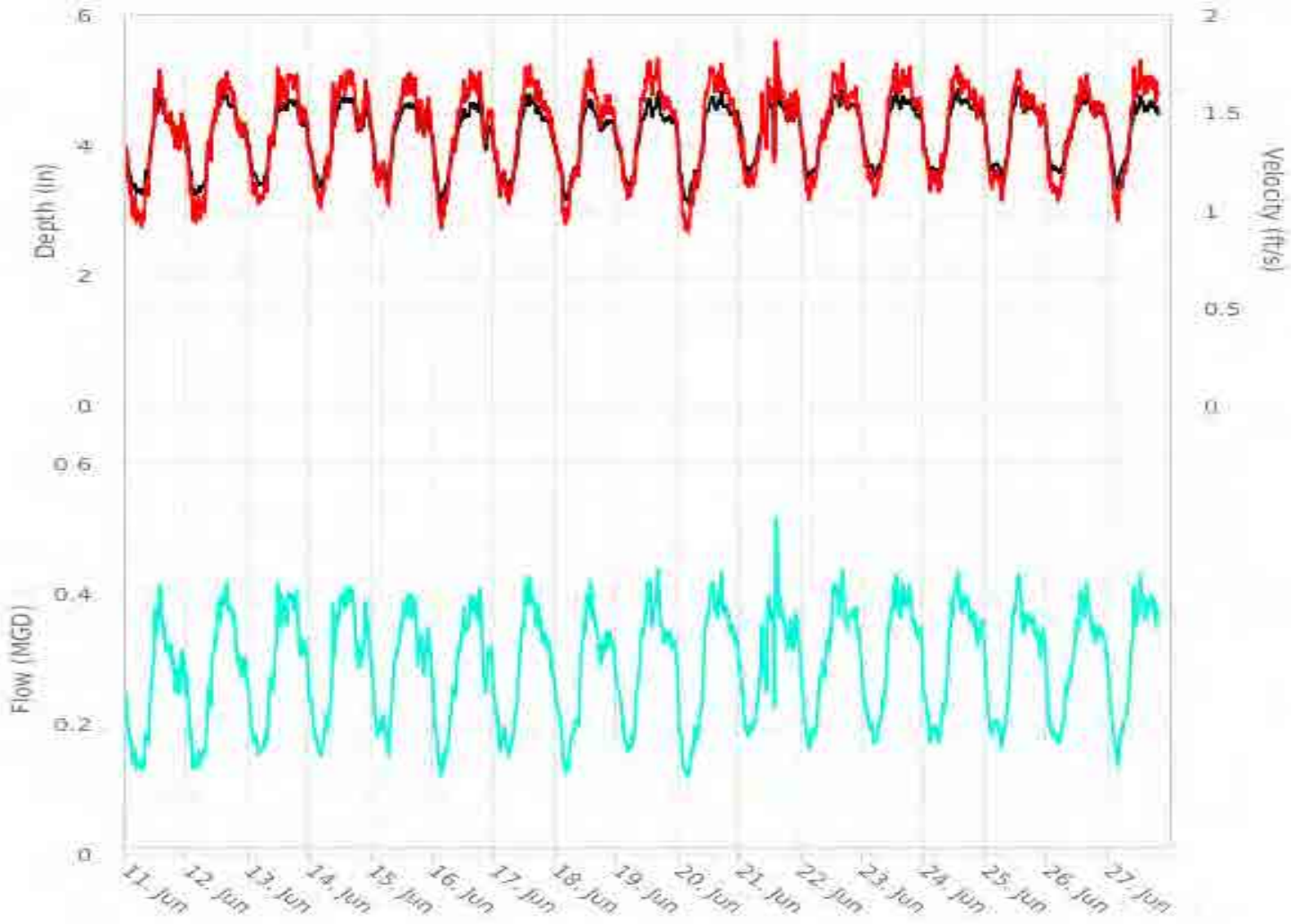
Report Period

06/11/2023
To
06/27/2023

Legend

— DFINAL
— QFINAL
— VFINAL

ABS ENVIRONMENTAL
SERVICES



Scattergraph Report

FM_11

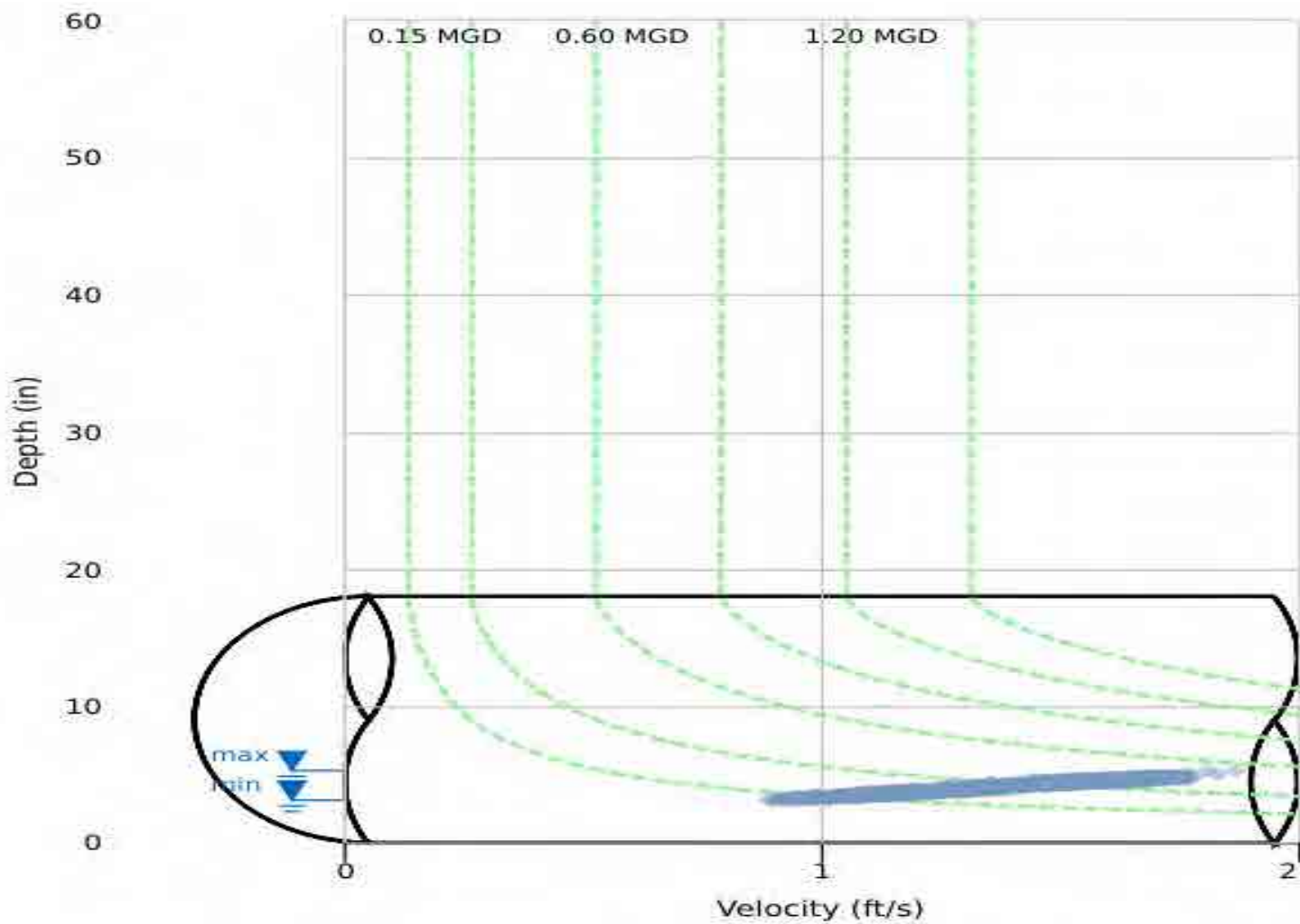
Flow Monitor
FM_11

Pipe Height
18.00
in

Report Period
06/11/2023
To
06/27/2023

Legend
□ DFINAL - VFINAL
--- Iso-QTH
▼ Min-Max Depth

ABS ENVIRONMENTAL
SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_11Pipe: Elliptical (18 in H x 18 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	06:20	3.24	13:10	4.77	3.98	06:15	0.90	13:10	1.75	1.31	06:15	0.126	13:10	0.424	0.253	0.253	
06/12/2023	03:25	3.22	15:25	4.80	4.10	03:30	0.91	15:30	1.72	1.36	03:30	0.126	15:30	0.421	0.276	0.276	
06/13/2023	03:45	3.40	11:25	4.82	4.16	03:50	1.01	11:30	1.76	1.41	03:50	0.151	11:25	0.430	0.289	0.289	
06/14/2023	04:05	3.35	09:00	4.76	4.20	04:05	1.00	09:00	1.76	1.44	04:05	0.147	09:00	0.425	0.299	0.299	
06/15/2023	06:45	3.39	15:00	4.69	4.17	06:45	1.02	15:05	1.74	1.43	06:45	0.152	15:05	0.408	0.292	0.292	
06/16/2023	03:15	3.12	18:30	4.74	4.08	03:20	0.90	14:40	1.75	1.40	03:20	0.119	18:25	0.414	0.280	0.280	
06/17/2023	05:45	3.32	14:10	4.81	4.11	05:40	0.99	14:10	1.76	1.41	05:40	0.144	14:10	0.432	0.285	0.285	
06/18/2023	04:05	3.15	13:45	4.75	4.06	03:55	0.91	13:45	1.80	1.39	03:55	0.123	13:45	0.434	0.277	0.277	
06/19/2023	04:20	3.38	16:05	4.84	4.19	04:20	1.05	16:05	1.80	1.46	04:20	0.156	16:05	0.445	0.301	0.301	
06/20/2023	03:55	3.10	16:55	4.86	4.13	02:40	0.87	13:45	1.78	1.40	03:55	0.114	16:55	0.438	0.287	0.287	
06/21/2023	03:40	3.57	14:30	5.28	4.29	02:30	1.07	14:15	1.89	1.44	03:45	0.173	14:20	0.521	0.306	0.306	
06/22/2023	03:25	3.47	16:15	4.87	4.28	03:05	1.04	16:05	1.78	1.45	03:30	0.160	16:05	0.443	0.308	0.308	
06/23/2023	04:50	3.52	13:10	4.83	4.27	04:40	1.05	13:30	1.79	1.45	04:45	0.167	13:30	0.442	0.308	0.308	
06/24/2023	02:50	3.49	13:25	4.89	4.26	05:30	1.07	13:10	1.77	1.45	05:30	0.169	13:10	0.440	0.307	0.307	
06/25/2023	06:25	3.50	13:05	4.93	4.24	06:20	1.03	12:40	1.74	1.42	06:20	0.162	13:00	0.439	0.297	0.297	
06/26/2023	05:05	3.58	15:30	4.82	4.25	04:35	1.04	15:40	1.71	1.41	04:40	0.168	15:40	0.419	0.295	0.295	
06/27/2023	04:00	3.31	12:40	4.78	4.20	03:55	0.94	10:15	1.79	1.43	03:55	0.136	12:35	0.431	0.299	0.245	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			4.905
Average	4.17	1.41	0.292

FM_12

Site Commentary

SITE INFORMATION

Pipe	Elliptical (12 in H x 11.5 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned upstream of site FM_16. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	3.49	1.04	0.131
Minimum	2.43	0.56	0.041
Maximum	4.60	1.55	0.258
Min Time	06/12/2023 4:45:00 AM	06/12/2023 4:30:00 AM	06/12/2023 4:30:00 AM
Max Time	06/21/2023 11:45:00 AM	06/21/2023 1:30:00 PM	06/21/2023 1:30:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

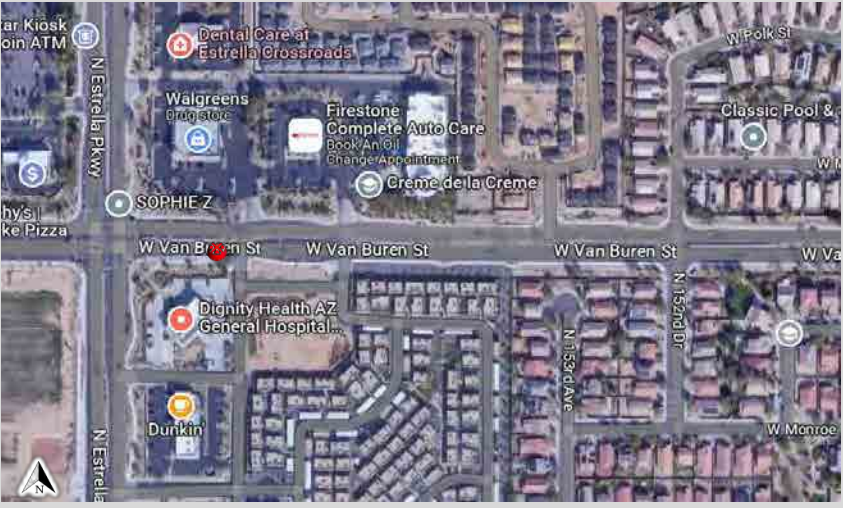
Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



GoodYear.Carollo.TFM.AZ23				Site Name	
Flow Monitoring Site Report		FM_12			

Site Address /Location:	251 N Estrella Pkwy, Goodyear, AZ 85338		Monitor Series	TRITON+		Location Type	Temporary	
Site Access Details:	Traffic Control required	Latitude:	33.4499772	Pipe Size (H x W)	12.00"x 11.50"		Pipe Shape	Elliptical
		Longitude:	-112.3916582					



Manhole #	System Characteristics
MH67A-104	Commercial
Access	Traffic
Drive	Heavy





Installation Information	
Installation Date:	Installation Type:
Tuesday, June 6, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Confirmation Time:	Pipe Size (HxW)
1:00:00 AM	12.00"x 11.50"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
2.88"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
0.91	0"
Silt (in)	Silt Type
0"	
Hydraulic Comments:	
Smooth flow with low depth and low velocity	
Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
10.12	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Vitrified Clay Pipe	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	
TC required	

ADS Project Name:	GoodYear.Carollo.TFM.AZ23
ADS Project Number:	22930.11.325

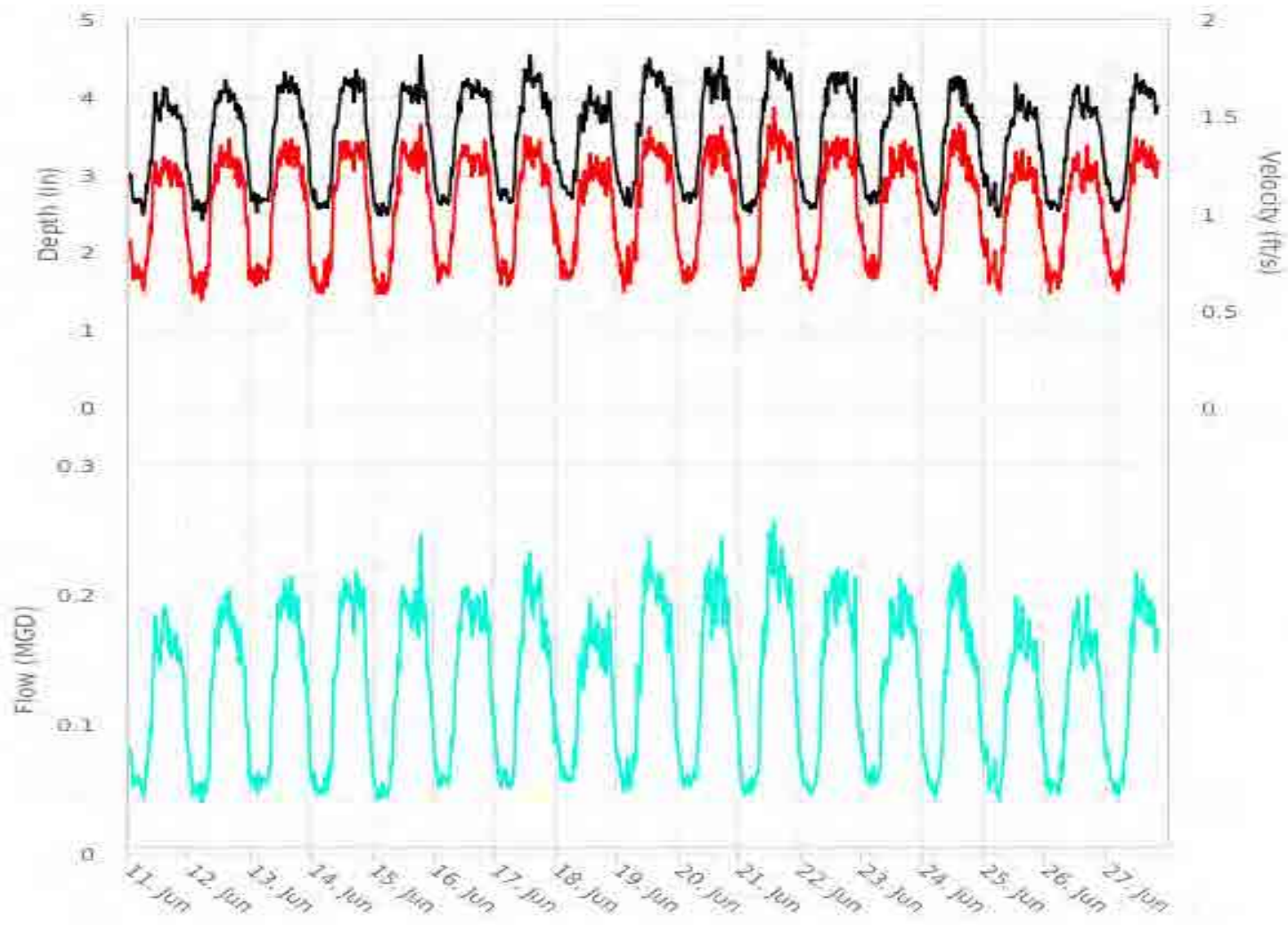
Hydrograph Report

FM_12

Flow Monitor FM_12

Report Period 06/11/2023 To 06/27/2023
Legend — DFINAL — QFINAL — VFINAL

ABS ENVIRONMENTAL SERVICES



Scattergraph Report
FM_12

Flow Monitor

FM_12

Pipe Height
12.00
in

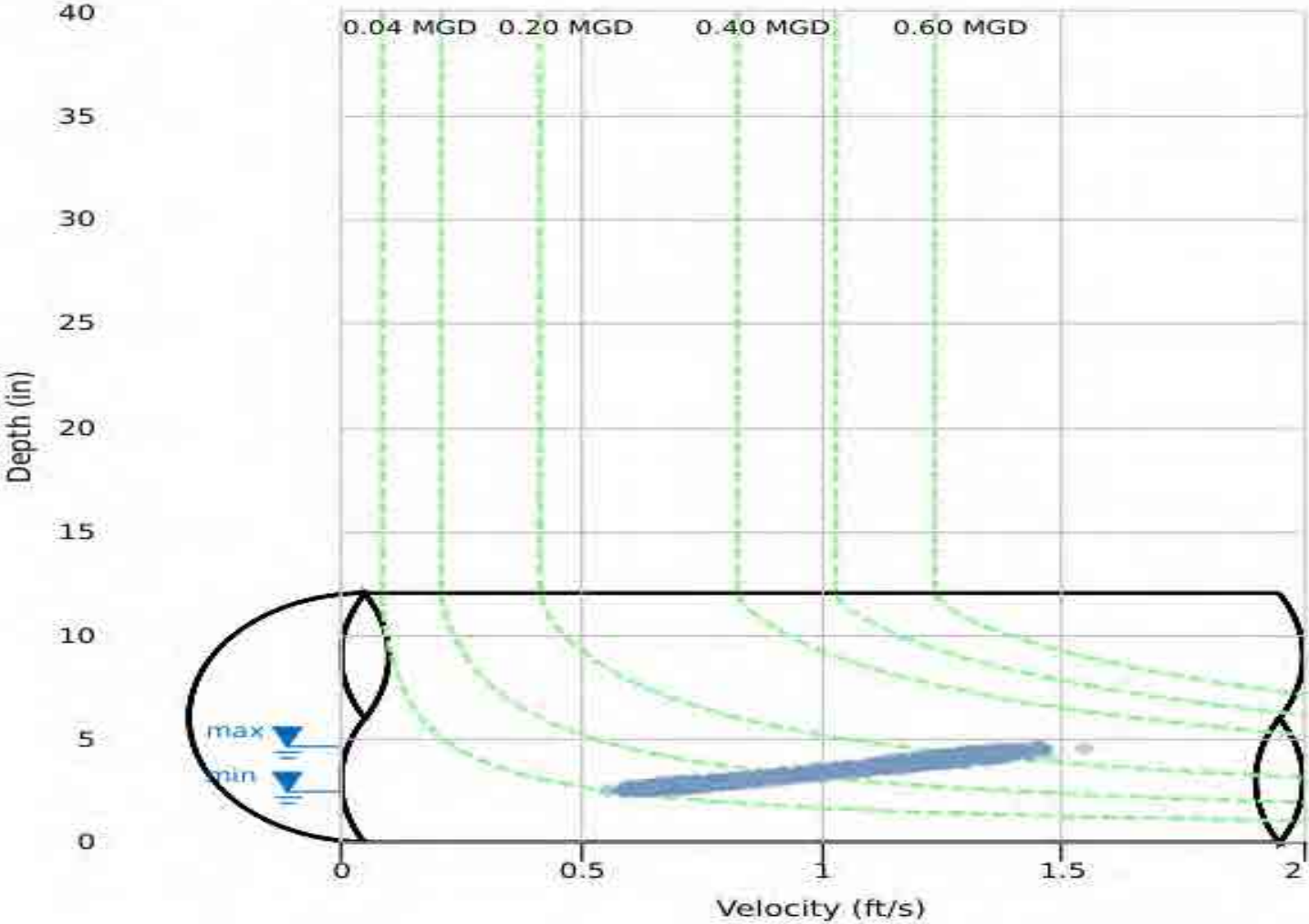
Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL - VFINAL
- Iso-Qth
- Min-Max Depth

ABS ENVIRONMENTAL
SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_12Pipe: Elliptical (12 in H x 11.5 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	05:40	2.48	13:40	4.18	3.38	05:50	0.60	13:50	1.33	1.00	05:50	0.043	13:50	0.198	0.119	0.119	
06/12/2023	04:45	2.42	14:05	4.27	3.41	04:35	0.55	15:30	1.41	1.01	04:35	0.039	15:50	0.211	0.124	0.124	
06/13/2023	02:20	2.51	13:15	4.34	3.47	01:45	0.60	16:00	1.40	1.03	02:35	0.045	13:10	0.219	0.129	0.129	
06/14/2023	02:10	2.57	17:25	4.37	3.49	04:10	0.57	13:00	1.44	1.04	04:10	0.044	13:00	0.225	0.132	0.132	
06/15/2023	03:30	2.47	18:30	4.66	3.47	01:55	0.57	18:30	1.53	1.04	03:30	0.041	18:30	0.267	0.131	0.131	
06/16/2023	05:35	2.61	13:15	4.27	3.57	01:35	0.61	11:45	1.39	1.07	01:35	0.050	11:45	0.213	0.138	0.138	
06/17/2023	06:05	2.63	13:55	4.63	3.57	04:50	0.60	11:35	1.45	1.05	05:55	0.049	14:00	0.244	0.135	0.135	
06/18/2023	06:10	2.69	13:25	4.16	3.46	03:40	0.64	13:25	1.35	1.01	04:30	0.054	13:25	0.203	0.122	0.122	
06/19/2023	05:05	2.58	12:25	4.58	3.61	02:45	0.59	12:25	1.53	1.08	02:45	0.047	12:25	0.260	0.142	0.142	
06/20/2023	04:30	2.63	16:50	4.56	3.57	02:15	0.61	16:50	1.47	1.06	02:15	0.050	16:50	0.249	0.137	0.137	
06/21/2023	04:20	2.50	11:40	4.69	3.60	01:50	0.60	13:35	1.59	1.08	01:50	0.046	13:35	0.268	0.144	0.144	
06/22/2023	03:40	2.56	21:30	4.46	3.56	04:25	0.57	21:30	1.46	1.07	04:25	0.043	21:30	0.240	0.139	0.139	
06/23/2023	03:40	2.62	15:15	4.32	3.52	03:15	0.65	17:05	1.40	1.06	06:00	0.051	15:20	0.215	0.134	0.134	
06/24/2023	04:55	2.48	13:15	4.31	3.46	05:20	0.60	14:15	1.48	1.06	05:20	0.044	12:20	0.227	0.131	0.131	
06/25/2023	06:10	2.42	12:40	4.22	3.36	06:00	0.57	15:00	1.38	1.00	06:00	0.041	12:45	0.208	0.117	0.117	
06/26/2023	05:25	2.53	12:40	4.18	3.41	02:00	0.58	16:50	1.37	1.01	02:00	0.045	16:50	0.206	0.121	0.121	
06/27/2023	04:40	2.52	12:05	4.32	3.48	04:35	0.60	12:45	1.44	1.04	04:35	0.045	12:05	0.224	0.131	0.111	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			2.205
Average	3.49	1.04	0.131

FM_13

Site Commentary

SITE INFORMATION

Pipe	Elliptical (23.75 in H x 24 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were experienced during the study. Backwater conditions were observed on 22 June 2023.

This site was positioned downstream of site FM_09 and upstream of site FM_05. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	9.89	2.22	1.792
Minimum	6.32	1.42	0.614
Maximum	14.82	3.10	3.929
Min Time	06/11/2023 6:00:00 AM	06/11/2023 5:30:00 AM	06/11/2023 6:00:00 AM
Max Time	06/23/2023 1:00:00 PM	06/22/2023 11:45:00 PM	06/23/2023 11:45:00 AM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



GoodYear.Carollo.TFM.AZ23				Site Name	
Flow Monitoring Site Report				FM_13	

Site Address /Location:	W Yuma and Sariva ave		Monitor Series	Location Type	
			TRITON+	Temporary	
Site Access Details:	Traffic Control required	Latitude:	33.4343999	Pipe Size (H x W)	Pipe Shape
		Longitude:	-112.4095445	23.75"x 24.00"	Elliptical



Manhole #	System Characteristics
MH75B-203	Commercial
Access	Traffic
Drive	Heavy





Installation Information	
Installation Date:	Installation Type:
Wednesday, June 7, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Confirmation Time:	Pipe Size (HxW)
9:00:00 PM	23.75"x 24.00"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
10.38"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.51	0"
Silt (in)	Silt Type
0"	
Hydraulic Comments:	
Smooth flow with low depth and low velocity	
Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
17.628	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Vitrified Clay Pipe	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	
No TC required	

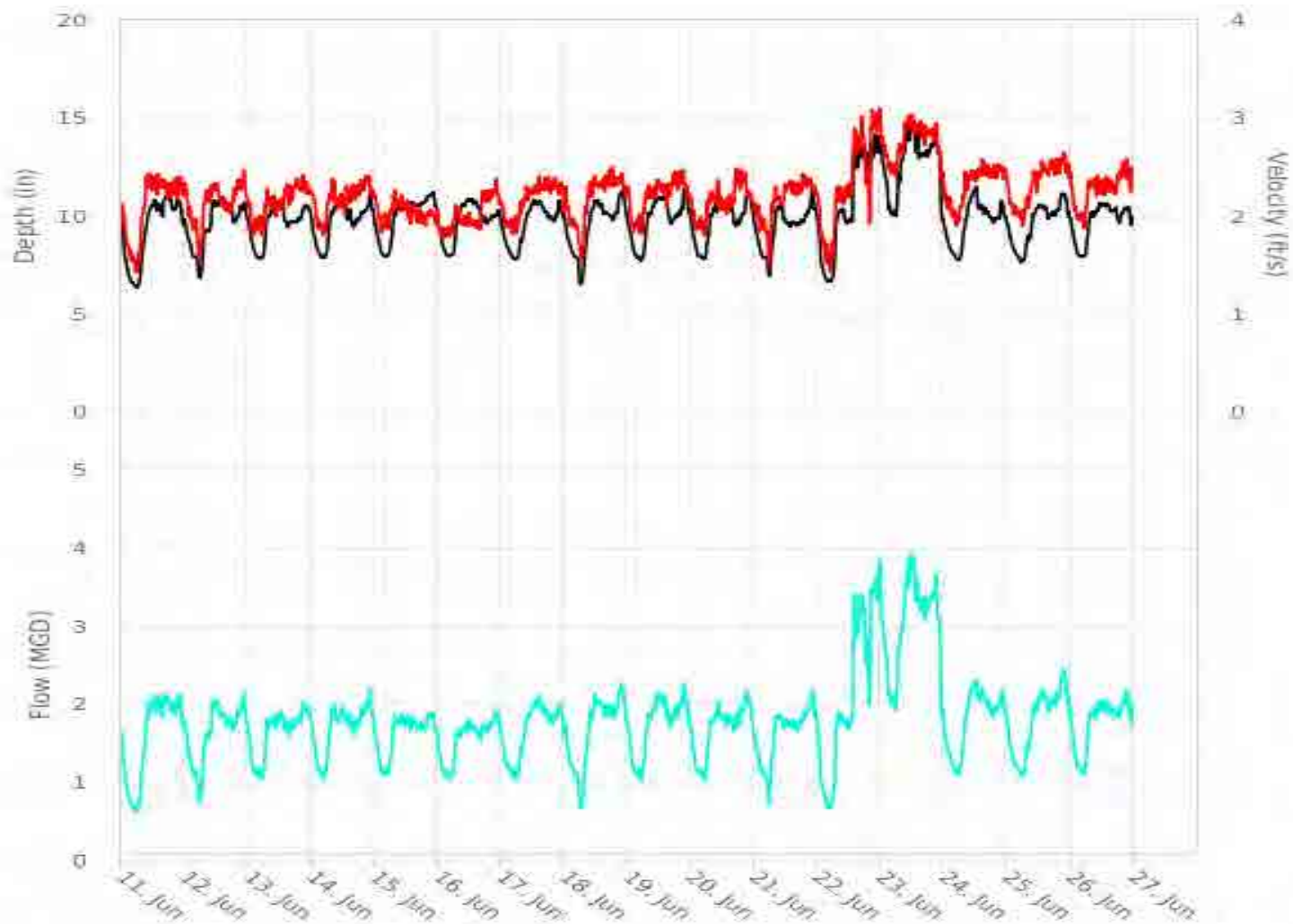
ADS Project Name:	GoodYear.Carollo.TFM.AZ23
ADS Project Number:	22930.11.325

Hydrograph Report

FM_13

Flow Monitor FM_13
 Pipe Height 23.75 in
Report Period 06/11/2023 To 06/27/2023
Legend — DFINAL — QFINAL — VFINAL

ABS ENVIRONMENTAL SERVICES



Scattergraph Report

FM_13

Flow Monitor

FM_13

Pipe Height
23.75
in

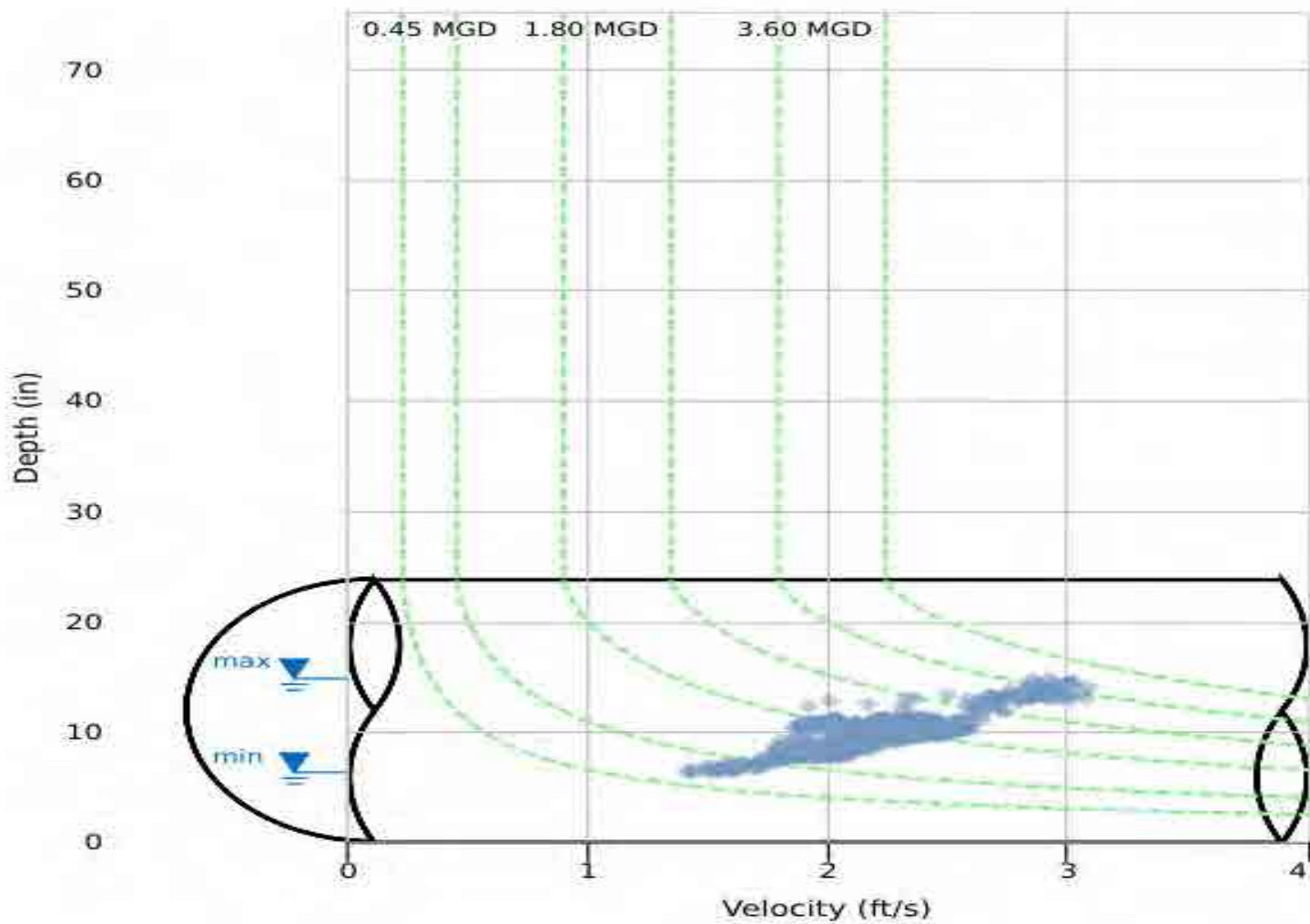
Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL - VFINAL
- Iso-Qth
- Min-Max Depth

ABS ENVIRONMENTAL SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_13Pipe: Elliptical (23.75 in H x 24 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	06:10	6.30	17:40	11.05	9.28	06:10	1.36	11:05	2.53	2.10	06:10	0.582	22:00	2.196	1.586	1.586	
06/12/2023	05:50	6.83	11:05	10.86	9.56	06:15	1.53	22:40	2.56	2.14	06:15	0.741	22:40	2.255	1.638	1.638	
06/13/2023	05:05	7.79	13:05	10.87	9.60	02:30	1.75	20:40	2.46	2.14	05:15	1.011	20:55	2.056	1.640	1.640	
06/14/2023	05:05	7.84	22:30	11.16	9.71	04:55	1.72	08:10	2.53	2.17	04:55	0.998	22:15	2.246	1.691	1.691	
06/15/2023	04:45	7.90	22:10	11.25	9.96	02:30	1.78	07:45	2.30	2.04	03:35	1.078	22:10	1.930	1.632	1.632	
06/16/2023	04:00	7.94	12:45	10.94	9.73	04:55	1.71	22:20	2.40	2.01	04:55	1.008	22:45	1.987	1.563	1.563	
06/17/2023	05:55	7.79	12:35	10.88	9.59	06:15	1.75	18:10	2.51	2.17	06:15	1.008	14:45	2.144	1.666	1.666	
06/18/2023	06:30	6.47	22:20	11.34	9.51	06:40	1.50	17:20	2.55	2.18	06:40	0.675	22:00	2.324	1.669	1.669	
06/19/2023	05:05	7.67	21:40	11.39	9.81	02:40	1.77	18:10	2.53	2.20	05:05	0.993	21:25	2.348	1.745	1.745	
06/20/2023	05:05	7.77	21:50	11.27	9.74	05:35	1.75	17:35	2.51	2.15	05:35	1.015	21:05	2.259	1.683	1.683	
06/21/2023	06:00	6.89	22:10	11.33	9.45	05:55	1.45	13:45	2.53	2.16	05:55	0.704	22:00	2.217	1.629	1.629	
06/22/2023	04:10	6.62	23:50	14.47	10.58	05:10	1.38	21:10	3.18	2.31	05:10	0.635	23:50	4.039	2.123	2.123	
06/23/2023	23:30	9.83	12:55	14.90	12.70	23:55	2.30	11:50	3.09	2.76	23:25	1.816	11:50	3.999	3.037	3.037	
06/24/2023	05:40	7.71	12:20	11.65	9.68	05:00	1.78	14:45	2.67	2.32	05:00	1.025	12:35	2.347	1.806	1.806	
06/25/2023	05:30	7.60	21:00	11.21	9.59	06:10	1.83	21:35	2.69	2.32	06:10	1.033	21:30	2.487	1.790	1.790	
06/26/2023	04:15	7.89	11:25	10.77	9.71	05:25	1.81	20:25	2.62	2.27	05:25	1.063	21:55	2.219	1.772	1.754	
06/27/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			28.652
Average	9.89	2.22	1.792

FM_14

Site Commentary

SITE INFORMATION

Pipe	Elliptical (11.88 in H x 11.88 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned upstream of site FM_06. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	2.74	1.91	0.179
Minimum	1.32	0.82	0.025
Maximum	4.07	2.45	0.369
Min Time	06/18/2023 5:45:00 AM	06/11/2023 4:45:00 AM	06/11/2023 5:45:00 AM
Max Time	06/11/2023 9:00:00 PM	06/11/2023 9:00:00 PM	06/11/2023 9:00:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



GoodYear.Carollo.TFM.AZ23				Site Name	
Flow Monitoring Site Report		FM_14			

Site Address /Location:	4219 S 181st Dr, Goodyear, AZ 85338		Monitor Series	TRITON+		Location Type	Temporary	
Site Access Details:	Traffic Control required	Latitude:	33.4071617	Pipe Size (H x W)	11.88"x 11.88"		Pipe Shape	Circular
		Longitude:	-112.4489827					



Manhole #	System Characteristics
MH83D-302	Residential
Access	Traffic
Drive	Light





Installation Information	
Installation Date:	Installation Type:
Thursday, June 8, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Confirmation Time:	Pipe Size (HxW)
9:30:00 PM	11.88"x11.88"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
3.38"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.55	0"
Silt (in)	Silt Type
0"	
Hydraulic Comments:	
Smooth flow with low depth and low velocity	
Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
21	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Vitrified Clay Pipe	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	
TC required site located in a cul-va-sac	



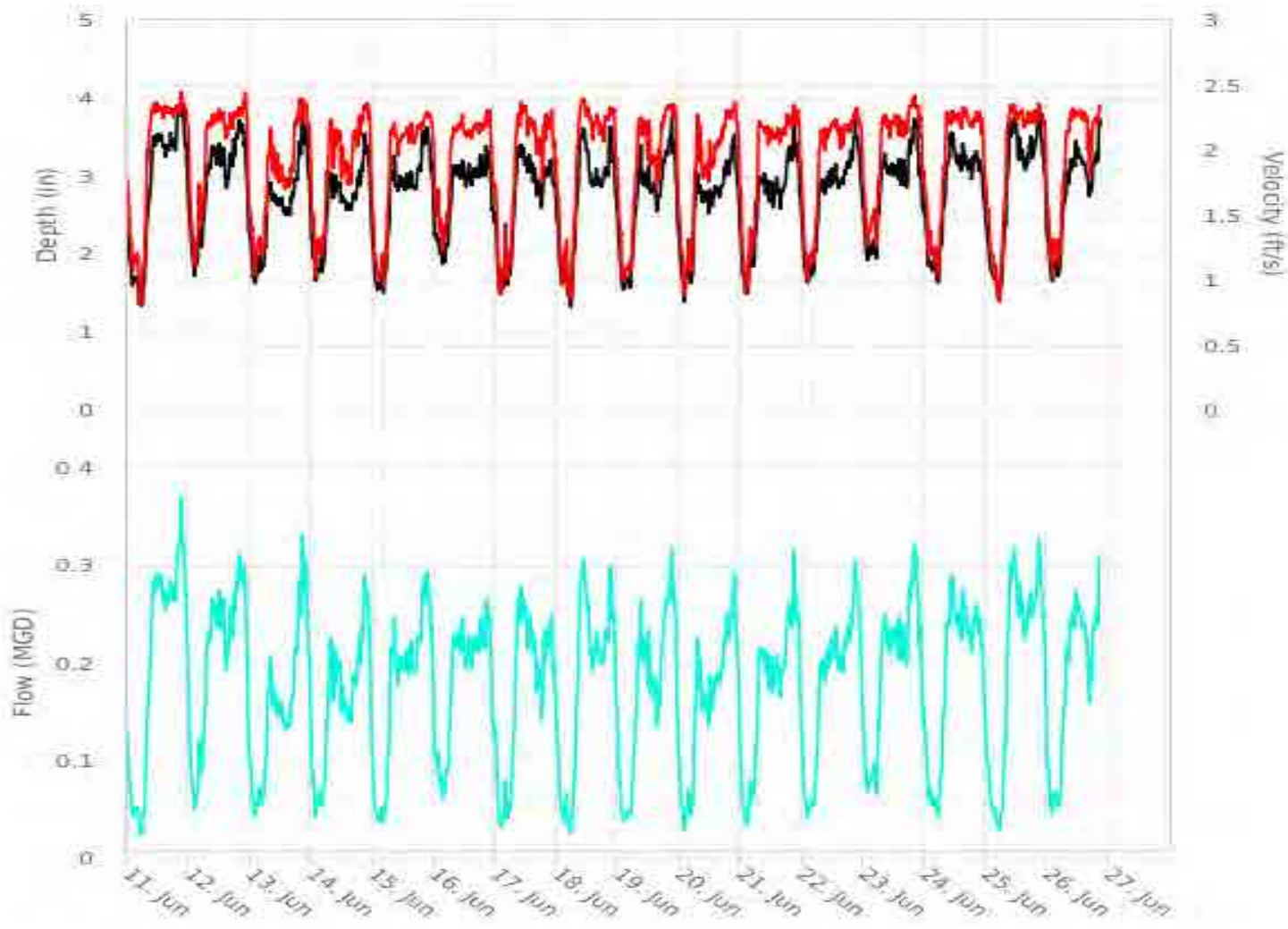
ADS Project Name:	GoodYear.Carollo.TFM.AZ23
ADS Project Number:	22930.11.325

Hydrograph Report

FM_14

Flow Monitor
FM_14
Pipe Height 11.88 in
Report Period
06/11/2023 To 06/27/2023
Legend
— DFINAL — QFINAL — VFINAL

ABS ENVIRONMENTAL SERVICES



Scattergraph Report

FM_14

Flow Monitor

FM_14

Pipe Height
11.88
in

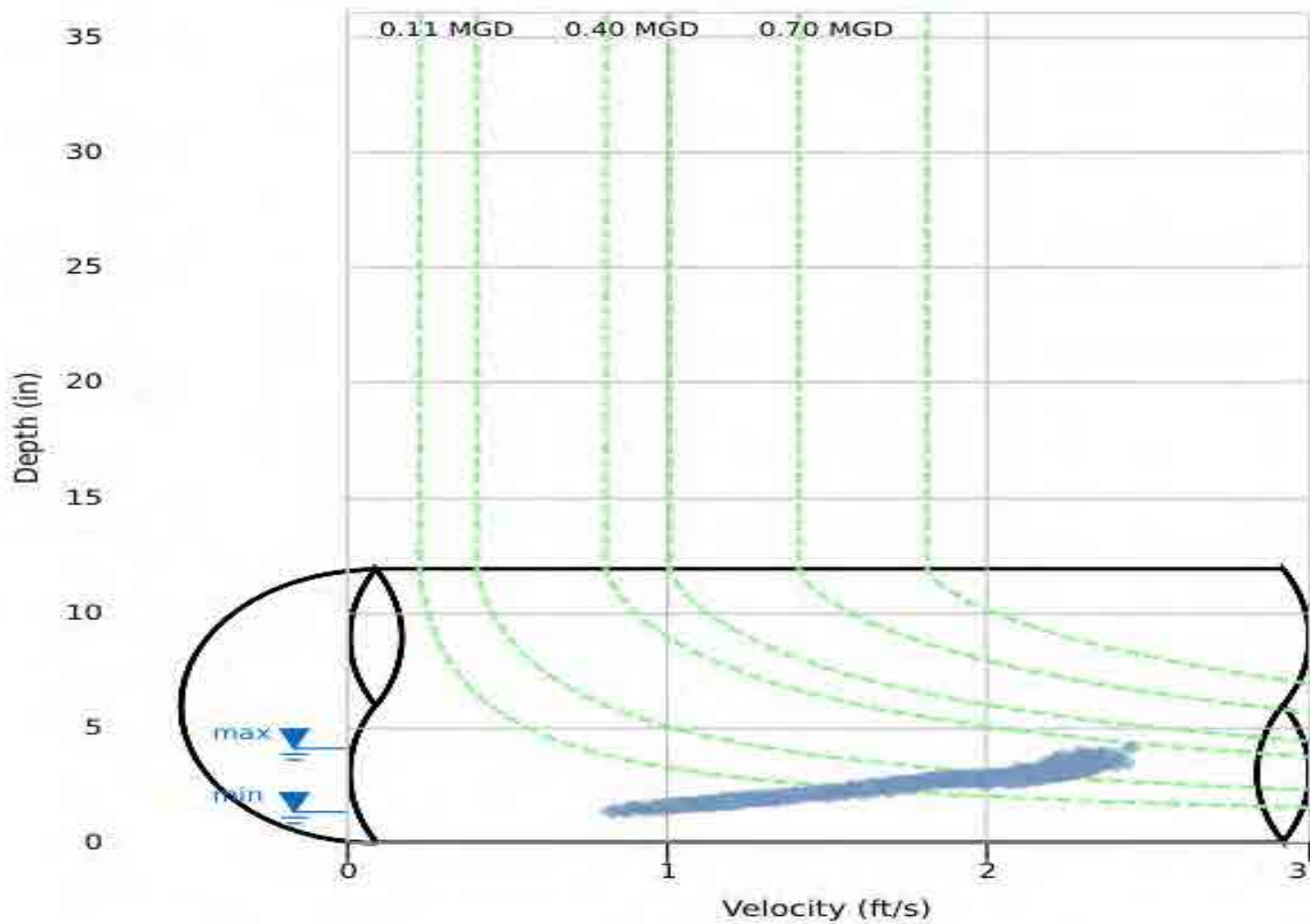
Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL - VFINAL
- Iso-Qth
- ▼ Min-Max Depth

ABS ENVIRONMENTAL SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_14Pipe: Elliptical (11.88 in H x 11.88 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	05:45	1.31	21:10	4.14	2.86	04:45	0.79	21:10	2.45	1.95	04:50	0.025	21:10	0.379	0.202	0.202	
06/12/2023	02:25	1.69	20:55	3.77	2.93	02:25	1.11	21:40	2.46	2.01	02:25	0.048	20:10	0.317	0.203	0.203	
06/13/2023	02:00	1.61	20:25	3.96	2.62	01:50	1.00	21:55	2.45	1.81	01:50	0.041	20:30	0.346	0.158	0.158	
06/14/2023	02:00	1.62	21:10	3.62	2.62	01:50	0.99	22:00	2.38	1.87	01:50	0.041	21:10	0.299	0.161	0.161	
06/15/2023	04:20	1.49	21:30	3.70	2.71	04:25	0.94	21:30	2.33	1.89	04:25	0.034	21:30	0.308	0.175	0.175	
06/16/2023	03:20	1.86	20:25	3.45	2.78	03:35	1.20	20:50	2.32	1.96	03:20	0.061	20:25	0.276	0.181	0.181	
06/17/2023	02:00	1.46	11:00	3.48	2.67	02:00	0.85	10:10	2.41	1.86	02:00	0.030	10:10	0.285	0.170	0.170	
06/18/2023	05:35	1.28	20:55	3.70	2.70	04:45	0.81	10:15	2.42	1.89	05:35	0.025	10:15	0.312	0.177	0.177	
06/19/2023	02:05	1.54	21:20	3.78	2.67	02:50	0.96	21:20	2.44	1.85	02:50	0.037	21:20	0.333	0.168	0.168	
06/20/2023	02:00	1.36	21:55	3.60	2.62	01:50	0.82	22:10	2.40	1.84	01:55	0.027	21:55	0.299	0.161	0.161	
06/21/2023	02:25	1.48	21:05	3.80	2.66	02:00	0.89	21:00	2.37	1.91	02:00	0.032	21:05	0.323	0.171	0.171	
06/22/2023	02:20	1.62	21:05	3.88	2.74	02:30	0.94	21:45	2.36	1.92	02:30	0.039	21:05	0.315	0.178	0.178	
06/23/2023	02:15	1.90	20:25	3.80	2.87	05:15	1.23	19:55	2.43	2.01	05:15	0.066	20:25	0.326	0.195	0.195	
06/24/2023	05:10	1.62	11:15	3.60	2.78	05:25	0.98	15:10	2.39	1.93	05:25	0.041	15:15	0.299	0.184	0.184	
06/25/2023	05:10	1.36	20:45	3.86	2.86	05:30	0.79	10:30	2.38	1.91	05:25	0.027	20:45	0.330	0.195	0.195	
06/26/2023	02:10	1.64	20:45	3.80	2.75	02:10	1.03	20:50	2.42	1.91	02:10	0.043	20:50	0.321	0.180	0.158	
06/27/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			2.837
Average	2.74	1.91	0.179

FM_15

Site Commentary

SITE INFORMATION

Pipe	Elliptical (24 in H x 24 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were experienced during the study. Backwater conditions were observed on 12 June 2023 and 13 June 2023.

This site was positioned downstream of site FM_05. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	9.45	2.86	2.133
Minimum	6.82	2.48	1.232
Maximum	12.34	3.10	3.198
Min Time	06/22/2023 4:45:00 AM	06/13/2023 3:30:00 AM	06/18/2023 7:00:00 AM
Max Time	06/23/2023 10:00:00 PM	06/23/2023 7:15:00 PM	06/23/2023 5:30:00 PM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100



GoodYear.Carollo.TFM.AZ23				Site Name	
Flow Monitoring Site Report				FM_15	

Site Address /Location:	4980 S 157th Ave, Goodyear, AZ 85338		Monitor Series	TRITON+		Location Type	Temporary	
Site Access Details:	No Traffic Control required	Latitude:	33.4030411	Pipe Size (H x W)	24.00"x 24.00"	Pipe Shape	Circular	
		Longitude:	-112.4008065					



Manhole #	System Characteristics
MH96B-108	Residential
Access	Traffic
Drive	Light





Installation Information	
Installation Date:	Installation Type:
Tuesday, June 6, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Confirmation Time:	Pipe Size (HxW)
8:00:00 PM	24.00"x24.00"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
10.50"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
3.25	0"
Silt (in)	Silt Type
0"	
Hydraulic Comments:	
Smooth flow with low depth and low velocity	
Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
8.634	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Vitrified Clay Pipe	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	
No TC required	



ADS Project Name:	GoodYear.Carollo.TFM.AZ23
ADS Project Number:	22930.11.325

Hydrograph Report
FM_15

Flow Monitor

FM_15

Pipe Height
24.00
in

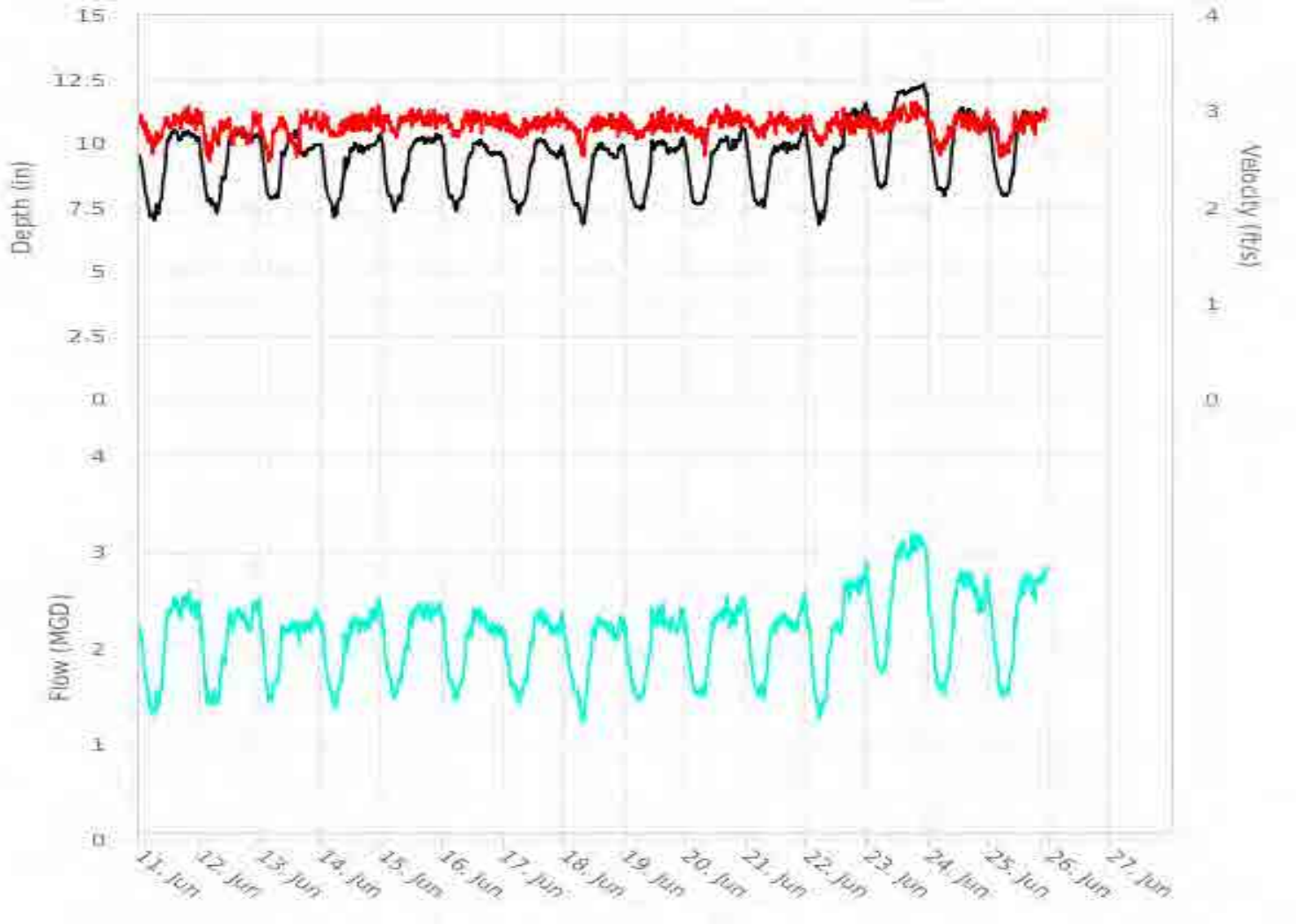
Report Period

06/11/2023
To
06/27/2023

Legend

— DFINAL
— QFINAL
— VFINAL

ABS ENVIRONMENTAL
SERVICES



Scattergraph Report

FM_15

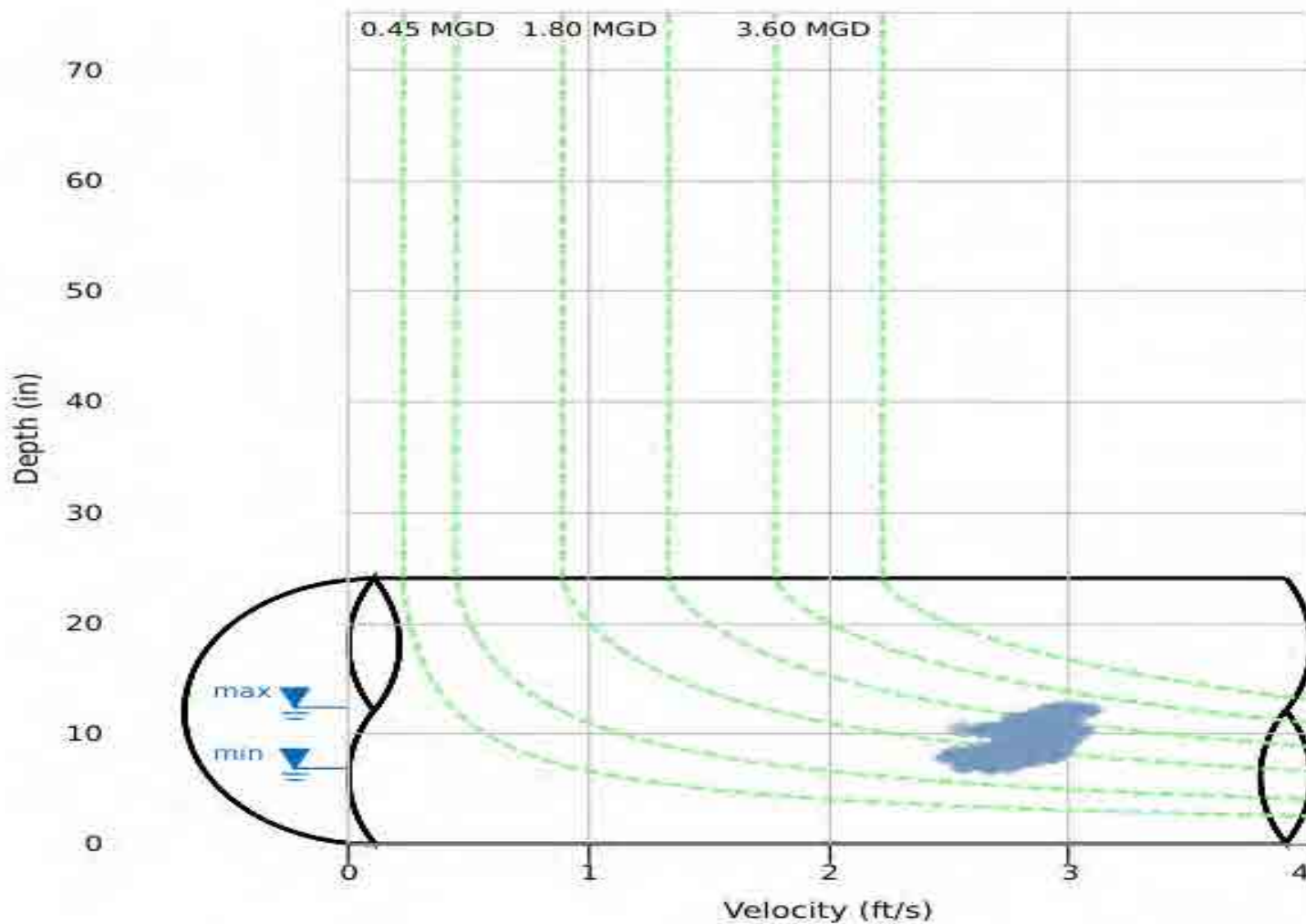
Flow Monitor
FM_15

Pipe Height
24.00
in

Report Period
06/11/2023
To
06/27/2023

Legend
□ DFINAL - VFINAL
--- Iso-QTM
▼ Min-Max Depth

ABS ENVIRONMENTAL SERVICES



Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_15Pipe: Elliptical (24 in H x 24 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	
06/11/2023	06:15	6.94	13:50	10.60	9.27	05:40	2.54	17:30	3.11	2.86	06:15	1.266	19:40	2.663	2.085	2.085	
06/12/2023	06:50	7.26	15:20	10.55	9.34	04:00	2.45	00:50	3.04	2.79	04:50	1.350	23:50	2.546	2.047	2.047	
06/13/2023	04:10	7.78	14:05	10.57	9.39	03:40	2.44	22:10	3.06	2.79	03:40	1.401	22:25	2.429	2.056	2.056	
06/14/2023	05:05	7.08	23:20	10.43	9.16	06:05	2.70	22:35	3.11	2.87	05:05	1.361	23:05	2.555	2.054	2.054	
06/15/2023	05:00	7.30	21:45	10.42	9.30	06:00	2.69	15:05	3.10	2.91	04:55	1.449	18:40	2.543	2.118	2.118	
06/16/2023	05:40	7.31	14:50	10.21	9.12	06:05	2.68	14:00	3.08	2.89	05:15	1.436	14:00	2.480	2.053	2.053	
06/17/2023	06:05	7.13	14:55	10.26	9.01	07:05	2.68	23:15	3.07	2.87	06:05	1.390	16:25	2.447	2.005	2.005	
06/18/2023	07:40	6.79	14:45	10.03	8.90	08:05	2.46	19:10	3.05	2.84	08:05	1.195	14:45	2.404	1.957	1.957	
06/19/2023	06:10	7.37	22:50	10.33	9.13	16:20	2.64	15:00	3.06	2.86	04:15	1.434	15:00	2.502	2.035	2.035	
06/20/2023	04:45	7.56	22:35	10.68	9.26	07:40	2.47	16:20	3.12	2.87	07:40	1.416	16:20	2.605	2.089	2.089	
06/21/2023	06:40	7.47	23:00	10.76	9.28	04:50	2.67	12:45	3.05	2.87	07:00	1.458	23:25	2.642	2.090	2.090	
06/22/2023	04:55	6.78	23:10	11.59	9.64	06:00	2.56	14:40	3.06	2.85	05:00	1.252	23:35	2.897	2.185	2.185	
06/23/2023	05:10	8.22	22:00	12.36	10.92	08:25	2.67	19:15	3.15	2.93	06:00	1.720	19:15	3.242	2.643	2.643	
06/24/2023	06:10	7.90	13:25	11.43	10.11	04:30	2.50	13:10	3.07	2.83	06:00	1.498	13:10	2.915	2.314	2.314	
06/25/2023	05:50	7.91	22:25	11.35	9.97	05:40	2.46	22:25	3.09	2.82	05:45	1.443	22:25	2.921	2.270	2.129	
06/26/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
06/27/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			31.859
Average	9.45	2.86	2.133

FM_16

Site Commentary

SITE INFORMATION

Pipe	Elliptical (36 in H x 36 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was positioned downstream of sites FM_02, FM_08, FM_11, FM_12, FM_03, FM_01, and FM_06. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Average	11.45	2.67	3.420
Minimum	7.36	2.08	1.445
Maximum	16.24	3.11	6.098
Min Time	06/22/2023 5:45:00 AM	06/22/2023 5:00:00 AM	06/22/2023 5:45:00 AM
Max Time	06/13/2023 11:45:00 AM	06/13/2023 11:00:00 AM	06/13/2023 11:00:00 AM

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the fifteen minutes average.

DATA UPTIME

Data uptime observed during **Sunday, 11 June 2023 to Tuesday, 27 June 2023** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

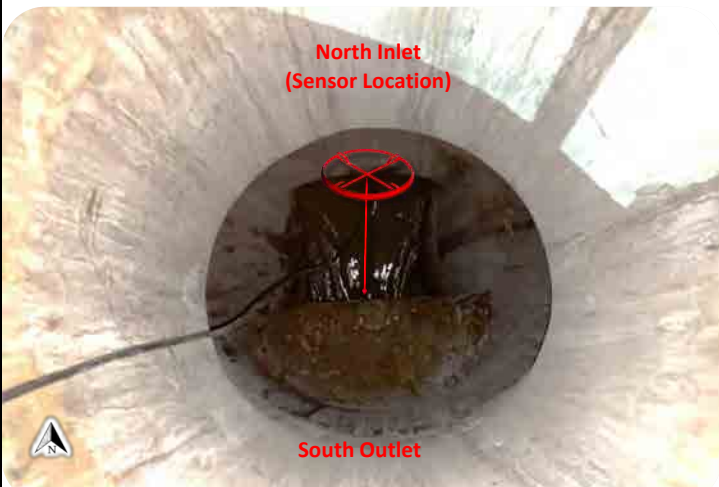
GoodYear.Carollo.TFM.AZ23				Site Name	
Flow Monitoring Site Report		FM_16			

Site Address /Location:	4980 S 157th Ave, Goodyear, AZ 85338		Monitor Series	TRITON+		Location Type	Temporary	
Site Access Details:	No Traffic Control required	Latitude:	33.4025189	Pipe Size (H x W)	36.00"x 36.00"		Pipe Shape	Circular
		Longitude:	-112.4007244					



Manhole #	System Characteristics
MH96B-102	Residential
Access	Traffic
Drive	Light





Installation Information	
Installation Date:	Installation Type:
Tuesday, June 6, 2023	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi
Installation Confirmation:	
Confirmation Time:	Pipe Size (HxW)
9:35:00 PM	36.00"x36.00"
Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)
12.50"	-
Downlooker Physical Offset (in)	Measurement Confidence (in)
NA	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
3.2	0"
Silt (in)	Silt Type
0"	
Hydraulic Comments:	
Smooth flow with medium depth and medium velocity	
Manhole / Pipe Information:	
Manhole Depth (Approx. FT):	Manhole Configuration
9.86	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
26"	54"
Manhole Cover	Manhole Frame
Unbolted	Normal
Active Drop Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Vitrified Clay Pipe	Good
Communication Information:	
Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole
Additional Site Info. / Comments:	
No TC required	



ADS Project Name:	GoodYear.Carollo.TFM.AZ23
ADS Project Number:	22930.11.325

Hydrograph Report
FM_16

Flow Monitor

FM_16

Pipe Height
36.00
in

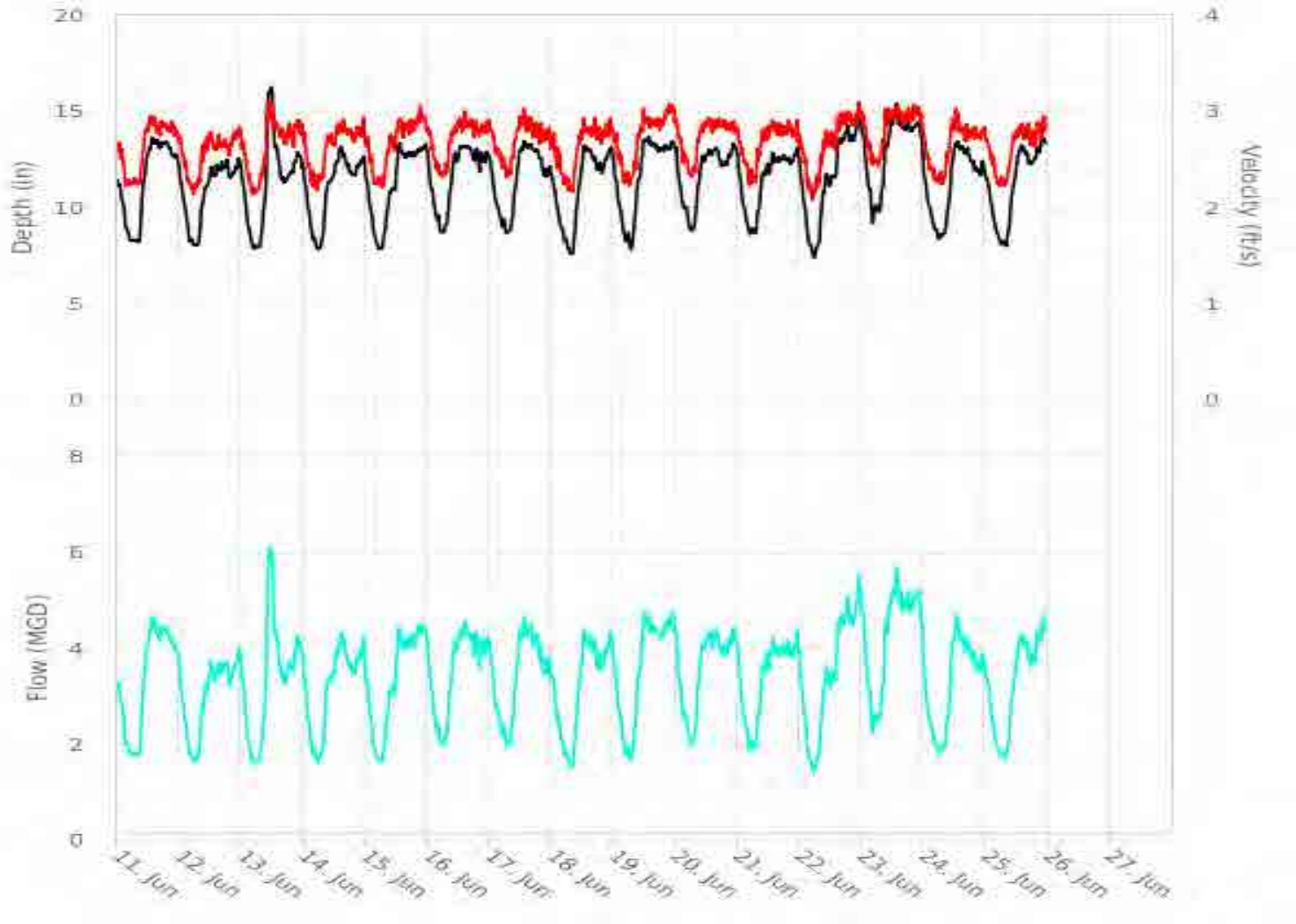
Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL
- QFINAL
- VFINAL

ABS ENVIRONMENTAL
SERVICES



Scattergraph Report
FM_16

Flow Monitor

FM_16

Pipe Height
36.00
in

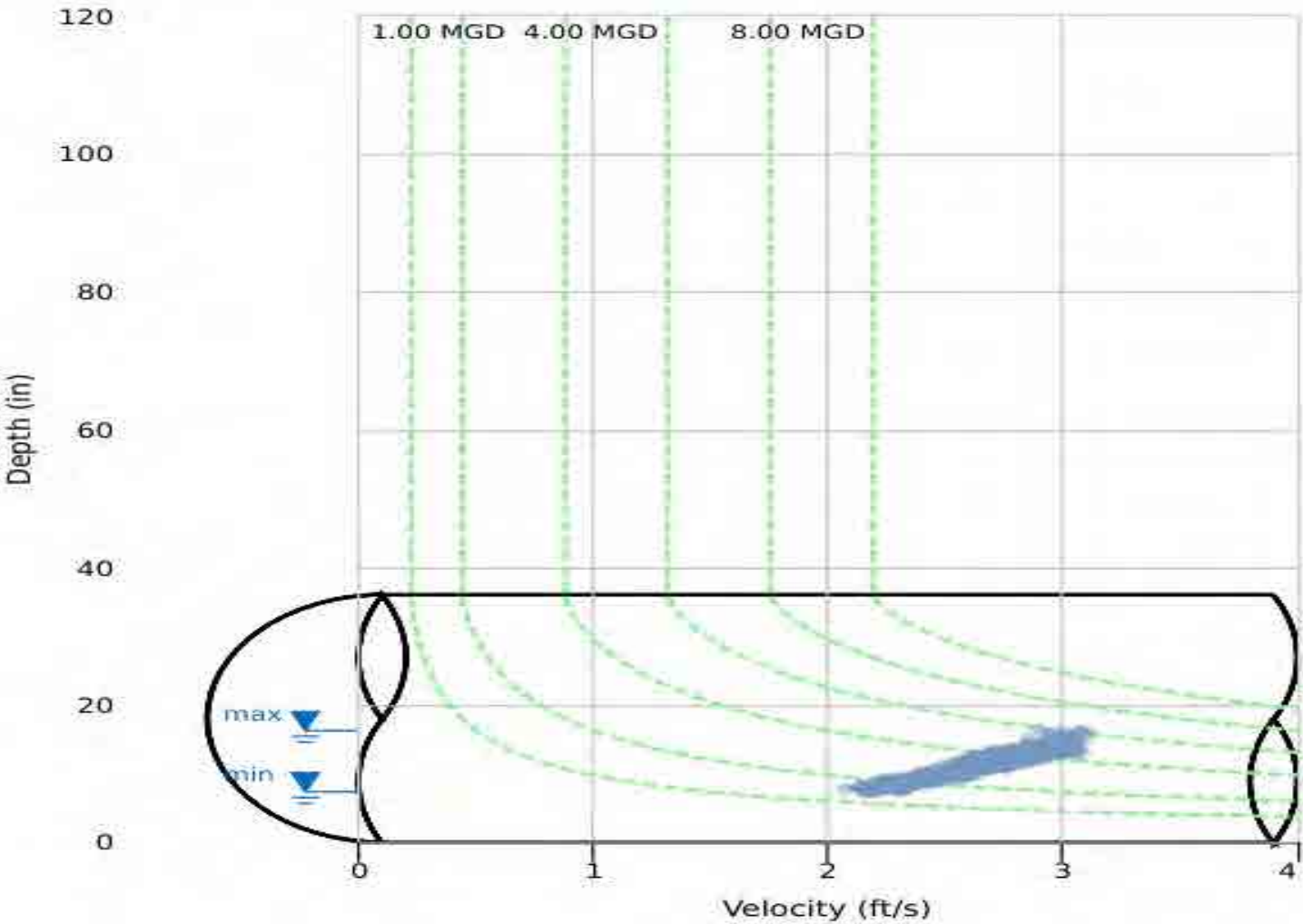
Report Period

06/11/2023
To
06/27/2023

Legend

- DFINAL - VFINAL
- Iso-Qth
- Min-Max Depth





Daily Tabular Report

06/11/2023 00:00 - 06/27/2023 23:59

FM_16Pipe: Elliptical (36 in H x 36 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)					
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total
06/11/2023	08:25	8.09	13:30	13.80	11.41	08:10	2.18	14:15	3.00	2.64	08:30	1.722	14:15	4.754	3.371	3.371
06/12/2023	06:15	7.97	18:40	12.69	10.83	05:30	2.09	23:20	2.89	2.56	05:35	1.607	23:20	4.065	3.015	3.015
06/13/2023	04:40	7.85	11:50	16.29	11.35	04:40	2.09	11:15	3.13	2.64	04:40	1.539	10:55	6.172	3.367	3.367
06/14/2023	05:45	7.75	14:30	13.29	11.01	05:25	2.15	23:25	2.95	2.64	05:35	1.590	14:50	4.361	3.189	3.189
06/15/2023	06:20	7.79	13:35	13.43	11.23	06:50	2.16	20:55	3.12	2.67	06:50	1.614	20:55	4.655	3.335	3.335
06/16/2023	05:50	8.64	13:55	13.43	11.67	07:00	2.25	12:25	3.02	2.72	05:45	1.928	14:55	4.604	3.542	3.542
06/17/2023	06:35	8.65	13:35	13.52	11.48	07:30	2.27	13:20	3.07	2.71	07:00	1.934	13:25	4.671	3.455	3.455
06/18/2023	08:05	7.55	12:45	13.27	11.03	08:40	2.10	17:05	2.98	2.63	07:30	1.494	12:55	4.408	3.194	3.194
06/19/2023	06:55	7.76	13:45	13.73	11.66	04:15	2.18	21:35	3.12	2.73	06:45	1.654	22:45	4.845	3.587	3.587
06/20/2023	06:25	8.77	22:40	13.38	11.75	05:45	2.30	13:15	3.04	2.74	06:35	1.988	22:45	4.503	3.593	3.593
06/21/2023	05:05	8.58	23:05	13.11	11.40	04:35	2.20	20:45	2.98	2.67	05:10	1.851	23:05	4.449	3.372	3.372
06/22/2023	05:50	7.34	23:15	14.96	11.47	05:10	2.06	23:05	3.12	2.66	05:50	1.439	23:15	5.604	3.451	3.451
06/23/2023	04:30	9.13	13:40	15.54	13.01	04:30	2.26	14:00	3.12	2.84	04:30	2.064	14:00	5.783	4.294	4.294
06/24/2023	06:05	8.34	12:55	13.57	11.23	06:15	2.21	13:00	3.10	2.64	06:15	1.784	13:00	4.842	3.284	3.284
06/25/2023	08:00	7.94	22:25	13.67	11.18	05:00	2.19	23:20	2.99	2.62	06:00	1.683	22:25	4.703	3.241	3.162
06/26/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06/27/2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

06/11/2023 00:00 - 06/27/2023 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			51.211
Average	11.45	2.67	3.420

APPENDIX 5B

MODEL CALIBRATION RESULTS

Flow Monitoring Site FM1, Dry Weather Flow Calibration

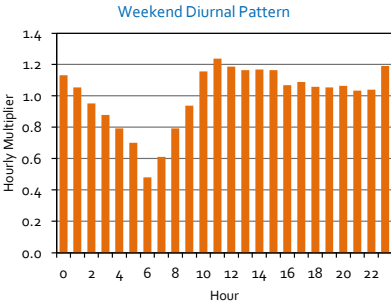
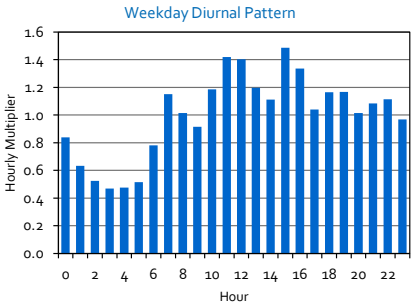
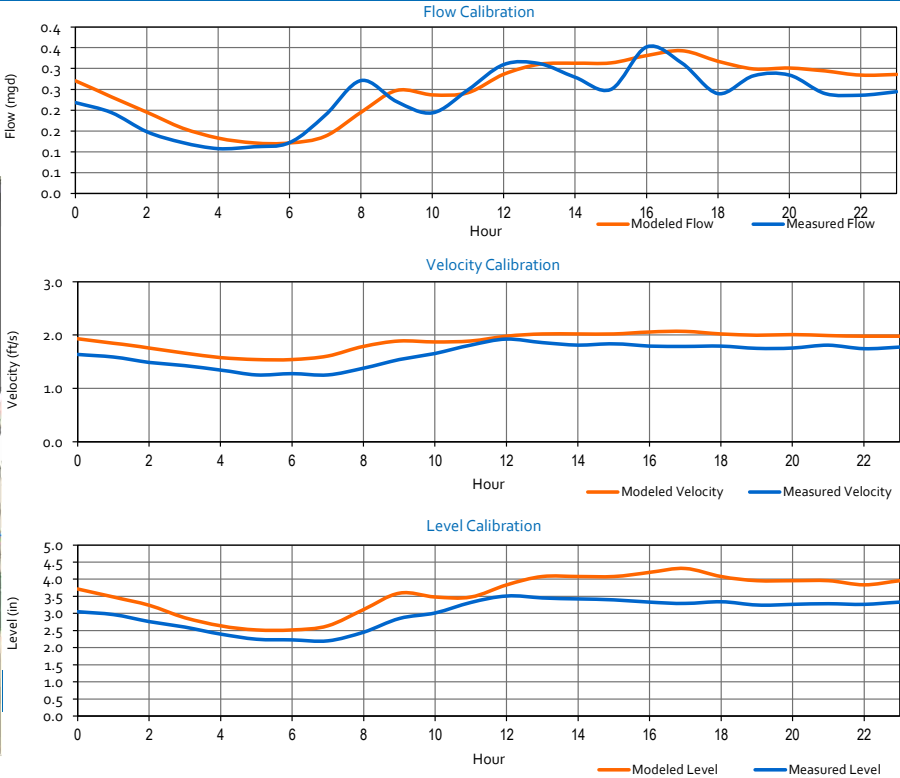
Pipeline Diameter: 12"
Manhole ID: MH88C-301
Model Pipe ID: 211 (gpm)



Model Calibration Summary

Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	0.23	0.35	3.5	1.8	0.25	0.34	3.61	1.89	9%	-3%	5%	2%

Notes:
(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM2, Dry Weather Flow Calibration

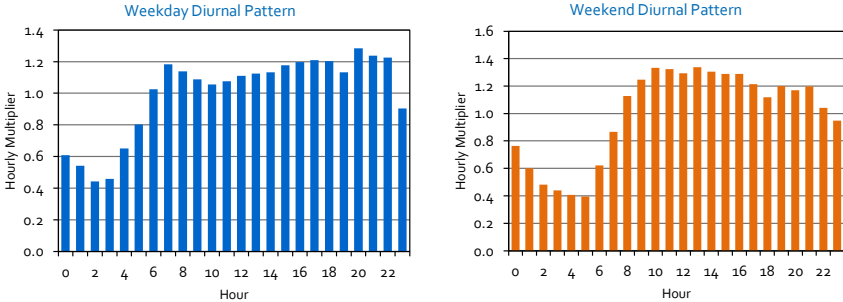
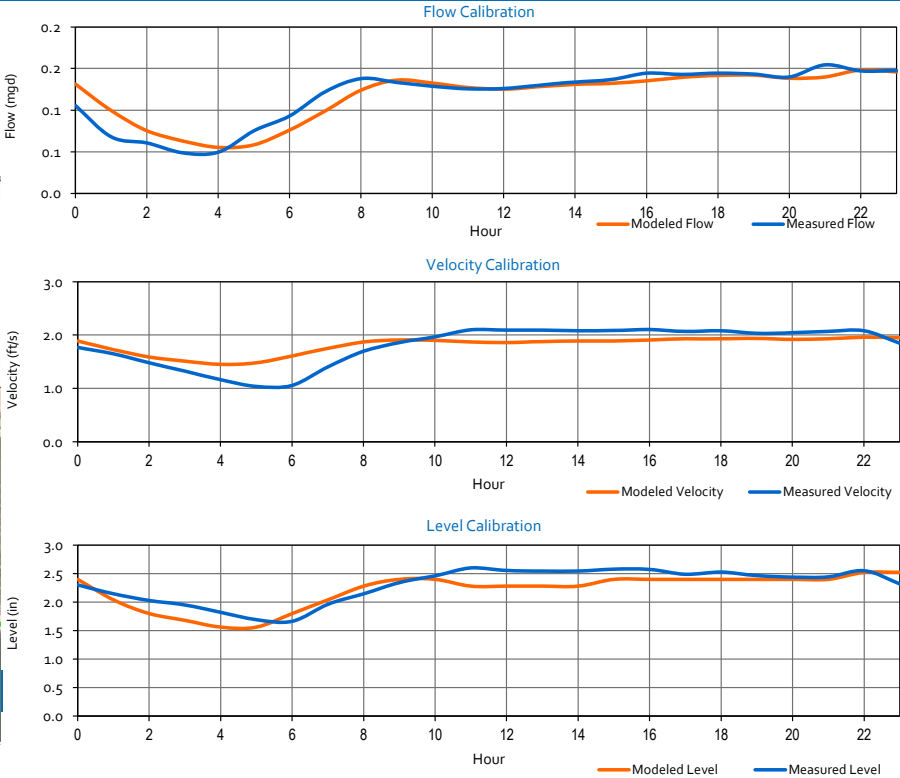
Pipeline Diameter: 12"
Manhole ID: MH86D-405
Model Pipe ID: 1758 (gpm)



Model Calibration Summary

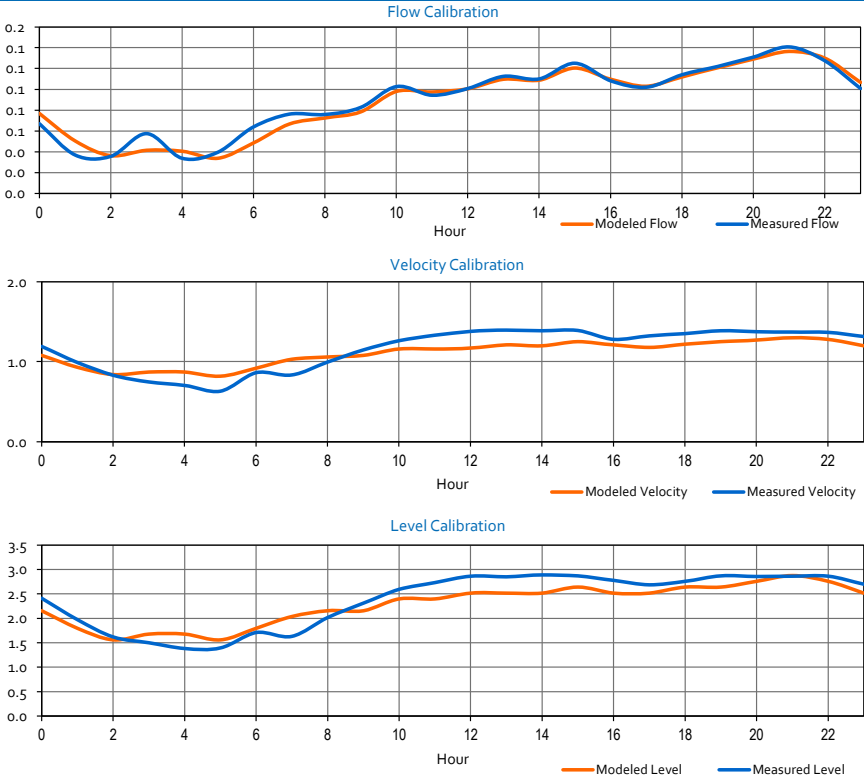
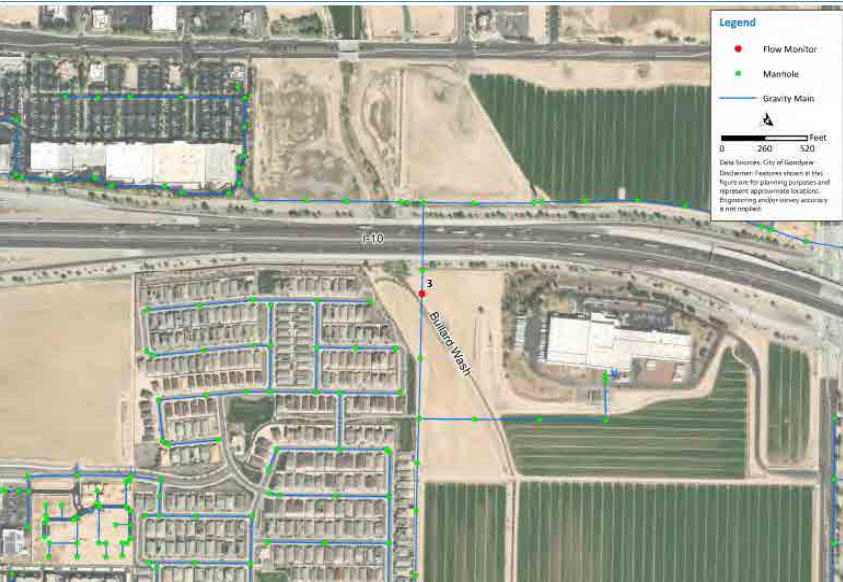
Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	0.12	0.15	2.3	1.7	0.12	0.15	2.21	1.81	0%	-4%	-3%	4%

Notes:
(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM3, Dry Weather Flow Calibration

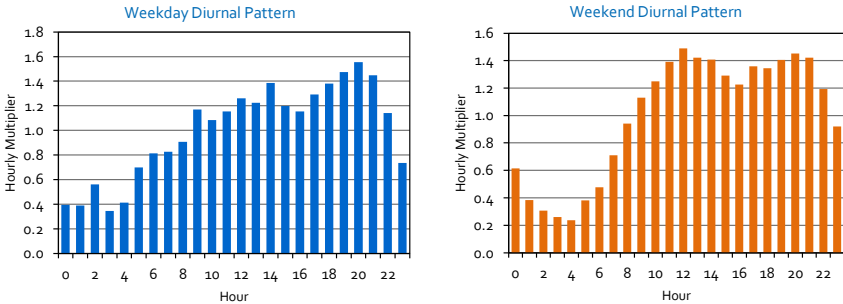
Pipeline Diameter: 15"
Manhole ID: MH57B-304
Model Pipe ID: 4029 (gpm)



Model Calibration Summary

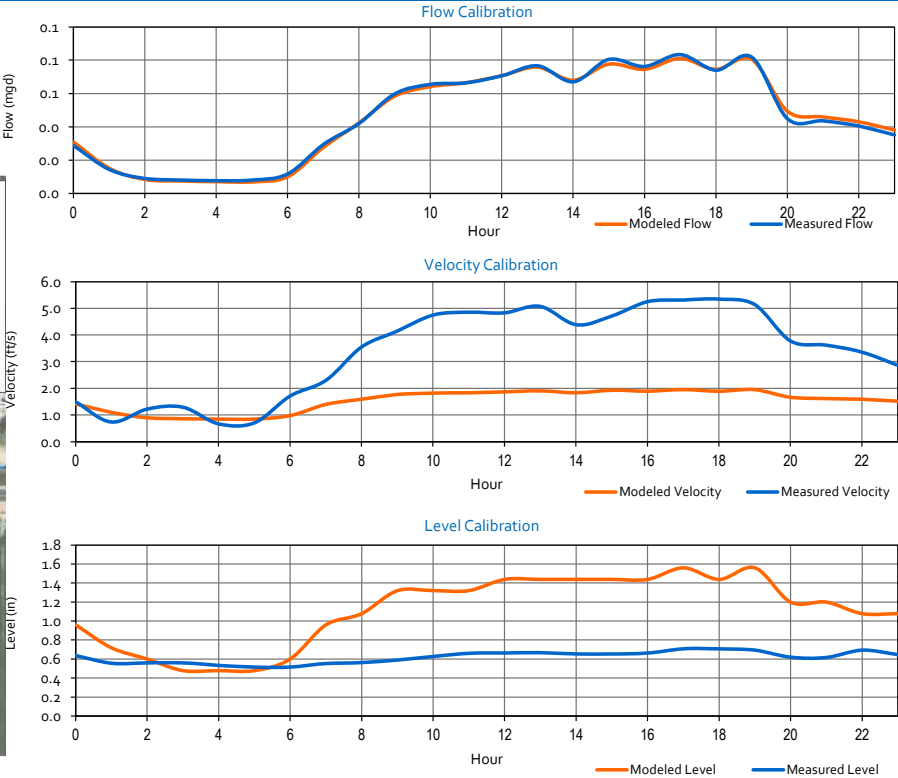
Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	0.09	0.14	2.3	1.2	0.09	0.14	2.29	1.11	-2%	-3%	-1%	-4%

Notes:
(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM4, Dry Weather Flow Calibration

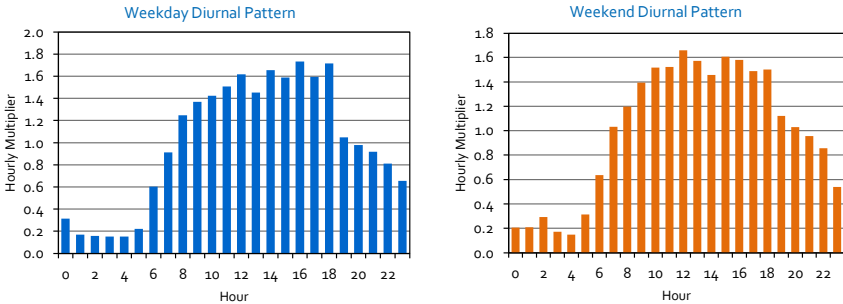
Pipeline Diameter: 15"
Manhole ID: MH64D-403
Model Pipe ID: 4263 (gpm)



Model Calibration Summary

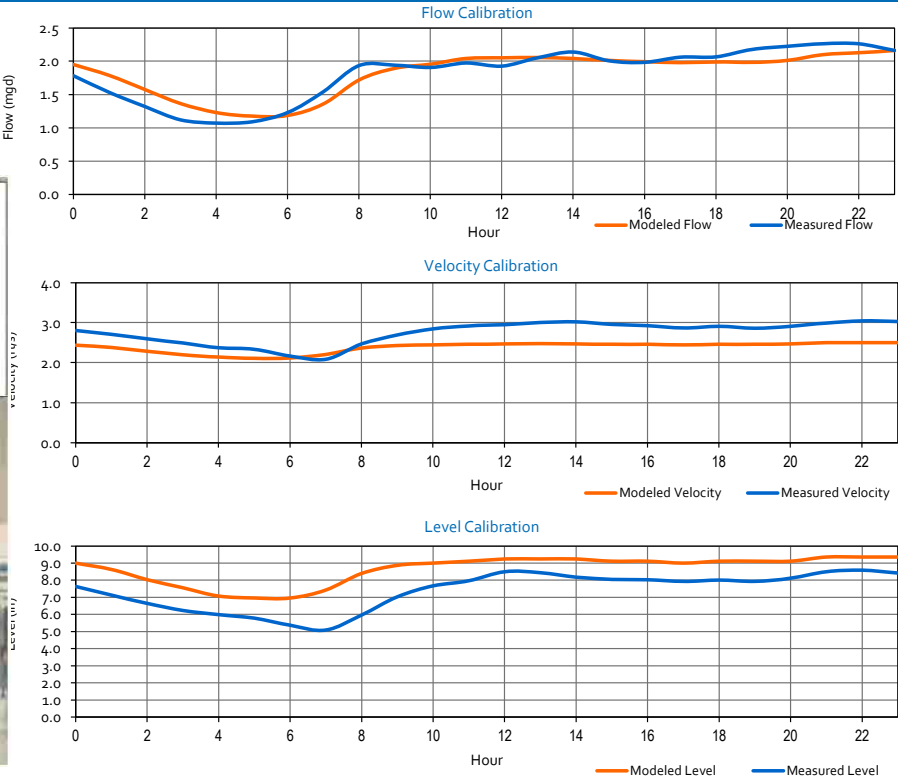
Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	0.05	0.08	0.7	3.6	0.05	0.08	1.11	1.54	0%	-3%	70%	-58%

Notes:
(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM5, Dry Weather Flow Calibration

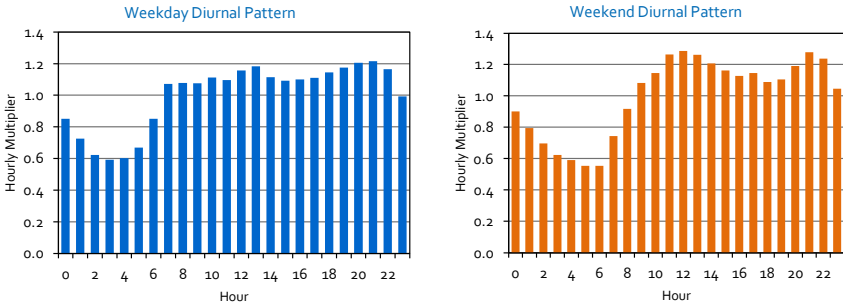
Pipeline Diameter: 30"
Manhole ID: MH86A-301
Model Pipe ID: 3056 (gpm)



Model Calibration Summary

Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	1.82	2.27	7.6	2.9	1.82	2.16	8.65	2.39	0%	-5%	13%	-16%

Notes:
(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM6, Dry Weather Flow Calibration

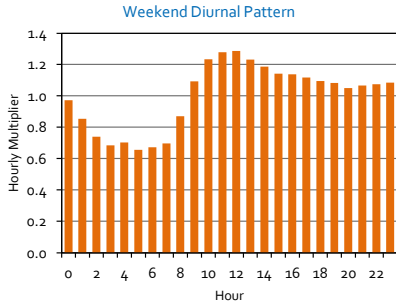
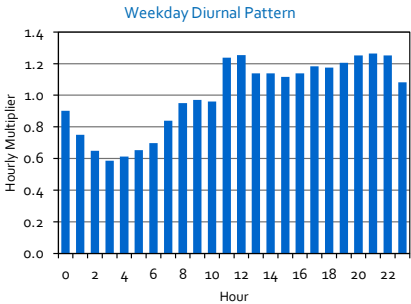
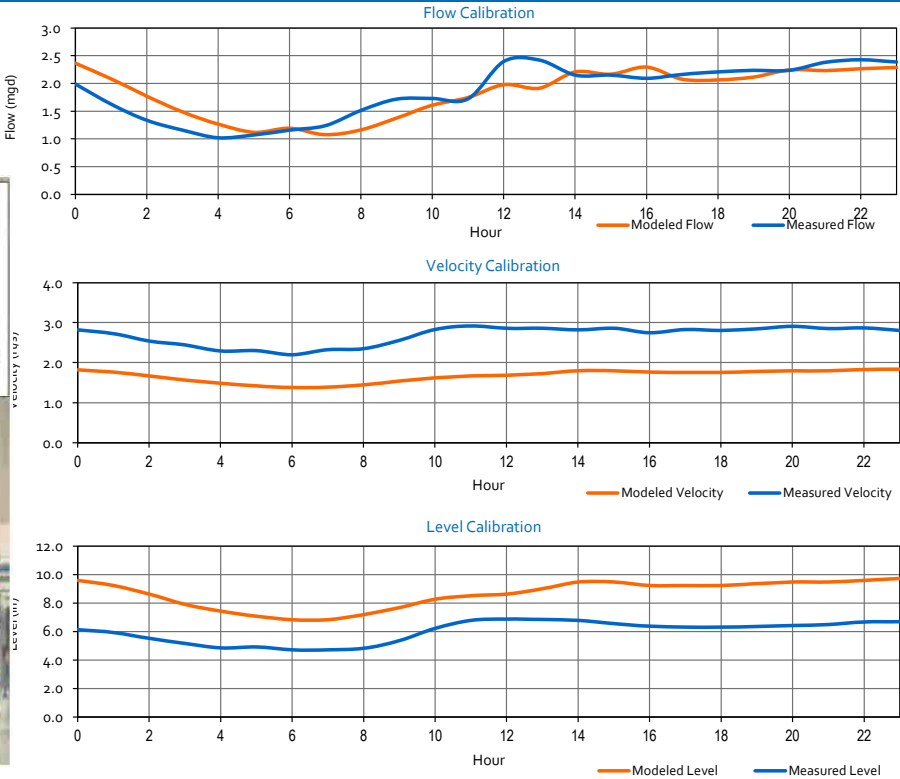
Pipeline Diameter: 54"
Manhole ID: MH86C-202
Model Pipe ID: 3859 (gpm)



Model Calibration Summary

Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	1.86	2.43	6.3	2.7	1.84	2.37	8.71	1.68	-1%	-3%	38%	-39%

Notes:
(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM7, Dry Weather Flow Calibration

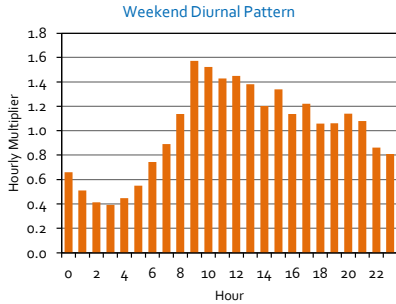
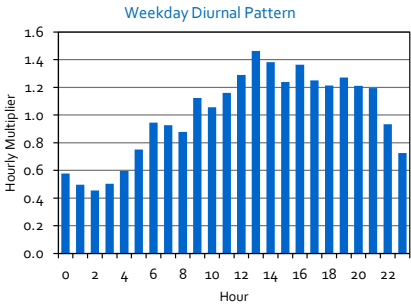
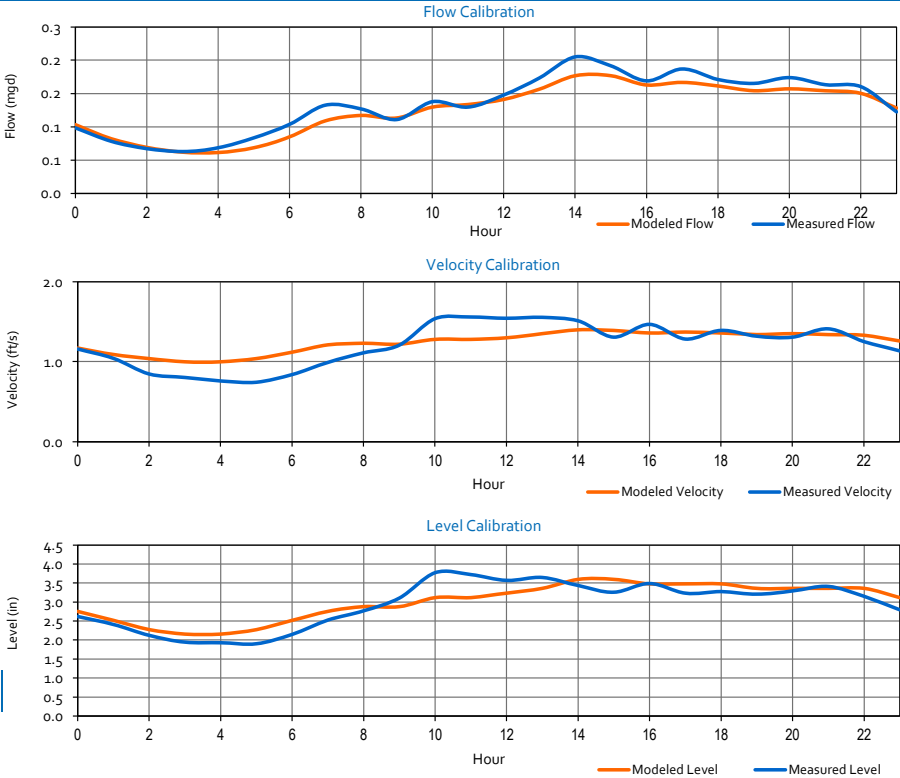
Pipeline Diameter: 12"
Manhole ID: MH79A-101
Model Pipe ID: 3099 (gpm)



Model Calibration Summary

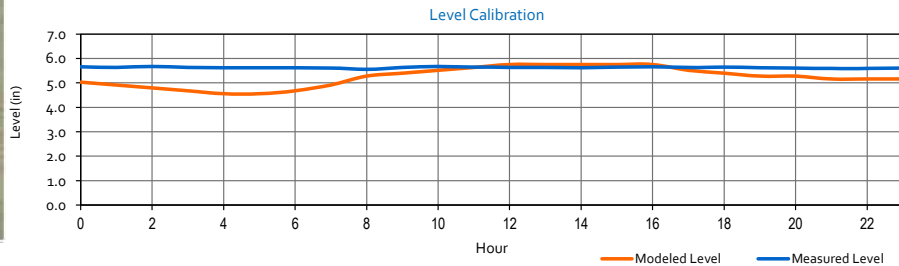
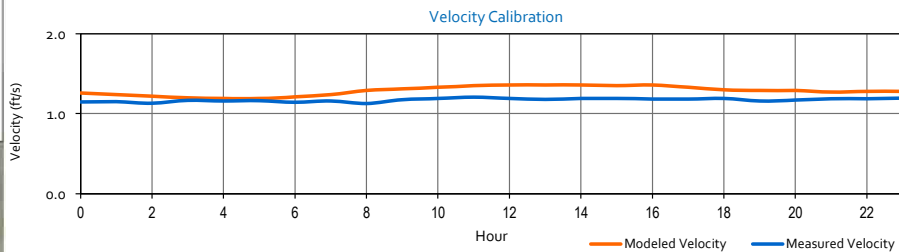
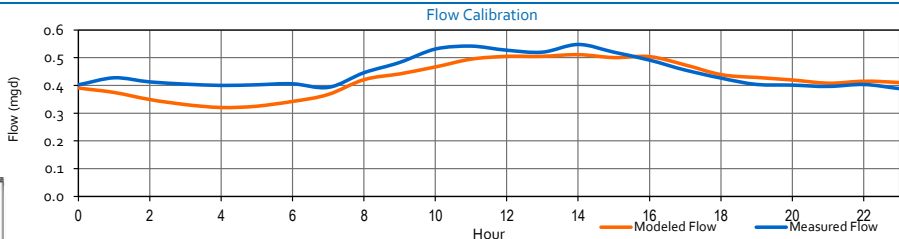
Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	0.13	0.21	3.0	1.3	0.13	0.18	2.99	1.24	-7%	-14%	-1%	-4%

Notes:
(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM8, Dry Weather Flow Calibration

Pipeline Diameter: 24"
 Manhole ID: MH77B-308
 Model Pipe ID: 5404 (gpm)

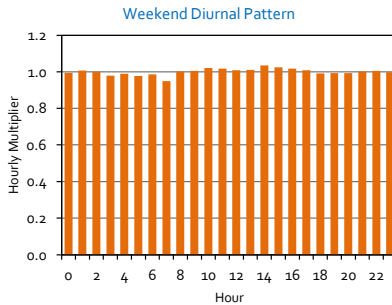
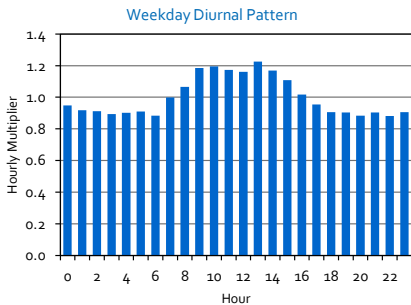


Model Calibration Summary

Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	0.45	0.55	5.9	1.2	0.42	0.51	5.24	1.29	-5%	-7%	-11%	8%

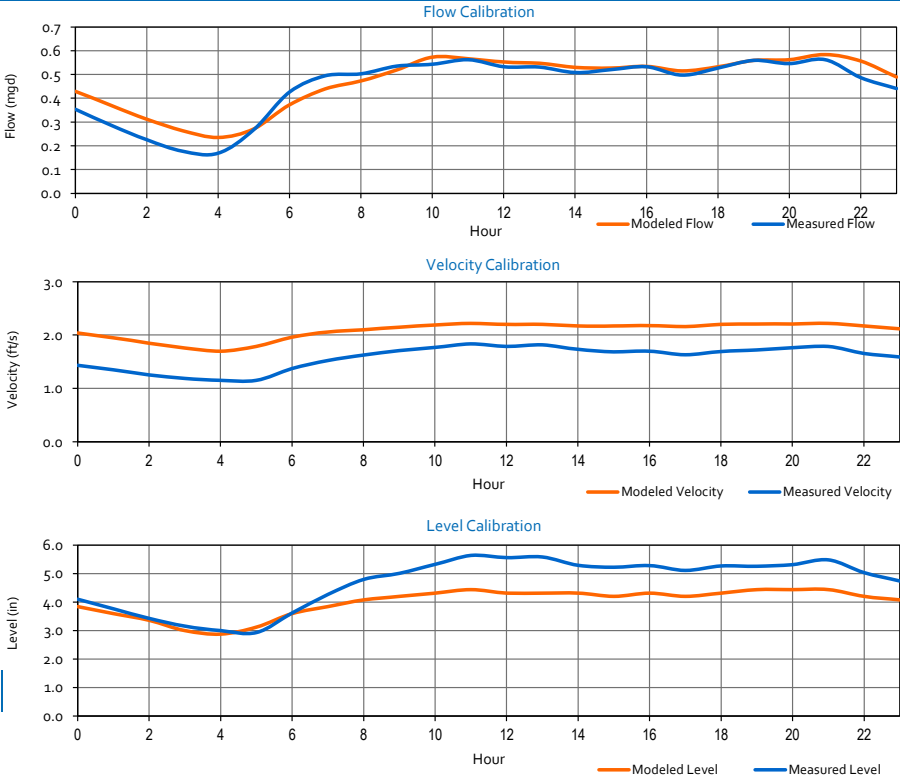
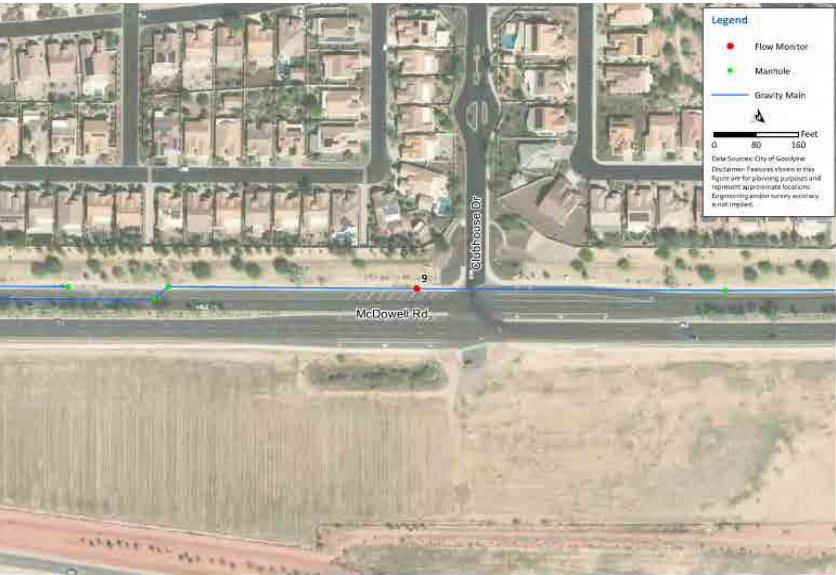
Notes:

(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FMg, Dry Weather Flow Calibration

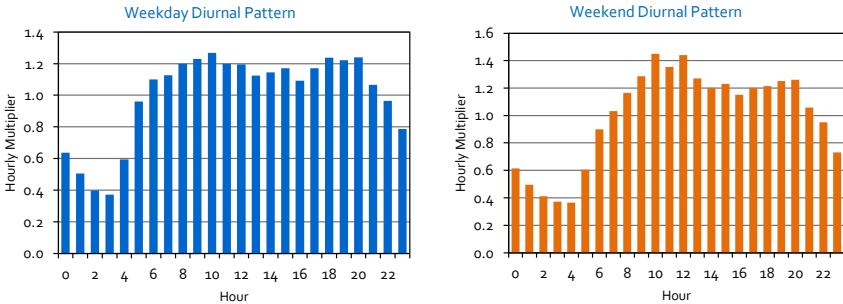
Pipeline Diameter: 24"
Manhole ID: MH45C-401
Model Pipe ID: 3091 (gpm)



Model Calibration Summary

Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	0.45	0.56	4.6	1.6	0.47	0.58	4.00	2.09	5%	4%	-13%	30%

Notes:
(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM11, Dry Weather Flow Calibration

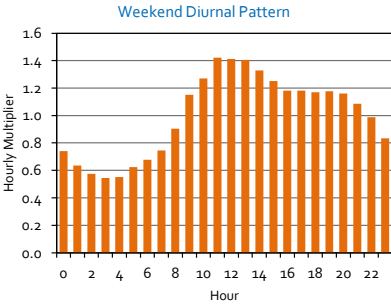
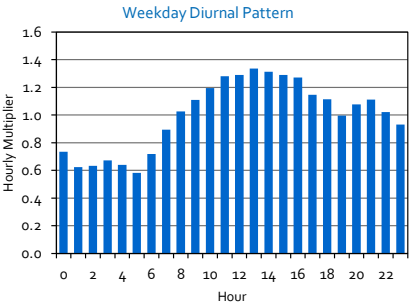
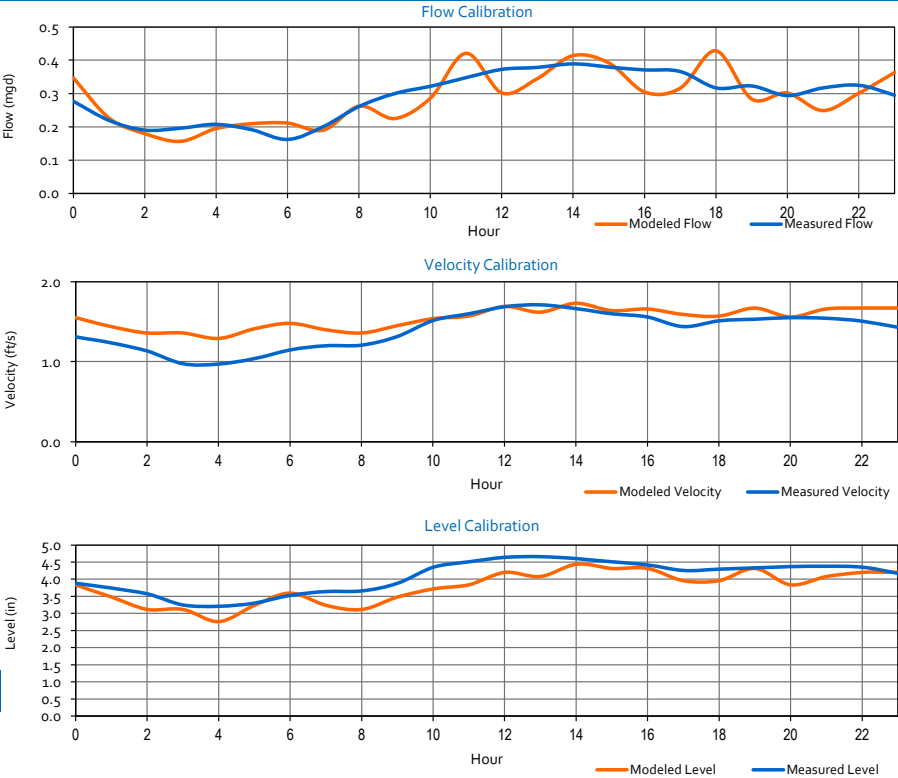
Pipeline Diameter: 18"
Manhole ID: MH58C-302
Model Pipe ID: 798 (gpm)



Model Calibration Summary

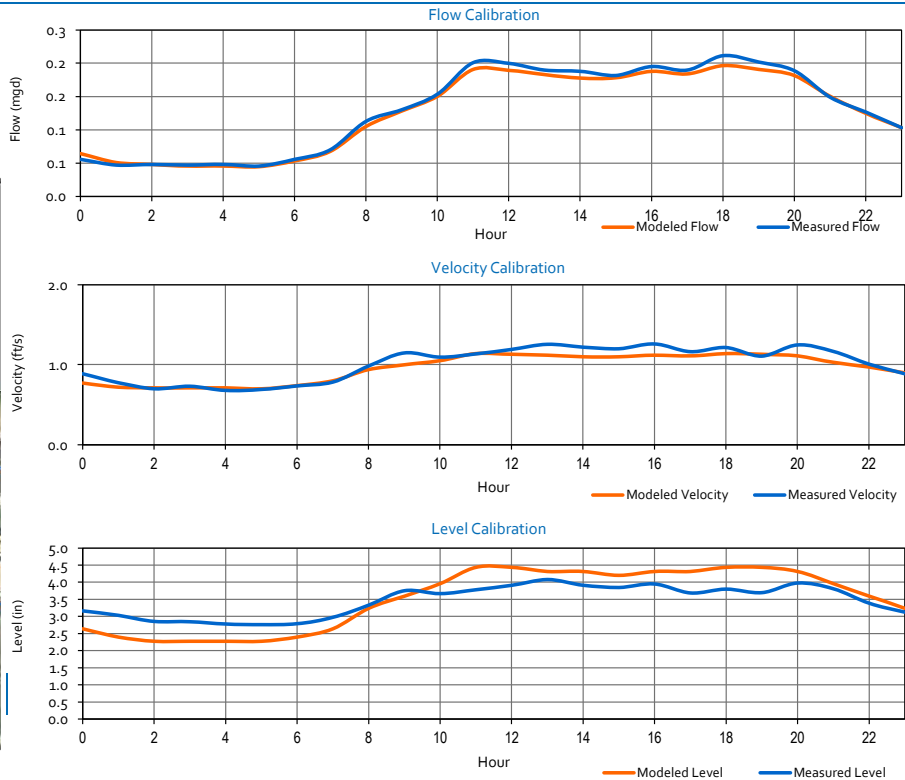
Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	0.29	0.39	4.2	1.4	0.29	0.43	3.87	1.57	-1%	10%	-7%	10%

Notes:
(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM12, Dry Weather Flow Calibration

Pipeline Diameter: 12"
Manhole ID: MH67A-104
Model Pipe ID: 3270 (gpm)

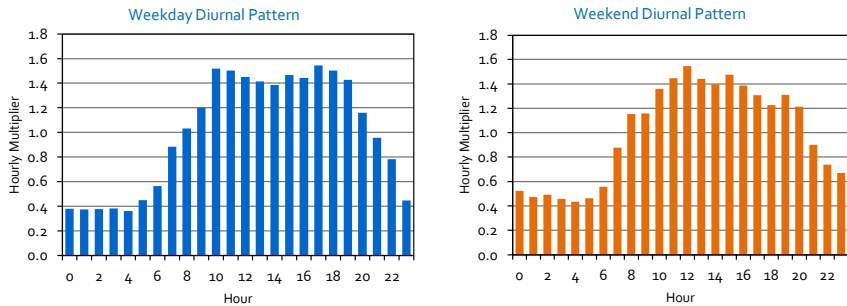


Model Calibration Summary

Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	0.13	0.21	3.5	1.0	0.13	0.20	3.51	0.95	-3%	-7%	1%	-8%

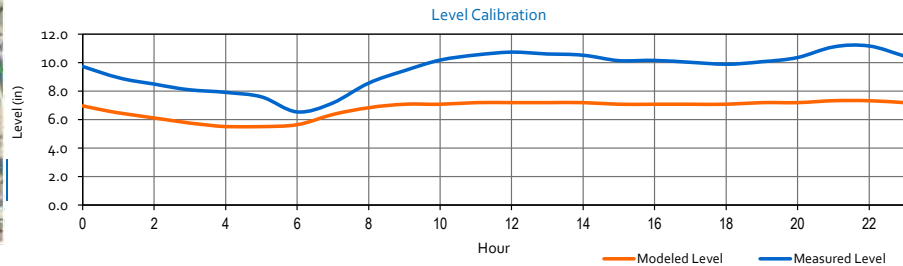
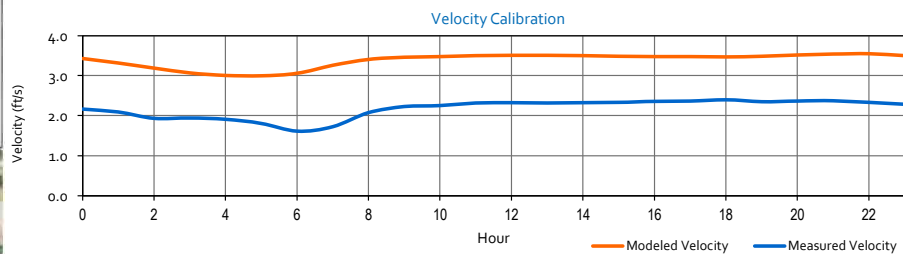
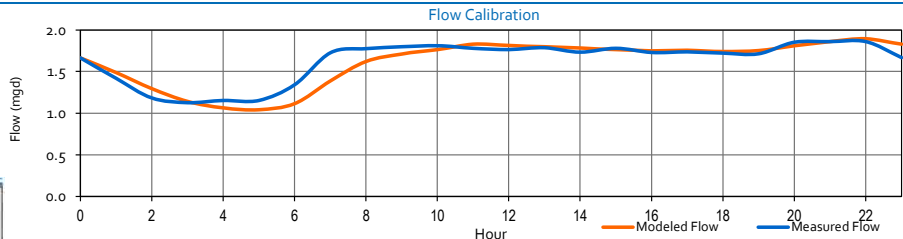
Notes:

(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM13, Dry Weather Flow Calibration

Pipeline Diameter: 24"
 Manhole ID: MH75B-203
 Model Pipe ID: 887 (gpm)

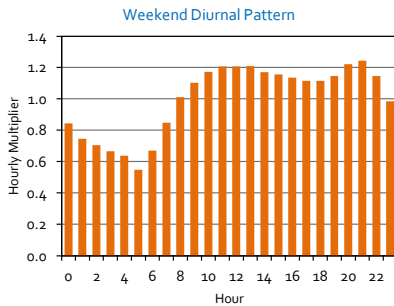
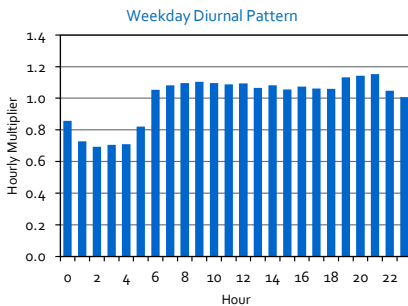


Model Calibration Summary

Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	1.63	1.86	10.0	2.0	1.61	1.89	6.79	3.39	-1%	2%	-32%	66%

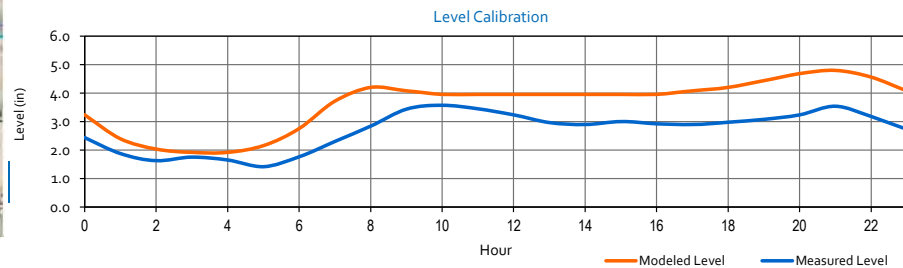
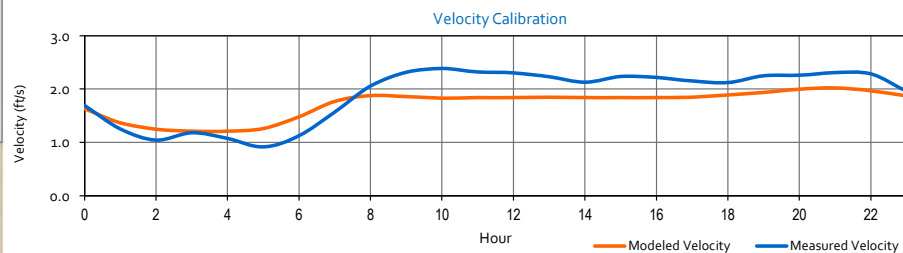
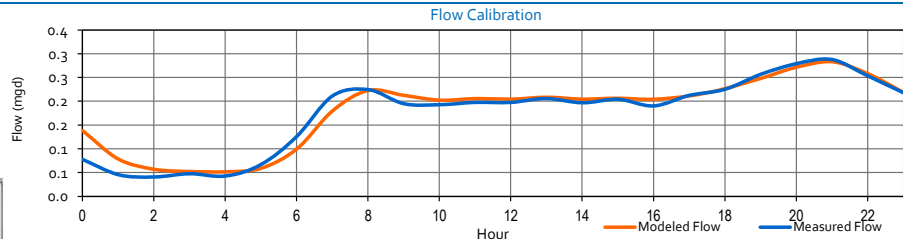
Notes:

(1) Percent Error = (Modeled - Measured) / Measured x 100



Flow Monitoring Site FM14, Dry Weather Flow Calibration

Pipeline Diameter: 8"
 Manhole ID: MH83D-301
 Model Pipe ID: 4231 (gpm)

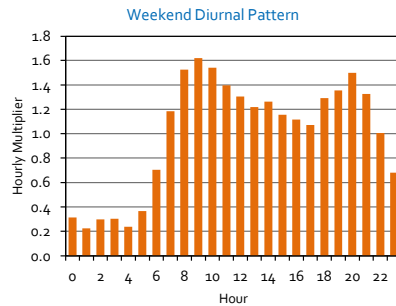
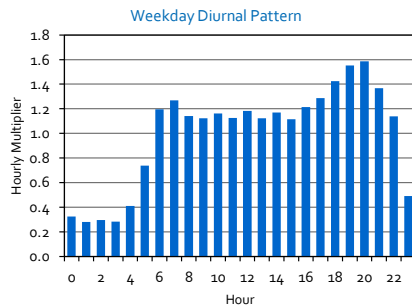


Model Calibration Summary

Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	0.18	0.29	2.7	1.9	0.18	0.28	3.63	1.72	3%	-2%	34%	-9%

Notes:

(1) Percent Error = (Modeled - Measured) / Measured x 100

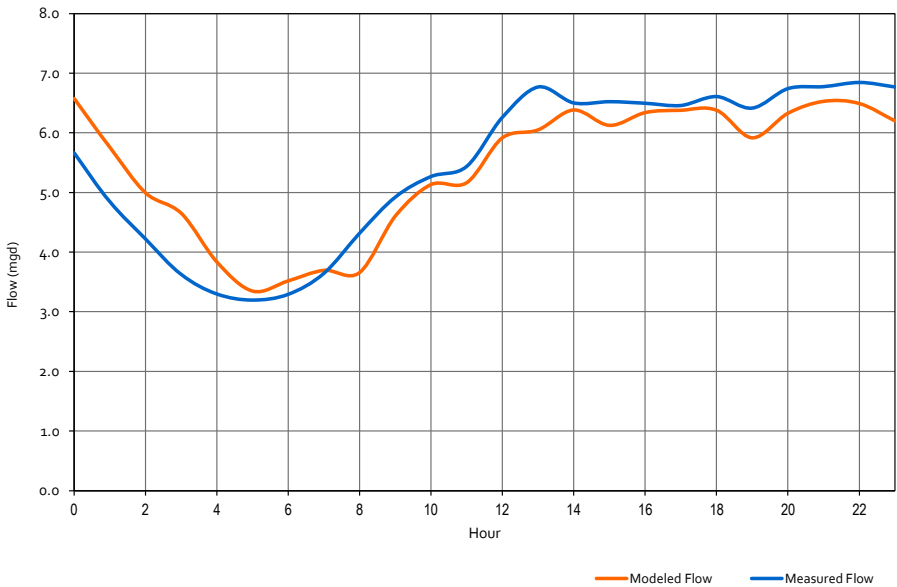


Flow Monitoring Site 15 and 16 DryWeatherFlowCalibration

Pipeline Diameter: 24-inch and 36-inch
 Manhole ID: MH96B-107 and MH96B-303
 Model Pipe ID: 3225 and 1975



Flow Calibration



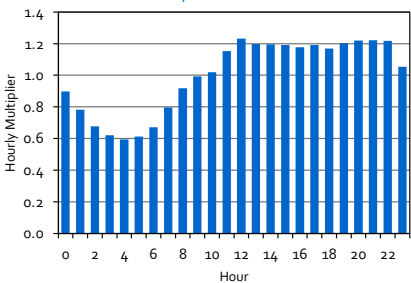
Model Calibration Summary

Day	Measured Data				Modeled Data				Percent Error ⁽¹⁾			
	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Vel. (ft/s)	Avg. Flow (%)	Peak Flow (%)	Avg. Level (%)	Avg. Vel. (%)
Thurs	5.46	6.85	-	-	5.42	6.58	-	-	-1%	-4%	-	-

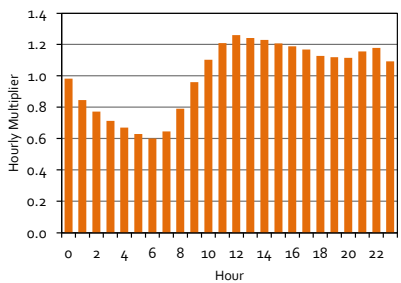
Notes:
 (1) Percent Error = (Modeled - Measured) / Measured x 100



Weekday Diurnal Pattern



Weekend Diurnal Pattern



APPENDIX 7A

WATER UNIT COSTS

8-inch Water Main

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Material DIP	Diameter (inch) 8	Length (mile) 1	Default Excavation Depth 4	Is the pipe crossing a freeway? No
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPING						
	8" Push-on Joint Ductile Iron Pipe	1	LF	\$ 57	\$ 57	
	8" Adder For Restrained Joints	0.25	LF	\$ 27	\$ 7	
	Total Piping (per LF)					\$ 64
EARTHWORK						
	Hard Digging	0.30	CY	\$ 51	\$ 15	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.20	CY	\$ 116	\$ 23	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.08	CY	\$ 105	\$ 8	
	Controlled Density Fill (CDF)	0.01	CY	\$ 138	\$ 1	
	20 CY Dump Truck, 20 Miles/Round Trip	2.33	CY	\$ 11	\$ 26	
	Site Specific Requirements (% of Total Earthwork)	10%	LS		\$ 8	
	Total Earthwork (per LF)					\$ 86
PAVING						
	Asphalt Pavement Cutting	6	IN (Depth)	1.97	11.79	
	Remove 6" Asphalt Pavement	4.0	FT (Trench Width)	0.12	0.47	
	6" AC Paving ON 8" ABC	4.0	FT (Trench Width)	11.07	44.30	
	Micro Seal	50	FT (Street Width)	0.67	33.33	
	Total Paving (per LF)					\$ 90
FITTINGS, VALVES AND MANHOLES		No. per mile				
	Fittings	4	EA	0.09	0.37	
	Isolation Valve (Gate Valve for dia < 36", Butterfly Valve for dia >= 36")	7	EA	0.56	3.92	
	Air release Valve Assembly	4	EA	0.06	0.24	
	Blow off Valve Assembly	2	EA	0.06	0.12	
	Air release and blow off and valve manholes	13	EA	0.86	11.15	
	Total fittings, valves and manholes (per LF)					\$ 16
HYDRANT		No. per mile				
	Fire Hydrant	1	CY	0.03	0.03	
	Total Hydrant (per LF)					\$ 0.03
	TOTAL DIRECT COST (per LF)					\$ 260
	Contractor Overhead	10%				\$ 30
	Construction Profit	6%				\$ 20
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 20
	General Conditions	10%				\$ 30
	Traffic Control Multiplier	20%				\$ 50
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 410
	TOTAL CONSTRUCTION COSTS FOR 1 mile(s)					\$ 2,160,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

10-inch Water Main

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Material DIP	Diameter (inch) 10	Length (mile) 1	Default Excavation Depth 6	Is the pipe crossing a freeway? No
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPING						
	10" Push-on Joint Ductile Iron Pipe	1	LF	\$ 55	\$ 55	
	10" Adder For Restrained Joints	0.25	LF	\$ 27	\$ 7	
	Total Piping (per LF)					\$ 62
EARTHWORK						
	Hard Digging	0.48	CY	\$ 51	\$ 25	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.23	CY	\$ 116	\$ 27	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.20	CY	\$ 105	\$ 22	
	Controlled Density Fill (CDF)	0.02	CY	\$ 138	\$ 3	
	20 CY Dump Truck, 20 Miles/Round Trip	2.77	CY	\$ 11	\$ 30	
	Site Specific Requirements (% of Total Earthwork)	10%	LS		\$ 11	
	Total Earthwork (per LF)					\$ 123
PAVING						
	Asphalt Pavement Cutting	6	IN (Depth)	1.97	11.79	
	Remove 6" Asphalt Pavement	4.2	FT (Trench Width)	0.12	0.48	
	6" AC Paving ON 8" ABC	4.2	FT (Trench Width)	11.07	46.14	
	Micro Seal	50	FT (Street Width)	0.67	33.33	
	Total Paving (per LF)					\$ 92
FITTINGS, VALVES AND MANHOLES		No. per mile				
	Fittings	4	EA	0.12	0.46	
	Isolation Valve (Gate Valve for dia < 36", Butterfly Valve for dia >= 36")	7	EA	0.71	4.98	
	Air release Valve Assembly	4	EA	0.06	0.24	
	Blow off Valve Assembly	2	EA	0.06	0.12	
	Air release and blow off and valve manholes	13	EA	0.86	11.15	
	Total fittings, valves and manholes (per LF)					\$ 17
HYDRANT		No. per mile				
	Fire Hydrant	1	CY	0.03	0.03	
	Total Hydrant (per LF)					\$ 0.03
	TOTAL DIRECT COST (per LF)					\$ 290
	Contractor Overhead	10%				\$ 30
	Construction Profit	6%				\$ 20
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 20
	General Conditions	10%				\$ 30
	Traffic Control Multiplier	20%				\$ 60
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 450
	TOTAL CONSTRUCTION COSTS FOR 1 mile(s)					\$ 2,380,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

12-inch Water Main

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Material DIP	Diameter (inch) 12	Length (mile) 1	Default Excavation Depth 6	Is the pipe crossing a freeway? No
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPING						
	12" Push-on Joint Ductile Iron Pipe	1	LF	\$ 71	\$ 71	
	12" Adder For Restrained Joints	0.25	LF	\$ 36	\$ 9	
	Total Piping (per LF)					\$ 80
EARTHWORK						
	Hard Digging	0.52	CY	\$ 51	\$ 26	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.27	CY	\$ 116	\$ 32	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.19	CY	\$ 105	\$ 20	
	Controlled Density Fill (CDF)	0.02	CY	\$ 138	\$ 3	
	20 CY Dump Truck, 20 Miles/Round Trip	2.87	CY	\$ 11	\$ 31	
	Site Specific Requirements (% of Total Earthwork)	10%	LS		\$ 12	
	Total Earthwork (per LF)					\$ 130
PAVING						
	Asphalt Pavement Cutting	6	IN (Depth)	1.97	11.79	
	Remove 6" Asphalt Pavement	4.3	FT (Trench Width)	0.12	0.50	
	6" AC Paving ON 8" ABC	4.3	FT (Trench Width)	11.07	47.99	
	Micro Seal	50	FT (Street Width)	0.67	33.33	
	Total Paving (per LF)					\$ 94
FITTINGS, VALVES AND MANHOLES		No. per mile				
	Fittings	4	EA	0.15	0.61	
	Isolation Valve (Gate Valve for dia < 36", Butterfly Valve for dia >= 36")	7	EA	0.90	6.29	
	Air release Valve Assembly	4	EA	0.06	0.24	
	Blow off Valve Assembly	2	EA	0.06	0.12	
	Air release and blow off and valve manholes	13	EA	0.86	11.15	
	Total fittings, valves and manholes (per LF)					\$ 18
HYDRANT		No. per mile				
	Fire Hydrant	1	CY	0.03	0.03	
	Total Hydrant (per LF)					\$ 0.03
	TOTAL DIRECT COST (per LF)					\$ 320
	Contractor Overhead	10%				\$ 30
	Construction Profit	6%				\$ 20
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 30
	General Conditions	10%				\$ 30
	Traffic Control Multiplier	20%				\$ 60
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 490
	TOTAL CONSTRUCTION COSTS FOR 1 mile(s)					\$ 2,590,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

16-inch Water Main

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Material DIP	Diameter (inch) 16	Length (mile) 1	Default Excavation Depth 8	Is the pipe crossing a freeway? No
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPING						
	16" Push-on Joint Ductile Iron Pipe	1	LF	\$ 115	\$ 115	
	16" Adder For Restrained Joints	0.25	LF	\$ 63	\$ 16	
	Total Piping (per LF)					\$ 131
EARTHWORK						
	Hard Digging	0.79	CY	\$ 51	\$ 40	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.36	CY	\$ 116	\$ 42	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.34	CY	\$ 105	\$ 36	
	Controlled Density Fill (CDF)	0.04	CY	\$ 138	\$ 5	
	20 CY Dump Truck, 20 Miles/Round Trip	3.51	CY	\$ 11	\$ 38	
	Site Specific Requirements (% of Total Earthwork)	10%	LS		\$ 17	
	Total Earthwork (per LF)					\$ 183
PAVING						
	Asphalt Pavement Cutting	6	IN (Depth)	1.97	11.79	
	Remove 6" Asphalt Pavement	4.7	FT (Trench Width)	0.12	0.54	
	6" AC Paving ON 8" ABC	4.7	FT (Trench Width)	11.07	51.68	
	Micro Seal	50	FT (Street Width)	0.67	33.33	
	Total Paving (per LF)					\$ 97
FITTINGS, VALVES AND MANHOLES		No. per mile				
	Fittings	4	EA	0.34	1.35	
	Isolation Valve (Gate Valve for dia < 36", Butterfly Valve for dia >= 36")	2	EA	3.03	6.06	
	Air release Valve Assembly	4	EA	0.06	0.24	
	Blow off Valve Assembly	2	EA	0.06	0.12	
	Air release and blow off and valve manholes	8	EA	0.86	6.86	
	Total fittings, valves and manholes (per LF)					\$ 15
HYDRANT		No. per mile				
	Fire Hydrant	1	CY	0.03	0.03	
	Total Hydrant (per LF)					\$ 0.03
	TOTAL DIRECT COST (per LF)					\$ 430
	Contractor Overhead	10%				\$ 40
	Construction Profit	6%				\$ 30
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 40
	General Conditions	10%				\$ 40
	Traffic Control Multiplier	20%				\$ 90
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 670
	TOTAL CONSTRUCTION COSTS FOR 1 mile(s)					\$ 3,540,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

20-inch Water Main

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Material DIP	Diameter (inch) 20	Length (mile) 1	Default Excavation Depth 8	Is the pipe crossing a freeway? No
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPING						
	20" Push-on Joint Ductile Iron Pipe	1	LF	\$ 159	\$ 159	
	20" Adder For Restrained Joints	0.25	LF	\$ 89	\$ 22	
	Total Piping (per LF)					\$ 181
EARTHWORK						
	Hard Digging	0.96	CY	\$ 51	\$ 49	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.50	CY	\$ 116	\$ 58	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.34	CY	\$ 105	\$ 36	
	Controlled Density Fill (CDF)	0.04	CY	\$ 138	\$ 5	
	20 CY Dump Truck, 20 Miles/Round Trip	3.95	CY	\$ 11	\$ 43	
	Site Specific Requirements (% of Total Earthwork)	10%	LS		\$ 20	
	Total Earthwork (per LF)					\$ 217
PAVING						
	Asphalt Pavement Cutting	6	IN (Depth)	1.97	11.79	
	Remove 6" Asphalt Pavement	5.3	FT (Trench Width)	0.12	0.61	
	6" AC Paving ON 8" ABC	5.3	FT (Trench Width)	11.07	58.14	
	Micro Seal	50	FT (Street Width)	0.67	33.33	
	Total Paving (per LF)					\$ 104
FITTINGS, VALVES AND MANHOLES		No. per mile				
	Fittings	4	EA	0.57	2.28	
	Isolation Valve (Gate Valve for dia < 36", Butterfly Valve for dia >= 36")	2	EA	6.09	12.19	
	Air release Valve Assembly	4	EA	0.06	0.24	
	Blow off Valve Assembly	2	EA	0.06	0.12	
	Air release and blow off and valve manholes	8	EA	0.86	6.86	
	Total fittings, valves and manholes (per LF)					\$ 22
	TOTAL DIRECT COST (per LF)					\$ 520
	Contractor Overhead	10%				\$ 50
	Construction Profit	6%				\$ 30
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 40
	General Conditions	10%				\$ 50
	Traffic Control Multiplier	20%				\$ 100
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 790
	TOTAL CONSTRUCTION COSTS FOR 1 mile(s)					\$ 4,170,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

24-inch Water Main

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Material DIP	Diameter (inch) 24	Length (mile) 1	Default Excavation Depth 8	Is the pipe crossing a freeway? No
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPING						
	24" Push-on Joint Ductile Iron Pipe	1	LF	\$ 215	\$ 215	
	24" Adder For Restrained Joints	0.25	LF	\$ 123	\$ 31	
	Total Piping (per LF)					\$ 246
EARTHWORK						
	Hard Digging	1.06	CY	\$ 51	\$ 54	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.61	CY	\$ 116	\$ 71	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.30	CY	\$ 105	\$ 31	
	Controlled Density Fill (CDF)	0.03	CY	\$ 138	\$ 5	
	20 CY Dump Truck, 20 Miles/Round Trip	4.19	CY	\$ 11	\$ 46	
	Site Specific Requirements (% of Total Earthwork)	10%	LS		\$ 21	
	Total Earthwork (per LF)					\$ 233
PAVING						
	Asphalt Pavement Cutting	6	IN (Depth)	1.97	11.79	
	Remove 6" Asphalt Pavement	5.6	FT (Trench Width)	0.12	0.65	
	6" AC Paving ON 8" ABC	5.6	FT (Trench Width)	11.07	61.83	
	Micro Seal	50	FT (Street Width)	0.67	33.33	
	Total Paving (per LF)					\$ 108
FITTINGS, VALVES AND MANHOLES		No. per mile				
	Fittings	4	EA	0.84	3.36	
	Isolation Valve (Gate Valve for dia < 36", Butterfly Valve for dia >= 36")	2	EA	9.60	19.20	
	Air release Valve Assembly	4	EA	0.16	0.62	
	Blow off Valve Assembly	2	EA	0.16	0.31	
	Air release and blow off and valve manholes	8	EA	0.86	6.86	
	Total fittings, valves and manholes (per LF)					\$ 30
	TOTAL DIRECT COST (per LF)					\$ 620
	Contractor Overhead	10%				\$ 60
	Construction Profit	6%				\$ 40
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 50
	General Conditions	10%				\$ 60
	Traffic Control Multiplier	20%				\$ 120
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 950
	TOTAL CONSTRUCTION COSTS FOR 1 mile(s)					\$ 5,020,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

2 MG Storage Tank

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

Capacity (MG)

2

	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	Cat Trackhoe, 1CY Bucket, Class B (Medium Digging), 0-16' D		1600	CY	\$ 19	\$ 29,921	
	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard Concrete Block, 8"	10'	5000	SF	\$ 25	\$ 124,412	
	2" ABC Finish		27	CY	\$ 133	\$ 3,591	
	6" AC Paving ON 6" ABC		162	SY	\$ 98	\$ 15,944	
	Bollard		12	EA	\$ 1,560	\$ 18,720	
	Overflow Retention Basin		1	LS	\$ 181,200	\$ 181,200	
	Large Site Grading		1	LS	\$ 75,000	\$ 75,000	
	Total Site Work						\$ 492,959
Structural Work	Reinforced concrete foundation		56	CY	\$ 500	\$ 28,000	
	Total Structural Work						\$ 28,000
Steel Tank	Welded steel tank	2 MGD	1	EA	\$ 2,144,645	\$ 2,144,645	
	2 MGD Active Mixing System with Recirculation Pump	2 MGD	1	EA	\$ 490,750	\$ 490,750	
	Total Steel Tank						\$ 2,635,395
Piping	Inlet piping	12"	110	LF	\$ 540	\$ 59,400	
	Outlet piping	12"	110	LF	\$ 540	\$ 59,400	
	Drain Piping	8"	100	LF	\$ 122	\$ 12,173	
	BFV Isolation valve	12"	2	EA	\$ 3,900	\$ 7,800	
	Check valve	12"	2	EA	\$ 12,905	\$ 25,810	
	Fitting	12"	6	EA	\$ 804	\$ 4,821	
	Total Piping						\$ 169,405
Painting & Coating	Epoxy Coating		50000	SF	\$ 9	\$ 450,000	
	Total Painting & Coating						\$ 450,000
	TOTAL						\$ 3,776,000
Electrical & Instrumentation	Electrical and Instrumentation		10%			\$ 377,600	
	Total Electrical & Instrumentation						\$ 378,000
Disinfection	Disinfection system		5%			\$ 188,800	
	Total Disinfection						\$ 189,000
	Total cost excluding landscaping and security						\$ 4,793,000
	Landscaping cost		1%			\$ 48,000	\$ 48,000
	Security costs for smaller capacity systems		1	EA	\$ 56,000	\$ 56,000	\$ 56,000
	TOTAL DIRECT COST						\$ 4,897,000
	Contractor Overhead		10%				\$ 490,000
	Construction Profit		6%				\$ 294,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 411,000
	General Conditions		10%				\$ 490,000
	TOTAL CONSTRUCTION COSTS						\$ 6,582,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

3 MG Storage Tank

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

Capacity (MG)
3

	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	Cat Trackhoe, 1CY Bucket, Class B (Medium Digging), 0-16' D		1600	CY	\$ 19	\$ 29,921	
	8' H Double Swing Gate, Chain Link, 20' Opening		1	EA	\$ 44,171	\$ 44,171	
	Standard Concrete Block, 8"	10'	5000	SF	\$ 25	\$ 124,412	
	2" ABC Finish		27	CY	\$ 133	\$ 3,591	
	6" AC Paving ON 6" ABC		18	SY	\$ 98	\$ 1,772	
	Bollard		12	EA	\$ 1,560	\$ 18,720	
	Overflow Retention Basin		1	LS	\$ 181,200	\$ 181,200	
	Large Site Grading		1	LS	\$ 75,000	\$ 75,000	
	Total Site Work						\$ 478,786
Structural Work	Reinforced concrete foundation		88	CY	\$ 500	\$ 44,000	
	Total Structural Work						\$ 44,000
Steel Tank	Welded steel tank	3 MGD	1	EA	\$ 2,882,280	\$ 2,882,280	
	3 MGD Active Mixing System with Recirculation Pump	3 MGD	1	EA	\$ 490,750	\$ 490,750	
	Total Steel Tank						\$ 3,373,030
Piping	Inlet piping	16"	130	LF	\$ 720	\$ 93,600	
	Outlet piping	16"	130	LF	\$ 720	\$ 93,600	
	Drain Piping	8"	100	LF	\$ 122	\$ 12,173	
	BFV Isolation valve	16"	2	EA	\$ 5,634	\$ 11,268	
	Check valve	16"	2	EA	\$ 33,147	\$ 66,294	
	Fitting	16"	6	EA	\$ 1,782	\$ 10,690	
	Total Piping						\$ 287,625
Painting & Coating	Epoxy Coating		66000	SF	\$ 9	\$ 594,000	
	Total Painting & Coating						\$ 594,000
	TOTAL						\$ 4,777,000
Electrical & Instrumentation	Electrical and Instrumentation		10%			\$ 477,700	
	Total Electrical & Instrumentation						\$ 478,000
Disinfection	Disinfection system		5%			\$ 238,850	
	Total Disinfection						\$ 239,000
	Total cost excluding landscaping and security						\$ 6,088,000
	Landscaping cost		1%			\$ 61,000	\$ 61,000
	Security costs for smaller capacity systems		1	EA	\$ 56,000	\$ 56,000	\$ 56,000
	TOTAL DIRECT COST						\$ 6,205,000
	Contractor Overhead		10%				\$ 621,000
	Construction Profit		6%				\$ 372,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 521,000
	General Conditions		10%				\$ 621,000
	TOTAL CONSTRUCTION COSTS						\$ 8,340,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

5 mgd Booster Pump Station

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Site Capacity (MGD)	Number of Pump Trains				
		5	4				
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	Cat Trackhoe, 1CY Bucket, Class B (Medium Digging), 0-16' D		175	CY	\$ 19	\$ 3,273	
	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard concrete block wall 8"	8'	2880	SF	\$ 25	\$ 71,661	
	2" ABC Finish		900	CY	\$ 133	\$ 119,700	
	6" AC Paving ON 6" ABC		162	SY	\$ 98	\$ 15,944	
	Bollard		18	EA	\$ 1,560	\$ 28,080	
	Medium Site Grading		1	LS	\$ 38,880	\$ 38,880	
	Total Site Work						\$ 321,709
Structural Work	Precast concrete chlorine equipment building	10'x12'	1	LS	\$ 121,100	\$ 121,100	
	8" Chlorine building pad	10'x12'x8"	3	CY	\$ 500	\$ 1,500	
	12" Hydropneumatic tank pad	10'x20'x12"	30	CY	\$ 500	\$ 14,815	
	12" Pump and discharge piping pad	10'x25'x12"	10	CY	\$ 500	\$ 5,000	
	18" Generator pad	20'x20'x18"	17	CY	\$ 500	\$ 8,333	
	Precast concrete electrical equipment building	10'x30'	1	LS	\$ 280,000	\$ 280,000	
	12" Reinforced Concrete	3'x3'x12"	4	EA	\$ 500	\$ 2,000	
	Total Structural Work						\$ 432,748
Suction Header	20" CI 52 CLDI Mj Pipe - Plant	20"	25	LF	\$ 3,003	\$ 75,080	
	20" CLDI Flg Straight Tee In Place - Plant	20"	1	EA	\$ 12,747	\$ 12,747	
	Total Suction Header						\$ 87,827
Pump Train	10" CLDI Flg Straight Tee In Place - Plant	10"	12	EA	\$ 5,830	\$ 69,964	
	10" Resilient Wedge Gate Valve	10"	4	EA	\$ 3,760	\$ 15,038	
	12"- 200 PSI CI Fxf Swing Check Valve	10"	4	EA	\$ 9,229	\$ 36,916	
	10" AWWA Class 150B Flanged Butterfly Valve	10"	4	EA	\$ 3,026	\$ 12,106	
	30" Pipe Support	30"	12	EA	\$ 894	\$ 10,733	
	40 HP Vertical Turbine Pump	1200 gpm	4	EA	\$ 232,320	\$ 929,280	
	10" CI 52 CLDI Mj Pipe - Plant	10"	40	LF	\$ 1,502	\$ 60,073	
	1" 300 PSI Air/Vac Valve W/Shutoff	1"	8	EA	\$ 1,028	\$ 8,223	
	10" Fca Above Ground	10"	8	EA	\$ 2,112	\$ 16,894	
	Pressure/Vacuum Measurement Gauges		8	EA	\$ 1,867	\$ 14,940	
	5' C. I. Valve Box For 3"-20" Valves	5'	4	EA	\$ 2,450	\$ 9,801	
	Total Pump Train						\$ 1,183,967
Discharge Header	20" CI 52 CLDI Mj Pipe - Plant	20"	25	LF	\$ 3,003	\$ 75,080	
	20" CLDI Flg Straight Tee In Place - Plant	20"	1	EA	\$ 12,747	\$ 12,747	
	30" Pipe Support	30"	4	EA	\$ 894	\$ 3,578	
	Total Discharge Header						\$ 91,404
Pressure Relief	10" CI 52 CLDI Mj Pipe - Plant	10"	10	LF	\$ 1,502	\$ 15,018	
	10" 90° CLDI Mj Bend - Plant	10"	4	EA	\$ 696	\$ 2,783	
	10" AWWA Class 150B Flanged Butterfly Valve	10"	2	EA	\$ 3,026	\$ 6,053	
	High pressure relief valve	10"	1	EA	\$ 25,536	\$ 25,536	
	1" 300 PSI Air/Vac Valve W/Shutoff	1"	1	EA	\$ 1,028	\$ 1,028	
	5,000 gallon hydropneumatic tank w/ air comp & controls		1	EA	\$ 247,500	\$ 247,500	
	10,000 gallon hydropneumatic tank w/ air comp & controls		1	EA	\$ 360,000	\$ 360,000	
	Total Pressure Relief						\$ 657,918
	TOTAL						\$ 2,776,000
Electrical & Instrumentation	Electrical and Instrumentation		40%			\$ 1,110,400	
	Total Electrical & Instrumentation						\$ 1,110,000
Disinfection	Chlorine Disinfection		10%			\$ 277,600	
	Total Disinfection						\$ 278,000
Painting & Coatings	Painting & coating		10%			\$ 277,600	
	Total Painting & Coating						\$ 278,000
	Total cost excluding landscaping and security						\$ 4,442,000
	Landscaping cost		1%			\$ 44,000	\$ 44,000
	Security costs for smaller capacity systems		1	EA	\$ 56,000	\$ 56,000	\$ 56,000
	TOTAL DIRECT COST						\$ 4,542,000
	SRP Design Fee				\$ 200,000		\$ 200,000
	Contractor Overhead		10%				\$ 454,000
	Construction Profit		6%				\$ 273,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 382,000
	General Conditions		10%				\$ 454,000
	TOTAL CONSTRUCTION COSTS						\$ 6,305,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

10 mgd Booster Pump Station

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Site Capacity (MGD)	Number of Pump Trains				
		10	4				
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	Cat Trackhoe, 1CY Bucket, Class B (Medium Digging), 0-16' D		280	CY	\$ 19	\$ 5,236	
	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard concrete block wall 8"	8'	2880	SF	\$ 25	\$ 71,661	
	2" ABC Finish		900	CY	\$ 133	\$ 119,700	
	6" AC Paving ON 6" ABC		162	SY	\$ 98	\$ 15,944	
	Bollard		18	EA	\$ 1,560	\$ 28,080	
	Medium Site Grading		1	LS	\$ 38,880	\$ 38,880	
	Total Site Work						\$ 323,672
Structural Work	Precast concrete chlorine equipment building	10'x12'	1	LS	\$ 121,100	\$ 121,100	
	8" Chlorine building pad	10'x12'x8"	3	CY	\$ 500	\$ 1,500	
	12" Hydropneumatic tank pad	10'x20'x12"	30	CY	\$ 500	\$ 14,815	
	12" Pump and discharge piping pad	10'x25'x12"	10	CY	\$ 500	\$ 5,000	
	18" Generator pad	20'x20'x18"	17	CY	\$ 500	\$ 8,333	
	Precast concrete electrical equipment building	10'x30'	1	LS	\$ 280,000	\$ 280,000	
	12" Reinforced Concrete	4'x4'x12"	4	EA	\$ 500	\$ 2,000	
	Total Structural Work						\$ 432,748
Suction Header	30" CI 52 CLDI Mj Pipeh - Plant	30"	25	LF	\$ 4,504	\$ 112,602	
	30" CLDI Flg Straight Tee In Place - Plant	30"	1	EA	\$ 26,153	\$ 26,153	
	Total Suction Header						\$ 138,755
Pump Train	10" CLDI Flg Straight Tee In Place - Plant	10"	12	EA	\$ 5,830	\$ 69,964	
	10" Resilient Wedge Gate Valve	10"	4	EA	\$ 3,760	\$ 15,038	
	12"- 200 PSI CI Fxf Swing Check Valve	10"	4	EA	\$ 9,229	\$ 36,916	
	10" AWWA Class 150B Flanged Butterfly Valve	10"	4	EA	\$ 3,026	\$ 12,106	
	30" Pipe Support	30"	12	EA	\$ 894	\$ 10,733	
	75 HP Vertical Turbine Pump	2400 gpm	4	EA	\$ 343,510	\$ 1,374,041	
	10" CI 52 CLDI Mj Pipe - Plant	10"	40	LF	\$ 1,502	\$ 60,073	
	1" 300 PSI Air/Vac Valve W/Shutoff	1"	8	EA	\$ 1,028	\$ 8,223	
	10" Fca Above Ground	10"	8	EA	\$ 2,112	\$ 16,894	
	Pressure/Vacuum Measurement Gauges		8	EA	\$ 1,867	\$ 14,940	
	5' C. I. Valve Box For 3"-20" Valves	5'	4	EA	\$ 2,450	\$ 9,801	
	Total Pump Train						\$ 1,628,728
Discharge Header	30" CI 52 CLDI Mj Pipeh - Plant	30"	25	LF	\$ 4,504	\$ 112,602	
	30" CLDI Flg Straight Tee In Place - Plant	30"	1	EA	\$ 26,153	\$ 26,153	
	30" Pipe Support	30"	4	EA	\$ 894	\$ 3,578	
	Total Discharge Header						\$ 142,333
Pressure Relief	14" CI 52 CLDI Mj Pipe - Plant	14"	10	LF	\$ 2,102	\$ 21,019	
	14" 90° CLDI Mj Bend - Plant	14"	4	EA	\$ 1,755	\$ 7,018	
	14" AWWA Class 150B Flanged Butterfly Valve	14"	2	EA	\$ 4,537	\$ 9,074	
	High pressure relief valve	14"	1	EA	\$ 76,811	\$ 76,811	
	1" 300 PSI Air/Vac Valve W/Shutoff	1"	1	EA	\$ 1,028	\$ 1,028	
	5,000 gallon hydropneumatic tank w/ air comp & controls		1	EA	\$ 247,500	\$ 247,500	
	10,000 gallon hydropneumatic tank w/ air comp & controls		1	EA	\$ 360,000	\$ 360,000	
	Total Pressure Relief						\$ 722,451
	TOTAL						\$ 3,389,000
Electrical & Instrumentation	Electrical and Instrumentation		40%			\$ 1,355,600	
	Total Electrical & Instrumentation						\$ 1,356,000
Disinfection	Chlorine Disinfection		10%			\$ 338,900	
	Total Disinfection						\$ 339,000
Painting & Coatings	Painting & coating		10%			\$ 338,900	
	Total Painting & Coating						\$ 339,000
	Total cost excluding landscaping and security						\$ 5,423,000
	Landscaping cost		1%			\$ 54,000	\$ 54,000
	Security costs for smaller capacity systems		1	EA	\$ 56,000	\$ 56,000	\$ 56,000
	TOTAL DIRECT COST						\$ 5,533,000
	SRP Design Fee				\$ 200,000		\$ 200,000
	Contractor Overhead		10%				\$ 553,000
	Construction Profit		6%				\$ 332,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 465,000
	General Conditions		10%				\$ 553,000
	TOTAL CONSTRUCTION COSTS						\$ 7,636,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

15 mgd Booster Pump Station

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Site Capacity (MGD)	Number of Pump Trains				
		15	5				
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	Cat Trackhoe, 1CY Bucket, Class B (Medium Digging), 0-16' D		335	CY	\$ 19	\$ 6,265	
	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard concrete block wall 8"	8"	2880	SF	\$ 25	\$ 71,661	
	2" ABC Finish		900	CY	\$ 133	\$ 119,700	
	6" AC Paving ON 6" ABC		162	SY	\$ 98	\$ 15,944	
	Bollard		20	EA	\$ 1,560	\$ 31,200	
	Medium Site Grading		1	LS	\$ 38,880	\$ 38,880	
	Total Site Work						\$ 327,821
Structural Work	Precast concrete chlorine equipment building	10'x12'	1	LS	\$ 121,100	\$ 121,100	
	8" Chlorine building pad	10'x12'x8"	3	CY	\$ 500	\$ 1,500	
	12" Hydropneumatic tank pad	10'x20'x12"	30	CY	\$ 500	\$ 14,815	
	12" Pump and discharge piping pad	10'x30'x12"	12	CY	\$ 500	\$ 6,000	
	18" Generator pad	20'x20'x18"	17	CY	\$ 500	\$ 8,333	
	Precast concrete electrical equipment building	10'x30'	1	LS	\$ 280,000	\$ 280,000	
	12" Reinforced Concrete	4'x4'x12"	8	EA	\$ 500	\$ 4,000	
	Total Structural Work						\$ 435,748
Suction Header	36" CI 52 CLDI MJ Pipe - Plant	36"	30	LF	\$ 5,400	\$ 162,004	
	36" CLDI Flg Straight Tee In Place	36"	1	EA	\$ 39,934	\$ 39,934	
	Total Suction Header						\$ 201,938
Pump Train	10" CLDI Flg Straight Tee In Place - Plant	10"	15	EA	\$ 5,830	\$ 87,455	
	10" Resilient Wedge Gate Valve	10"	5	EA	\$ 3,760	\$ 18,798	
	12"- 200 PSI CI Fxf Swing Check Valve	10"	5	EA	\$ 9,229	\$ 46,144	
	10" AWWA Class 150B Flanged Butterfly Valve	10"	5	EA	\$ 3,026	\$ 15,132	
	30" Pipe Support	30"	15	EA	\$ 894	\$ 13,416	
	125 HP Vertical Turbine Pump	3127 gpm	5	EA	\$ 393,136	\$ 1,965,678	
	10" CI 52 CLDI MJ Pipe - Plant	10"	50	LF	\$ 1,502	\$ 75,092	
	1" 300 PSI Air/Vac Valve W/Shutoff	1"	10	EA	\$ 1,028	\$ 10,278	
	10" Fca Above Ground	10"	10	EA	\$ 2,112	\$ 21,117	
	Pressure/Vacuum Measurement Gauges		10	EA	\$ 1,867	\$ 18,675	
	5' C. I. Valve Box For 3"-20" Valves	5'	5	EA	\$ 2,450	\$ 12,251	
	Total Pump Train						\$ 2,284,037
Discharge Header	36" CI 52 CLDI MJ Pipe - Plant	36"	30	LF	\$ 5,400	\$ 162,004	
	36" CLDI Flg Straight Tee In Place	36"	1	EA	\$ 39,934	\$ 39,934	
	Concrete Pipe Support		5	EA	\$ 6,745	\$ 33,725	
	Total Discharge Header						\$ 235,663
Pressure Relief	16" CI 52 CLDI MJ Pipe - Plant	16"	10	LF	\$ 2,403	\$ 24,030	
	16" 90° CLDI MJ Bend - Plant	16"	4	EA	\$ 2,038	\$ 8,153	
	16" AWWA Class 150B Flanged Butterfly Valve	16"	2	EA	\$ 5,634	\$ 11,268	
	High pressure relief valve	16"	1	EA	\$ 78,650	\$ 78,650	
	1" 300 PSI Air/Vac Valve W/Shutoff	1"	1	EA	\$ 1,028	\$ 1,028	
	10,000 gallon hydropneumatic tank w/ air comp & controls		1	EA	\$ 360,000	\$ 360,000	
	20,000 gallon hydropneumatic tank w/ air comp & controls		1	EA	\$ 525,000	\$ 525,000	
	Total Pressure Relief						\$ 1,008,128
	TOTAL						\$ 4,493,000
Electrical & Instrumentation	Electrical and Instrumentation		40%			\$ 1,797,200	
	Total Electrical & Instrumentation						\$ 1,797,000
Disinfection	Chlorine Disinfection		10%			\$ 449,300	
	Total Disinfection						\$ 449,000
Painting & Coatings	Painting & coating		10%			\$ 449,300	
	Total Painting & Coating						\$ 449,000
	Total cost excluding landscaping and security						\$ 7,188,000
	Landscaping cost		1%			\$ 72,000	\$ 72,000
	Security costs for larger capacity systems		1	EA	\$ 84,000	\$ 84,000	\$ 84,000
	TOTAL DIRECT COST						\$ 7,344,000
	SRP Design Fee				\$ 200,000		\$ 200,000
	Contractor Overhead		10%				\$ 734,000
	Construction Profit		6%				\$ 441,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 617,000
	General Conditions		10%				\$ 734,000
	TOTAL CONSTRUCTION COSTS						\$ 10,070,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

20 mgd Booster Pump Station

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Site Capacity (MGD)	Number of Pump Trains				
		20	5				
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	Cat Trackhoe, 1CY Bucket, Class B (Medium Digging), 0-16' D		740	CY	\$ 19	\$ 13,838	
	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard concrete block wall 8"	8'	2880	SF	\$ 25	\$ 71,661	
	2" ABC Finish		900	CY	\$ 133	\$ 119,700	
	6" AC Paving ON 6" ABC		162	SY	\$ 98	\$ 15,944	
	Bollard		20	EA	\$ 1,560	\$ 31,200	
	Medium Site Grading		1	LS	\$ 38,880	\$ 38,880	
	Total Site Work						\$ 335,395
Structural Work	Precast concrete chlorine equipment building	10'x12'		LS	\$ 121,100	\$ -	
	8" Chlorine building pad	10'x12'x8"	3	CY	\$ 500	\$ 1,500	
	12" Hydropneumatic tank pad	10'x20'x12"	30	CY	\$ 500	\$ 14,815	
	12" Pump and discharge piping pad	10'x45'x12"	17	CY	\$ 500	\$ 8,500	
	18" Generator pad	20'x20'x18"	17	CY	\$ 500	\$ 8,333	
	Precast concrete electrical equipment building	10'x30'	1	LS	\$ 280,000	\$ 280,000	
	12" Reinforced Concrete	6'x6'x12"	20	EA	\$ 500	\$ 10,000	
	Total Structural Work						\$ 323,148
Suction Header	42" CI 52 CLDI MJ Pipe - Plant	42"	45	LF	\$ 6,300	\$ 283,507	
	42" CLDI Flg Straight Tee In Place	42"	1	EA	\$ 61,898	\$ 61,898	
	Total Suction Header						\$ 345,405
Pump Train	16" CLDI Flg Straight Tee In Place - Plant	16"	15	EA	\$ 17,397	\$ 260,957	
	16" Resilient Wedge Gate Valve	16"	5	EA	\$ 15,990	\$ 79,950	
	20"-250 PSI Swing Check Valve	16"	5	EA	\$ 44,439	\$ 222,196	
	16" AWWA Class 150B Flanged Butterfly Valve	16"	5	EA	\$ 5,634	\$ 28,171	
	30" Pipe Support	30"	15	EA	\$ 894	\$ 13,416	
	150 HP Vertical Turbine Pump	4169 gpm	5	EA	\$ 439,656	\$ 2,198,279	
	16" CI 52 CLDI MJ Pipe - Plant	16"	50	LF	\$ 2,403	\$ 120,148	
	1" 300 PSI Air/Vac Valve W/Shutoff	1"	10	EA	\$ 1,028	\$ 10,278	
	16" Fca Above Ground	16"	10	EA	\$ 3,756	\$ 37,562	
	Pressure/Vacuum Measurement Gauges		10	EA	\$ 1,867	\$ 18,675	
	5' C. I. Valve Box For 3"-20" Valves	5'	5	EA	\$ 2,450	\$ 12,251	
	Total Pump Train						\$ 3,001,884
Discharge Header	42" CI 52 CLDI MJ Pipe - Plant	42"	45	LF	\$ 6,300	\$ 283,507	
	42" CLDI Flg Straight Tee In Place	42"	1	EA	\$ 61,898	\$ 61,898	
	Concrete Pipe Support		5	EA	\$ 6,745	\$ 33,725	
	Total Discharge Header						\$ 379,130
Pressure Relief	20" CI 52 CLDI MJ Pipe - Plant	20"	10	LF	\$ 3,003	\$ 30,032	
	20" 90" CLDI MJ Bend - Plant	20"	4	EA	\$ 3,458	\$ 13,831	
	20" DIMJ AWWA Butterfly Valve, No Op	20"	2	EA	\$ 13,930	\$ 27,861	
	High pressure relief valve	20"	1	EA	\$ 85,391	\$ 85,391	
	1" 300 PSI Air/Vac Valve W/Shutoff	1"	1	EA	\$ 1,028	\$ 1,028	
	10,000 gallon hydropneumatic tank w/ air comp & controls		1	EA	\$ 360,000	\$ 360,000	
	20,000 gallon hydropneumatic tank w/ air comp & controls		1	EA	\$ 525,000	\$ 525,000	
	Total Pressure Relief						\$ 1,043,142
	TOTAL						\$ 5,428,000
Electrical & Instrumentation	Electrical and Instrumentation		40%			\$ 2,171,200	
	Total Electrical & Instrumentation						\$ 2,171,000
Disinfection	Chlorine Disinfection		10%			\$ 542,800	
	Total Disinfection						\$ 543,000
Painting & Coatings	Painting & coating		10%			\$ 542,800	
	Total Painting & Coating						\$ 543,000
	Total cost excluding landscaping and security						\$ 8,685,000
	Landscaping cost		1%			\$ 87,000	\$ 87,000
	Security costs for larger capacity systems		1	EA	\$ 84,000	\$ 84,000	\$ 84,000
	TOTAL DIRECT COST						\$ 8,856,000
	SRP Design Fee				\$ 200,000		\$ 200,000
	Contractor Overhead		10%				\$ 886,000
	Construction Profit		6%				\$ 531,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 744,000
	General Conditions		10%				\$ 886,000
	TOTAL CONSTRUCTION COSTS						\$ 12,103,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

1 mgd Well

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Well Capacity (MGD)	Well Depth (ft)	Well Diameter (in)			
3 MGD Well		1	1200	14			
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard Concrete Block, 8"	8'	1600	SF	\$ 25	\$ 39,812	
	2" ABC Finish		20	CY	\$ 133	\$ 2,660	
	6" AC Paving ON 6" ABC		162	CY	\$ 98	\$ 15,944	
	Bollard		10	EA	\$ 1,560	\$ 15,600	
	Well drilling & steel casing		1	LS	\$ 1,000,000	\$ 1,000,000	
	Small Site Grading		1	LS	\$ 12,000	\$ 12,000	
	Total Site Work						\$ 1,130,187
Structural Work	12" Sloped Slab On Grade (To 30%)	10'x30'x12"	12	CY	\$ 500	\$ 6,000	
	Precast concrete building (HVAC, electrical and lighting)	10'x30'	1	LS	\$ 280,000	\$ 280,000	
	12" Reinforced Concrete	10'x20'x12"	7	CY	\$ 500	\$ 3,704	
	Total Structural Work						\$ 289,704
Well Pump	Well pump	694 gpm	1	LS	\$ 250,000	\$ 250,000	
	Total Well Pump						\$ 250,000
Discharge Header	Fitting	8"	3	EA	\$ 1,749	\$ 5,247	
	8" Flex Cplg, Above Ground	8"	3	EA	\$ 889	\$ 2,668	
	8" CLDI Flg Straight Tee In Place	8"	30	LF	\$ 1,749	\$ 52,467	
	2" 300 PSI Air/Vac Valve W/Shutoff	2"	1	EA	\$ 1,647	\$ 1,647	
	2" 150 PSI Air Release Valve Stainless Steel 317	2"	1	EA	\$ 819	\$ 819	
	10"- 200 PSI CI FXF Swing Check Valve	8"	1	EA	\$ 4,665	\$ 4,665	
	30" Pipe Support	30"	3	EA	\$ 894	\$ 2,683	
	8" AWWA Class 150B Flanged Butterfly Valve	8"	1	EA	\$ 2,980	\$ 2,980	
	SCH40 PVC Drain Pipe	2.5"	20	LF	\$ 192	\$ 3,831	
	Process Pressure Gauge		1	EA	\$ 240	\$ 240	
	Total Discharge Header						\$ 77,247
Pressure Relief	10,000 gal discharge surge tank	10,000 gal	1	EA	\$ 360,000	\$ 360,000	
	Total Pressure Relief						\$ 360,000
TOTAL							\$ 2,107,000
Electrical & Instrumentation	Electrical and Instrumentation		35%			\$ 737,450	
	Total Electrical & Instrumentation						\$ 737,000
Disinfection	Chlorination system		10%			\$ 210,700	
	Total Disinfection						\$ 211,000
	Total cost excluding landscaping and security						\$ 3,055,000
	Landscaping cost		1%			\$ 31,000	\$ 31,000
	Security costs for smaller capacity systems		1	EA	\$ 56,000	\$ 56,000	\$ 56,000
	TOTAL DIRECT COST						\$ 3,142,000
	SRP Design Fee				\$ 200,000		\$ 200,000
	Contractor Overhead		10%				\$ 314,000
	Construction Profit		6%				\$ 189,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 264,000
	General Conditions		10%				\$ 314,000
TOTAL CONSTRUCTION COSTS							\$ 4,423,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

1.5 mgd Well

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Well Capacity (MGD)	Well Depth (ft)	Well Diameter (in)			
3 MGD Well		1.5	1200	16			
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard Concrete Block, 8"	8'	1600	SF	\$ 25	\$ 39,812	
	2" ABC Finish		20	CY	\$ 133	\$ 2,660	
	6" AC Paving ON 6" ABC		162	CY	\$ 98	\$ 15,944	
	Bollard		10	EA	\$ 1,560	\$ 15,600	
	Well drilling & steel casing		1	LS	\$ 1,000,000	\$ 1,000,000	
	Small Site Grading		1	LS	\$ 12,000	\$ 12,000	
	Total Site Work						\$ 1,130,187
Structural Work	12" Sloped Slab On Grade (To 30%)	10'x30'x12"	12	CY	\$ 500	\$ 6,000	
	Precast concrete building (HVAC, electrical and lighting)	10'x30'	1	LS	\$ 280,000	\$ 280,000	
	12" Reinforced Concrete	10'x20'x12"	7	CY	\$ 500	\$ 3,704	
	Total Structural Work						\$ 289,704
Well Pump	Well pump	1050 gpm	1	LS	\$ 255,747	\$ 255,747	
	Total Well Pump						\$ 255,747
Discharge Header	Fitting	10"	3	EA	\$ 4,523	\$ 13,570	
	10" Flex Cplg, Above Ground	10"	3	EA	\$ 1,156	\$ 3,468	
	10" CLDI Flg Straight Tee In Place	10"	30	LF	\$ 4,523	\$ 135,705	
	2" 300 PSI Air/Vac Valve W/Shutoff	2"	1	EA	\$ 1,647	\$ 1,647	
	2" 150 PSI Air Release Valve Stainless Steel 317	2"	1	EA	\$ 819	\$ 819	
	12"- 200 PSI CI FXF Swing Check Valve	10"	1	EA	\$ 9,229	\$ 9,229	
	30" Pipe Support	30"	3	EA	\$ 894	\$ 2,683	
	10" AWWA Class 150B Flanged Butterfly Valve	10"	1	EA	\$ 3,026	\$ 3,026	
	SCH40 PVC Drain Pipe	2.5"	20	LF	\$ 192	\$ 3,831	
	Process Pressure Gauge		1	EA	\$ 240	\$ 240	
	Total Discharge Header						\$ 174,218
Pressure Relief	10,000 gal discharge surge tank	10,000 gal	1	EA	\$ 360,000	\$ 360,000	
	Total Pressure Relief						\$ 360,000
TOTAL							\$ 2,210,000
Electrical & Instrumentation	Electrical and Instrumentation		35%			\$ 773,500	
	Total Electrical & Instrumentation						\$ 774,000
Disinfection	Chlorination system		10%			\$ 221,000	
	Total Disinfection						\$ 221,000
Total cost excluding landscaping and security							\$ 3,205,000
Landscaping cost			1%			\$ 32,000	\$ 32,000
Security costs for smaller capacity systems			1	EA	\$ 56,000	\$ 56,000	\$ 56,000
TOTAL DIRECT COST							\$ 3,293,000
SRP Design Fee					\$ 200,000		\$ 200,000
Contractor Overhead			10%				\$ 329,000
Construction Profit			6%				\$ 198,000
Sales Tax (Applied to 65% of Total Direct Cost)			8%				\$ 277,000
General Conditions			10%				\$ 329,000
TOTAL CONSTRUCTION COSTS							\$ 4,626,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

3 mgd Well

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Well Capacity (MGD)	Well Depth (ft)	Well Diameter (in)			
3 MGD Well		3	1200	18			
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard Concrete Block, 8"	8'	1600	SF	\$ 25	\$ 39,812	
	2" ABC Finish		20	CY	\$ 133	\$ 2,660	
	6" AC Paving ON 6" ABC		162	CY	\$ 98	\$ 15,944	
	Bollard		10	EA	\$ 1,560	\$ 15,600	
	Well drilling & steel casing		1	LS	\$ 1,000,000	\$ 1,000,000	
	Small Site Grading		1	LS	\$ 12,000	\$ 12,000	
	Total Site Work						\$ 1,130,187
Structural Work	12" Sloped Slab On Grade (To 30%)	10'x30'x12"	12	CY	\$ 500	\$ 6,000	
	Precast concrete building (HVAC, electrical and lighting)	10'x30'	1	LS	\$ 280,000	\$ 280,000	
	12" Reinforced Concrete	10'x20'x12"	7	CY	\$ 500	\$ 3,704	
	Total Structural Work						\$ 289,704
Well Pump	Well pump	2082 gpm	1	LS	\$ 327,427	\$ 327,427	
	Total Well Pump						\$ 327,427
Discharge Header	Fitting	14"	3	EA	\$ 8,342	\$ 25,025	
	14" Flex Cplg, Above Ground	14"	3	EA	\$ 2,256	\$ 6,767	
	14" CLDI Flg Straight Tee In Place	14"	30	LF	\$ 8,342	\$ 250,245	
	3" 300 PSI Air/Vac Valve W/Shutoff	3"	1	EA	\$ 3,373	\$ 3,373	
	3" 150 PSI Air Release Valve Stainless Steel 318	3"	1	EA	\$ 1,744	\$ 1,744	
	16"- 125# Di FXF Swing Check Valve	14"	1	EA	\$ 33,147	\$ 33,147	
	30" Pipe Support	30"	3	EA	\$ 894	\$ 2,683	
	14" AWWA Class 150B Flanged Butterfly Valve	14"	1	EA	\$ 4,537	\$ 4,537	
	SCH40 PVC Drain Pipe	2.5"	20	LF	\$ 192	\$ 3,831	
	Process Pressure Gauge		1	EA	\$ 240	\$ 240	
	Total Discharge Header						\$ 331,592
Pressure Relief	10,000 gal discharge surge tank	10,000 gal	1	EA	\$ 360,000	\$ 360,000	
	Total Pressure Relief						\$ 360,000
	TOTAL						\$ 2,439,000
Electrical & Instrumentation	Electrical and Instrumentation		35%			\$ 853,650	
	Total Electrical & Instrumentation						\$ 854,000
Disinfection	Chlorination system		10%			\$ 243,900	
	Total Disinfection						\$ 244,000
	Total cost excluding landscaping and security						\$ 3,537,000
	Landscaping cost		1%			\$ 35,000	\$ 35,000
	Security costs for smaller capacity systems		1	EA	\$ 56,000	\$ 56,000	\$ 56,000
	TOTAL DIRECT COST						\$ 3,628,000
	SRP Design Fee				\$ 200,000		\$ 200,000
	Contractor Overhead		10%				\$ 363,000
	Construction Profit		6%				\$ 218,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 305,000
	General Conditions		10%				\$ 363,000
	TOTAL CONSTRUCTION COSTS						\$ 5,077,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

APPENDIX 7B

WASTEWATER UNIT COSTS

8-inch Gravity Main						
Project:		2024 Integrated Water Master Plan				
Client:		City of Goodyear				
		Material	Diameter	Length (mile)	Default Excavation Depth	
		VCP	8	1	6	
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPE						
	8" C-700 VCP In Open Trench	1	LF	\$ 31	\$ 31	
	Total Piping (per LF)					\$ 31
EARTHWORK						
Excavation	Hard Digging	0.44	CY	\$ 51	\$ 23	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
&Backfill	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.20	CY	\$ 116	\$ 23	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.21	CY	\$ 31	\$ 7	
	Controlled Density Fill (CDF)	0.02	CY	\$ 138	\$ 3	
	20 CY Dump Truck, 20 Miles/Round Trip	5.02	CY	\$ 11	\$ 55	
	Site Specific Requirements	10%	LS		\$ 12	
	Total Earthwork (per LF)					\$ 127
Asphalt Paving	ASPHALT PAVEMENT CUTTING	4	IN (Depth)	\$ 2	\$ 8	
Demo & Replacement	REMOVE 4"-6" ASPHALT PAVEMENT	12	FT (Street Width)	\$ 1	\$ 1	
	4" AC PAVING ON 8" ABC	12	FT (Street Width)	\$ 11	\$ 15	
	Micro Seal	50	FT (Street Width)	\$ 1	\$ 33	
	Total Paving (per LF)					\$ 57
Manholes						
		No. per 400 ft				
	Manhole	1	EA	\$ 11	\$ 11	
	Heavy Traffic Frame and Manhole Cover	1	EA	\$ 2	\$ 2	
	Concrete Manhole Invert, Single Channel	1	EA	\$ 2	\$ 2	
	Total Manholes (per LF)					\$ 20
	TOTAL DIRECT COST (per LF)					\$ 230
	Contractor Overhead	10%				\$ 20
	Construction Profit	6%				\$ 10
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 20
	General Conditions	10%				\$ 20
	Traffic Control costs	10%				\$ 20
	Cost for bypass lines	10%				\$ 20
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 340
	TOTAL CONSTRUCTION COSTS (per mile)					\$ 1,800,000

Notes:

This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

12-inch Gravity Main						
Project:		2024 Integrated Water Master Plan				
Client:		City of Goodyear				
		Material	Diameter	Length (mile)	Default Excavation Depth	
		VCP	12	1	6	
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPE						
	12" C-700 VCP In Open Trench	1	LF	\$ 43	\$ 43	
	Total Piping (per LF)					\$ 43
EARTHWORK						
Excavation	Hard Digging	0.52	CY	\$ 51	\$ 26	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
&Backfill	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.27	CY	\$ 116	\$ 32	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.19	CY	\$ 31	\$ 6	
	Controlled Density Fill (CDF)	0.02	CY	\$ 138	\$ 3	
	20 CY Dump Truck, 20 Miles/Round Trip	5.18	CY	\$ 11	\$ 57	
	Site Specific Requirements	10%	LS		\$ 13	
	Total Earthwork (per LF)					\$ 142
Asphalt Paving	ASPHALT PAVEMENT CUTTING	4	IN (Depth)	\$ 2	\$ 8	
Demo & Replacement	REMOVE 4"-6" ASPHALT PAVEMENT	12	FT (Street Width)	\$ 1	\$ 1	
	4" AC PAVING ON 8" ABC	12	FT (Street Width)	\$ 11	\$ 15	
	Micro Seal	50	FT (Street Width)	\$ 1	\$ 33	
	Total Paving (per LF)					\$ 57
Manholes						
		No. per 400 ft				
	Manhole	1	EA	\$ 11	\$ 11	
	Heavy Traffic Frame and Manhole Cover	1	EA	\$ 2	\$ 2	
	Concrete Manhole Invert, Single Channel	1	EA	\$ 2	\$ 2	
	Total Manholes (per LF)					\$ 20
	TOTAL DIRECT COST (per LF)					\$ 260
	Contractor Overhead	10%				\$ 30
	Construction Profit	6%				\$ 20
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 20
	General Conditions	10%				\$ 30
	Traffic Control costs	10%				\$ 30
	Cost for bypass lines	10%				\$ 30
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 420
	TOTAL CONSTRUCTION COSTS (per mile)					\$ 2,220,000

Notes:

This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

15-inch Gravity Main						
Project:		2024 Integrated Water Master Plan				
Client:		City of Goodyear				
		Material	Diameter	Length (mile)	Default Excavation Depth	
		VCP	15	1	8	
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPE						
	15" C-700 VCP In Open Trench	1	LF	\$ 72	\$ 72	
	Total Piping (per LF)					\$ 72
EARTHWORK						
Excavation	Hard Digging	0.77	CY	\$ 51	\$ 39	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
&Backfill	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.34	CY	\$ 116	\$ 39	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.34	CY	\$ 31	\$ 11	
	Controlled Density Fill (CDF)	0.04	CY	\$ 138	\$ 5	
	20 CY Dump Truck, 20 Miles/Round Trip	5.74	CY	\$ 11	\$ 63	
	Site Specific Requirements	10%	LS		\$ 16	
	Total Earthwork (per LF)					\$ 178
Asphalt Paving	ASPHALT PAVEMENT CUTTING	4	IN (Depth)	\$ 2	\$ 8	
Demo & Replacement	REMOVE 4"-6" ASPHALT PAVEMENT	12	FT (Street Width)	\$ 1	\$ 1	
	4" AC PAVING ON 8" ABC	12	FT (Street Width)	\$ 11	\$ 15	
	Micro Seal	50	FT (Street Width)	\$ 1	\$ 33	
	Total Paving (per LF)					\$ 57
Manholes						
		No. per 400 ft				
	Manhole	1	EA	\$ 11	\$ 11	
	Heavy Traffic Frame and Manhole Cover	1	EA	\$ 2	\$ 2	
	Concrete Manhole Invert, Single Channel	1	EA	\$ 2	\$ 2	
	Total Manholes (per LF)					\$ 20
	TOTAL DIRECT COST (per LF)					\$ 330
	Contractor Overhead	10%				\$ 30
	Construction Profit	6%				\$ 20
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 30
	General Conditions	10%				\$ 30
	Traffic Control costs	10%				\$ 30
	Cost for bypass lines	10%				\$ 30
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 500
	TOTAL CONSTRUCTION COSTS (per mile)					\$ 2,640,000

Notes:

This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

16-inch Gravity Main						
Project:		2024 Integrated Water Master Plan				
Client:		City of Goodyear				
		Material	Diameter	Length (mile)	Default Excavation Depth	
		VCP	16	1	8	
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPE						
	16" C-700 VCP In Open Trench	1	LF	\$ 104	\$ 104	
	Total Piping (per LF)					\$ 104
EARTHWORK						
Excavation	Hard Digging	0.79	CY	\$ 51	\$ 40	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
&Backfill	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.36	CY	\$ 116	\$ 42	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.34	CY	\$ 31	\$ 10	
	Controlled Density Fill (CDF)	0.04	CY	\$ 138	\$ 5	
	20 CY Dump Truck, 20 Miles/Round Trip	5.79	CY	\$ 11	\$ 64	
	Site Specific Requirements	10%	LS		\$ 17	
	Total Earthwork (per LF)					\$ 183
Asphalt Paving	ASPHALT PAVEMENT CUTTING	4	IN (Depth)	\$ 2	\$ 8	
Demo & Replacement	REMOVE 4"-6" ASPHALT PAVEMENT	12	FT (Street Width)	\$ 1	\$ 1	
	4" AC PAVING ON 8" ABC	12	FT (Street Width)	\$ 11	\$ 15	
	Micro Seal	50	FT (Street Width)	\$ 1	\$ 33	
	Total Paving (per LF)					\$ 57
		No. per 400 ft				
Manholes	Manhole	1	EA	\$ 11	\$ 11	
	Heavy Traffic Frame and Manhole Cover	1	EA	\$ 2	\$ 2	
	Concrete Manhole Invert, Single Channel	1	EA	\$ 2	\$ 2	
	Total Manholes (per LF)					\$ 20
TOTAL DIRECT COST (per LF)						\$ 360
Contractor Overhead		10%				\$ 40
Construction Profit		6%				\$ 20
Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 30
General Conditions		10%				\$ 40
Traffic Control costs		10%				\$ 40
Cost for bypass lines		10%				\$ 40
TOTAL CONSTRUCTION COSTS (per LF)						\$ 570
TOTAL CONSTRUCTION COSTS (per mile)						\$ 3,010,000

Notes:

This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

18-inch Gravity Main						
Project:		2024 Integrated Water Master Plan				
Client:		City of Goodyear				
		Material	Diameter	Length (mile)	Default Excavation Depth	
		VCP	18	1	8	
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPE						
	18" C-700 VCP In Open Trench	1	LF	\$ 86	\$ 86	
	Total Piping (per LF)					\$ 86
EARTHWORK						
Excavation	Hard Digging	0.91	CY	\$ 51	\$ 47	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
&Backfill	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.45	CY	\$ 116	\$ 52	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.36	CY	\$ 31	\$ 11	
	Controlled Density Fill (CDF)	0.04	CY	\$ 138	\$ 6	
	20 CY Dump Truck, 20 Miles/Round Trip	6.07	CY	\$ 11	\$ 67	
	Site Specific Requirements	10%	LS		\$ 19	
	Total Earthwork (per LF)					\$ 205
Asphalt Paving	ASPHALT PAVEMENT CUTTING	4	IN (Depth)	\$ 2	\$ 8	
Demo & Replacement	REMOVE 4"-6" ASPHALT PAVEMENT	12	FT (Street Width)	\$ 1	\$ 1	
	4" AC PAVING ON 8" ABC	12	FT (Street Width)	\$ 11	\$ 15	
	Micro Seal	50	FT (Street Width)	\$ 1	\$ 33	
	Total Paving (per LF)					\$ 57
Manholes						
		No. per 400 ft				
	Manhole	1	EA	\$ 11	\$ 11	
	Heavy Traffic Frame and Manhole Cover	1	EA	\$ 2	\$ 2	
	Concrete Manhole Invert, Single Channel	1	EA	\$ 2	\$ 2	
	Total Manholes (per LF)					\$ 20
	TOTAL DIRECT COST (per LF)					\$ 370
	Contractor Overhead	10%				\$ 40
	Construction Profit	6%				\$ 20
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 30
	General Conditions	10%				\$ 40
	Traffic Control costs	10%				\$ 40
	Cost for bypass lines	10%				\$ 40
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 580
	TOTAL CONSTRUCTION COSTS (per mile)					\$ 3,060,000

Notes:

This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

20-inch Gravity Main						
Project:		2024 Integrated Water Master Plan				
Client:		City of Goodyear				
		Material	Diameter	Length (mile)	Default Excavation Depth	
		VCP	20	1	8	
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPE						
	20" C-700 VCP In Open Trench	1	LF	\$ 130	\$ 130	
	Total Piping (per LF)					\$ 130
EARTHWORK						
	Excavation					
	Hard Digging	0.96	CY	\$ 51	\$ 49	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
	&Backfill	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.50	CY	\$ 116	\$ 58
		Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.34	CY	\$ 31	\$ 11
		Controlled Density Fill (CDF)	0.04	CY	\$ 138	\$ 5
		20 CY Dump Truck, 20 Miles/Round Trip	6.17	CY	\$ 11	\$ 68
		Site Specific Requirements	10%	LS		\$ 20
		Total Earthwork (per LF)				\$ 215
	Asphalt Paving					
	ASPHALT PAVEMENT CUTTING	4	IN (Depth)	\$ 2	\$ 8	
	Demo &					
	REMOVE 4"-6" ASPHALT PAVEMENT	12	FT (Street Width)	\$ 1	\$ 1	
	Replacement					
	4" AC PAVING ON 8" ABC	12	FT (Street Width)	\$ 11	\$ 15	
Manholes	Micro Seal	50	FT (Street Width)	\$ 1	\$ 33	
	Total Paving (per LF)					\$ 57
		No. per 400 ft				
	Manhole	1	EA	\$ 11	\$ 11	
	Heavy Traffic Frame and Manhole Cover	1	EA	\$ 2	\$ 2	
	Concrete Manhole Invert, Single Channel	1	EA	\$ 2	\$ 2	
	Total Manholes (per LF)					\$ 20
	TOTAL DIRECT COST (per LF)					\$ 420
	Contractor Overhead	10%				\$ 40
	Construction Profit	6%				\$ 30
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 40
	General Conditions	10%				\$ 40
	Traffic Control costs	10%				\$ 40
	Cost for bypass lines	10%				\$ 40
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 650
	TOTAL CONSTRUCTION COSTS (per mile)					\$ 3,430,000

Notes:

This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

21-inch Gravity Main						
Project:		2024 Integrated Water Master Plan				
Client:		City of Goodyear				
		Material	Diameter	Length (mile)	Default Excavation Depth	
		VCP	21	1	8	
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPE						
	21" C-700 VCP In Open Trench	1	LF	\$ 167	\$ 167	
	Total Piping (per LF)					\$ 167
EARTHWORK Excavation &Backfill						
	Hard Digging	0.99	CY	\$ 51	\$ 50	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.53	CY	\$ 116	\$ 61	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.33	CY	\$ 31	\$ 10	
	Controlled Density Fill (CDF)	0.04	CY	\$ 138	\$ 5	
	20 CY Dump Truck, 20 Miles/Round Trip	6.22	CY	\$ 11	\$ 68	
	Site Specific Requirements	10%	LS		\$ 20	
	Total Earthwork (per LF)					\$ 220
	Asphalt Paving	4	IN (Depth)	\$ 2	\$ 8	
	Demo &	12	FT (Street Width)	\$ 1	\$ 1	
	Replacement	12	FT (Street Width)	\$ 11	\$ 15	
	Micro Seal	50	FT (Street Width)	\$ 1	\$ 33	
	Total Paving (per LF)					\$ 57
Manholes						
		No. per 400 ft				
	Manhole	1	EA	\$ 11	\$ 11	
	Heavy Traffic Frame and Manhole Cover	1	EA	\$ 2	\$ 2	
	Concrete Manhole Invert, Single Channel	1	EA	\$ 2	\$ 2	
	Total Manholes (per LF)					\$ 20
	TOTAL DIRECT COST (per LF)					\$ 460
	Contractor Overhead	10%				\$ 50
	Construction Profit	6%				\$ 30
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 40
	General Conditions	10%				\$ 50
	Traffic Control costs	10%				\$ 50
	Cost for bypass lines	10%				\$ 50
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 730
	TOTAL CONSTRUCTION COSTS (per mile)					\$ 3,850,000

Notes:

This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

24-inch Gravity Main						
Project:		2024 Integrated Water Master Plan				
Client:		City of Goodyear				
		Material	Diameter	Length (mile)	Default Excavation Depth	
		VCP	24	1	8	
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
PIPE						
	24" C-700 VCP In Open Trench	1	LF	\$ 179	\$ 179	
	Total Piping (per LF)					\$ 179
EARTHWORK						
Excavation	Hard Digging	1.06	CY	\$ 51	\$ 54	
	Trenching: Box Shoring	1	Day	\$ 5	\$ 5	
&Backfill	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.61	CY	\$ 116	\$ 71	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.30	CY	\$ 31	\$ 9	
	Controlled Density Fill (CDF)	0.03	CY	\$ 138	\$ 5	
	20 CY Dump Truck, 20 Miles/Round Trip	6.37	CY	\$ 11	\$ 70	
	Site Specific Requirements	10%	LS		\$ 21	
	Total Earthwork (per LF)					\$ 235
Asphalt Paving	ASPHALT PAVEMENT CUTTING	4	IN (Depth)	\$ 2	\$ 8	
Demo & Replacement	REMOVE 4"-6" ASPHALT PAVEMENT	12	FT (Street Width)	\$ 1	\$ 1	
	4" AC PAVING ON 8" ABC	12	FT (Street Width)	\$ 11	\$ 15	
	Micro Seal	50	FT (Street Width)	\$ 1	\$ 33	
	Total Paving (per LF)					\$ 57
		No. per 400 ft				
Manholes	Manhole	1	EA	\$ 11	\$ 11	
	Heavy Traffic Frame and Manhole Cover	1	EA	\$ 2	\$ 2	
	Concrete Manhole Invert, Single Channel	1	EA	\$ 2	\$ 2	
	Total Manholes (per LF)					\$ 20
TOTAL DIRECT COST (per LF)						\$ 490
Contractor Overhead		10%				\$ 50
Construction Profit		6%				\$ 30
Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 40
General Conditions		10%				\$ 50
Traffic Control costs		10%				\$ 50
Cost for bypass lines		10%				\$ 50
TOTAL CONSTRUCTION COSTS (per LF)						\$ 760
TOTAL CONSTRUCTION COSTS (per mile)						\$ 4,010,000

Notes:

This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

6-inch Force Main

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Material DIP	Diameter 6	Length (mile) 1	Default Excavation Depth 6.00	User entered Excavation Depth 6
DESCRIPTION		QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Pipe	6" Push-on Joint Ductile Iron Pipe	2	LF	\$ 43	86.56	
	6" Adder For Restrained Joints	0.5	LF	\$ 21	10.59	
						\$ 97
EARTHWORK Excavation						
	Hard Digging	1.63	CY	\$ 51	83.05	
& Backfill	Trenching: Box Shoring	1	Day	\$ 5	5.00	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.66	CY	\$ 116	76.96	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.86	CY	\$ 31	26.36	
	Controlled Density Fill (CDF)	0.10	CY	\$ 138	13.14	
	20 CY Dump Truck, 20 Miles/Round Trip	7.78	CY	\$ 11	85.38	
	Site Specific Requirements	10%	LS		28.99	
	Total Earthwork (per LF)					\$ 319
Asphalt Paving Demo & Replacement	ASPHALT PAVEMENT CUTTING	4.00	Depth (in)	1.97	7.86	
	REMOVE 4"-6" ASPHALT PAVEMENT	12.00	Street Width (FT)	0.12	1.40	
	4" AC paving on 8" ABC	12.00		11.07	132.90	
	Micro Seal	50.00	FT (Street Width)	0.67	33.33	
	Total Paving (per LF)					\$ 175
Fittings & Valves		No. per mile				
	Fittings	2.00	EA	0.07	0.13	
	Air release valve Assembly	2.00	EA	0.06	0.12	
	Plug Valve	2.00	EA	0.71	1.43	
Manholes & Vaults	Total Fittings & Valves (per LF)					\$ 2
	Air release manhole	2.00	EA	0.86	1.71	
	Plug valve vault	2.00	EA	0.86	1.71	
	Total fittings, valves and manholes (per LF)					\$ 3
	TOTAL DIRECT COST (per LF)					\$ 600
	Contractor Overhead	10%				\$ 60
	Construction Profit	6%				\$ 40
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 50
	General Conditions	10%				\$ 60
	Traffic Control costs	10%				\$ 60
	Cost for bypass lines	10%				\$ 60
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 930
	TOTAL CONSTRUCTION COSTS (per mile)					\$ 4,910,400

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

8-inch Force Main

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Material DIP	Diameter 8	Length (mile) 1	Default Excavation Depth 6.00	User entered Excavation Depth 6
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Pipe	8" Push-on Joint Ductile Iron Pipe	2	LF	\$ 57	113.98	
	8" Adder For Restrained Joints	0.5	LF	\$ 27	13.69	
						\$ 128
EARTHWORK Excavation						
	Hard Digging	1.70	CY	\$ 51	86.83	
	Trenching: Box Shoring	1	Day	\$ 5	5.00	
& Backfill	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.78	CY	\$ 116	90.19	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.81	CY	\$ 31	24.94	
	Controlled Density Fill (CDF)	0.09	CY	\$ 138	12.43	
	20 CY Dump Truck, 20 Miles/Round Trip	7.95	CY	\$ 11	87.25	
	Site Specific Requirements	10%	LS		30.66	
	Total Earthwork (per LF)					\$ 337
Asphalt Paving Demo & Replacement	ASPHALT PAVEMENT CUTTING	4.00	Depth (in)	1.97	7.86	
	REMOVE 4"-6" ASPHALT PAVEMENT	12.00	Street Width (FT)	0.12	1.40	
	4" AC paving on 8" ABC	12.00		11.07	132.90	
	Micro Seal	50.00	FT (Street Width)	0.67	33.33	
	Total Paving (per LF)					\$ 175
		No. per mile				
Fittings & Valves	Fittings	2.00	EA	0.09	0.18	
	Air release valve Assembly	2.00	EA	0.06	0.12	
	Plug Valve	2.00	EA	0.93	1.87	
	Total Fittings & Valves (per LF)					\$ 2
Manholes & Vaults						
	Air release manhole	2.00	EA	0.86	1.71	
	Plug valve vault	2.00	EA	0.86	1.71	
	Total fittings, valves and manholes (per LF)					\$ 3
	TOTAL DIRECT COST (per LF)					\$ 650
	Contractor Overhead	10%				\$ 70
	Construction Profit	6%				\$ 40
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 50
	General Conditions	10%				\$ 70
	Traffic Control costs	10%				\$ 70
	Cost for bypass lines	10%				\$ 70
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 1,020
	TOTAL CONSTRUCTION COSTS (per mile)					\$ 5,385,600

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

10-inch Force Main

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Material DIP	Diameter 10	Length (mile) 1	Default Excavation Depth 6.00	User entered Excavation Depth 6
DESCRIPTION		QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Pipe	10" Push-on Joint Ductile Iron Pipe	2	LF	\$ 55	110.55	
	10" Adder For Restrained Joints	0.5	LF	\$ 27	13.68	
						\$ 124
EARTHWORK Excavation						
	Hard Digging	1.78	CY	\$ 51	90.60	
	Trenching: Box Shoring	1	Day	\$ 5	5.00	
& Backfill	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.90	CY	\$ 116	103.99	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.76	CY	\$ 31	23.28	
	Controlled Density Fill (CDF)	0.08	CY	\$ 138	11.60	
	20 CY Dump Truck, 20 Miles/Round Trip	8.12	CY	\$ 11	89.09	
	Site Specific Requirements	10%	LS		32.36	
	Total Earthwork (per LF)					\$ 356
Asphalt Paving Demo & Replacement	ASPHALT PAVEMENT CUTTING	4.00	Depth (in)	1.97	7.86	
	REMOVE 4"-6" ASPHALT PAVEMENT	12.00	Street Width (FT)	0.12	1.40	
	4" AC paving on 8" ABC	12.00		11.07	132.90	
	Micro Seal	50.00	FT (Street Width)	0.67	33.33	
	Total Paving (per LF)					\$ 175
		No. per mile				
Fittings & Valves	Fittings	2.00	EA	0.12	0.23	
	Air release valve Assembly	2.00	EA	0.06	0.12	
	Plug Valve	2.00	EA	1.17	2.34	
	Total Fittings & Valves (per LF)					\$ 3
Manholes & Vaults						
	Air release manhole	2.00	EA	0.86	1.71	
	Plug valve vault	2.00	EA	0.86	1.71	
	Total fittings, valves and manholes (per LF)					\$ 3
TOTAL DIRECT COST (per LF)						\$ 660
Contractor Overhead		10%				\$ 70
Construction Profit		6%				\$ 40
Sales Tax (Applied to 65% of Total Direct Cost)		8%				\$ 60
General Conditions		10%				\$ 70
Traffic Control costs		10%				\$ 70
Cost for bypass lines		10%				\$ 70
TOTAL CONSTRUCTION COSTS (per LF)						\$ 1,040
TOTAL CONSTRUCTION COSTS (per mile)						\$ 5,491,200

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

12-inch Force Main

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Material DIP	Diameter 12	Length (mile) 1	Default Excavation Depth 6.00	User entered Excavation Depth 6
	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Pipe	12" Push-on Joint Ductile Iron Pipe	2	LF	\$ 71	141.99	
	12" Adder For Restrained Joints	0.5	LF	\$ 36	17.96	
						\$ 160
EARTHWORK Excavation						
	Hard Digging	1.85	CY	\$ 51	94.38	
	Trenching: Box Shoring	1	Day	\$ 5	5.00	
& Backfill	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	1.02	CY	\$ 116	118.38	
	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.69	CY	\$ 31	21.40	
	Controlled Density Fill (CDF)	0.08	CY	\$ 138	10.66	
	20 CY Dump Truck, 20 Miles/Round Trip	8.28	CY	\$ 11	90.90	
	Site Specific Requirements	10%	LS		34.07	
	Total Earthwork (per LF)					\$ 375
Asphalt Paving Demo & Replacement	ASPHALT PAVEMENT CUTTING	4.00	Depth (in)	1.97	7.86	
	REMOVE 4"-6" ASPHALT PAVEMENT	12.00	Street Width (FT)	0.12	1.40	
	4" AC paving on 8" ABC	12.00		11.07	132.90	
	Micro Seal	50.00	FT (Street Width)	0.67	33.33	
	Total Paving (per LF)					\$ 175
		No. per mile				
Fittings & Valves	Fittings	2.00	EA	0.15	0.30	
	Air release valve Assembly	2.00	EA	0.06	0.12	
	Plug Valve	2.00	EA	1.44	2.89	
	Total Fittings & Valves (per LF)					\$ 3
Manholes & Vaults						
	Air release manhole	2.00	EA	0.86	1.71	
	Plug valve vault	2.00	EA	0.86	1.71	
	Total fittings, valves and manholes (per LF)					\$ 3
	TOTAL DIRECT COST (per LF)					\$ 720
	Contractor Overhead	10%				\$ 70
	Construction Profit	6%				\$ 40
	Sales Tax (Applied to 65% of Total Direct Cost)	8%				\$ 60
	General Conditions	10%				\$ 70
	Traffic Control costs	10%				\$ 70
	Cost for bypass lines	10%				\$ 70
	TOTAL CONSTRUCTION COSTS (per LF)					\$ 1,100
	TOTAL CONSTRUCTION COSTS (per mile)					\$ 5,808,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

1 mgd Lift Station

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Capacity (MGD)	Number of Pump Trains				
		1	2				
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard Concrete Block, 8"	8'	2400	SF	\$ 25	\$ 59,718	
	Site grading with 2" ABC finish		35	CY	\$ 133	\$ 4,655	
	Concrete work/drive pad	8'x10'x12"	3	CY	\$ 500	\$ 1,500	
	4" AC Paving ON 6" ABC	20'	85	SY	\$ 98	\$ 8,366	
	Wetwell excavation		150	CY	\$ 19	\$ 2,805	
	Bollard		10	EA	\$ 1,560	\$ 15,600	
	Medium Site Grading		1	LS	\$ 38,880	\$ 38,880	
	Total Site Work						\$ 175,694
Structural Work	12" Reinforced Concrete	10'x20'x12"	8	CY	\$ 500	\$ 4,000	
	18" Structural Flat Mat On Grade	15'x20'x18"	12	CY	\$ 500	\$ 6,000	
	12" Reinforced Concrete	10'x30'x12"	12	CY	\$ 500	\$ 6,000	
	Concrete Wet Well	8'x10'x24'	1	LS	\$ 67,500	\$ 67,500	
	Electrical and chemical pre-cast building	10'x30'		LS	\$ 280,000	\$ -	
	Lift station access hatch	60"	1	EA	\$ 4,550	\$ 4,550	
	Stainless steel pump rails		12	EA	\$ 2,162	\$ 25,939	
	Pole & base		1	LS	\$ 1,500	\$ 1,500	
	Davitt pump removal crane		1	EA	\$ 2,266	\$ 2,266	
	Total Structural Work						\$ 117,755
Pump Train	8" Push-On Joint Ductile Iron Pipe - Plant	8"	20	LF	\$ 1,200	\$ 24,000	
	8" Flex Cplg, Above Ground	8"	2	EA	\$ 889	\$ 1,779	
	10"- 200 PSI CI FXF Swing Check Valve	8"	2	EA	\$ 4,665	\$ 9,331	
	8" FXF Cast Iron Plug Valve W/Handwheel Op	8"	2	EA	\$ 4,936	\$ 9,872	
	30" Pipe Support	30"	6	EA	\$ 894	\$ 5,366	
	3" 300 PSI Combination Air Valve Stainless Steel	3"	2	EA	\$ 3,280	\$ 6,560	
	8" CLDI Flg Straight Tee In Place - Plant	8"	10	EA	\$ 2,236	\$ 22,357	
	Total Pump Train						\$ 79,265
Mechanical	8" Push-On Joint Ductile Iron Pipe - Plant	8"	50	LF	\$ 1,200	\$ 60,000	
	75 HP submersible pumps (duty and standby)	695 gpm	2	EA	\$ 65,340	\$ 130,680	
	8" FXF Cast Iron Plug Valve W/Handwheel Op	8"	5	EA	\$ 4,936	\$ 24,681	
	30" Pipe Support	30"	7	EA	\$ 894	\$ 6,261	
	3" 300 PSI Combination Air Valve Stainless Steel	3"	1	EA	\$ 3,280	\$ 3,280	
	8" Adder For Restrained Joints	8"	50	LF	\$ 27	\$ 1,369	
	Total Mechanical						\$ 226,270
Dual Force Main	8" Push-On Joint Ductile Iron Pipe - Plant	8"	30	LF	\$ 1,200	\$ 36,000	
	8" CLDI Flg Straight Tee In Place - Plant	8"	6	EA	\$ 2,236	\$ 13,414	
	Total Dual Force Main						\$ 49,414
	TOTAL						\$ 648,000
Electrical	Electrical & Instrumentation		40%			\$ 259,200	
	Total Electrical & Instrumentation						\$ 259,000
Odor Control	Odor control biofilters		10%			\$ 64,800	
	Total Odor Control						\$ 65,000
Painting & Coating	Painting & Coatings		10%			\$ 64,800	
	Total Painting & Coating						\$ 65,000
	Total cost excluding landscaping and security						\$ 1,037,000
	Landscaping cost		1%			\$ 10,000	\$ 10,000
	Security costs for smaller capacity systems		1	EA	\$ 56,000	\$ 56,000	\$ 56,000
	TOTAL DIRECT COST						\$ 1,103,000
	Contractor Overhead		10%	%			\$ 110,000
	Construction Profit		6%	%			\$ 66,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%	%			\$ 93,000
	General Conditions		10%	%			\$ 110,000
	Bypass pump costs		10%	%			\$ 110,000
	TOTAL CONSTRUCTION COSTS						\$ 1,592,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

3 mgd Lift Station

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Capacity (MGD)	Number of Pump Trains				
		3	3				
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard Concrete Block, 8"	8'	2400	SF	\$ 25	\$ 59,718	
	Site grading with 2" ABC finish		35	CY	\$ 133	\$ 4,655	
	Concrete work/drive pad	7'x12'x12"	4	CY	\$ 500	\$ 2,000	
	4" AC Paving ON 6" ABC	20'	85	SY	\$ 98	\$ 8,366	
	Wetwell excavation		190	CY	\$ 19	\$ 3,553	
	Bollard		10	EA	\$ 1,560	\$ 15,600	
	Medium Site Grading		1	LS	\$ 38,880	\$ 38,880	
	Total Site Work						\$ 176,942
Structural Work	12" Reinforced Concrete	10'x20'x12"	8	CY	\$ 500	\$ 4,000	
	18" Structural Flat Mat On Grade	15'x20'x18"	12	CY	\$ 500	\$ 6,000	
	12" Reinforced Concrete	10'x30'x12"	12	CY	\$ 500	\$ 6,000	
	Concrete Wet Well	7'x12'x30'	1	LS	\$ 90,000	\$ 90,000	
	Electrical and chemical pre-cast building	10'x30'	1	LS	\$ 280,000	\$ 280,000	
	Lift station access hatch	60"	2	EA	\$ 4,550	\$ 9,100	
	Stainless steel pump rails		12	EA	\$ 2,162	\$ 25,939	
	Pole & base		1	LS	\$ 1,500	\$ 1,500	
	Davitt pump removal crane		1	EA	\$ 2,266	\$ 2,266	
	Total Structural Work						\$ 424,805
Pump Train	8" Push-On Joint Ductile Iron Pipe - Plant	8"	30	LF	\$ 1,200	\$ 36,000	
	8" Flex Cplg, Above Ground	8"	3	EA	\$ 889	\$ 2,668	
	10"- 200 PSI CI FXF Swing Check Valve	8"	3	EA	\$ 4,665	\$ 13,996	
	8" FXF Cast Iron Plug Valve W/Handwheel Op	8"	3	EA	\$ 4,936	\$ 14,808	
	30" Pipe Support	30"	9	EA	\$ 894	\$ 8,050	
	3" 300 PSI Combination Air Valve Stainless Steel	3"	3	EA	\$ 3,280	\$ 9,840	
	8" CLDI Flg Straight Tee In Place - Plant	8"	15	EA	\$ 2,236	\$ 33,535	
	Total Pump Train						\$ 118,898
Mechanical	16" Push-On Joint Ductile Iron Pipe - Plant	16"	50	LF	\$ 2,400	\$ 120,000	
	75 HP submersible pumps (duty and standby)	1041 gpm	3	EA	\$ 110,550	\$ 331,650	
	16" FXF Cast Iron Plug Valve W/Handwheel Op	16"	5	EA	\$ 13,645	\$ 68,226	
	30" Pipe Support	30"	7	EA	\$ 894	\$ 6,261	
	3" 300 PSI Combination Air Valve Stainless Steel	3"	1	EA	\$ 3,280	\$ 3,280	
	16" Adder For Restrained Joints	16"	50	LF	\$ 63	\$ 3,175	
	Total Mechanical						\$ 532,592
Dual Force Main	16" CI 52 CLDI Mj Pipe - Plant	16"	30	LF	\$ 2,403	\$ 72,089	
	16" CLDI Flg Straight Tee In Place - Plant	16"	6	EA	\$ 12,578	\$ 75,468	
	Total Dual Force Main						\$ 147,557
	TOTAL						\$ 1,401,000
Electrical	Electrical & Instrumentation		40%			\$ 560,400	
	Total Electrical & Instrumentation						\$ 560,000
Odor Control	Odor control biofilters		10%			\$ 140,100	
	Total Odor Control						\$ 140,000
Painting & Coating	Painting & Coatings		10%			\$ 140,100	
	Total Painting & Coating						\$ 140,000
	Total cost excluding landscaping and security						\$ 2,241,000
	Landscaping cost		1%			\$ 22,000	\$ 22,000
	Security costs for smaller capacity systems		1	EA	\$ 56,000	\$ 56,000	\$ 56,000
	TOTAL DIRECT COST						\$ 2,319,000
	Contractor Overhead		10%	%			\$ 232,000
	Construction Profit		6%	%			\$ 139,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%	%			\$ 195,000
	General Conditions		10%	%			\$ 232,000
	Bypass pump costs		10%	%			\$ 232,000
	TOTAL CONSTRUCTION COSTS						\$ 3,349,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

3.5 mgd Lift Station

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Capacity (MGD)	Number of Pump Trains				
		3.5	3				
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard Concrete Block, 8"	8'	2400	SF	\$ 25	\$ 59,718	
	Site grading with 2" ABC finish		35	CY	\$ 133	\$ 4,655	
	Concrete work/drive pad	8'x16'x12"	5	CY	\$ 500	\$ 2,500	
	4" AC Paving ON 6" ABC	20'	85	SY	\$ 98	\$ 8,366	
	Wetwell excavation		260	CY	\$ 19	\$ 4,862	
	Bollard		10	EA	\$ 1,560	\$ 15,600	
	Medium Site Grading		1	LS	\$ 38,880	\$ 38,880	
	Total Site Work						\$ 178,752
Structural Work	12" Reinforced Concrete	10'x20'x12"	8	CY	\$ 500	\$ 4,000	
	18" Structural Flat Mat On Grade	15'x20'x18"	12	CY	\$ 500	\$ 6,000	
	12" Reinforced Concrete	10'x30'x12"	12	CY	\$ 500	\$ 6,000	
	Concrete Wet Well	8'x16'x27'	1	LS	\$ 105,000	\$ 105,000	
	Electrical and chemical pre-cast building	10'x30'	1	LS	\$ 280,000	\$ 280,000	
	Lift station access hatch	60"	2	EA	\$ 4,550	\$ 9,100	
	Stainless steel pump rails		12	EA	\$ 2,162	\$ 25,939	
	Pole & base		1	LS	\$ 1,500	\$ 1,500	
	Davitt pump removal crane		1	EA	\$ 2,266	\$ 2,266	
	Total Structural Work						\$ 439,805
Pump Train	8" Push-On Joint Ductile Iron Pipe - Plant	8"	30	LF	\$ 1,200	\$ 36,000	
	8" Flex Cplg, Above Ground	8"	3	EA	\$ 889	\$ 2,668	
	10"- 200 PSI CI FXF Swing Check Valve	8"	3	EA	\$ 4,665	\$ 13,996	
	8" FXF Cast Iron Plug Valve W/Handwheel Op	8"	3	EA	\$ 4,936	\$ 14,808	
	30" Pipe Support	30"	9	EA	\$ 894	\$ 8,050	
	3" 300 PSI Combination Air Valve Stainless Steel	3"	3	EA	\$ 3,280	\$ 9,840	
	8" CLDI Flg Straight Tee In Place - Plant	8"	15	EA	\$ 2,236	\$ 33,535	
	Total Pump Train						\$ 118,898
Mechanical	16" Push-On Joint Ductile Iron Pipe - Plant	16"	50	LF	\$ 2,400	\$ 120,000	
	75 HP submersible pumps (duty and standby)	1215 gpm	3	EA	\$ 110,550	\$ 331,650	
	16" FXF Cast Iron Plug Valve W/Handwheel Op	16"	5	EA	\$ 13,645	\$ 68,226	
	30" Pipe Support	30"	7	EA	\$ 894	\$ 6,261	
	3" 300 PSI Combination Air Valve Stainless Steel	3"	1	EA	\$ 3,280	\$ 3,280	
	16" Adder For Restrained Joints	16"	50	LF	\$ 63	\$ 3,175	
	Total Mechanical						\$ 532,592
Dual Force Main	16" CI 52 CLDI Mj Pipe - Plant	16"	30	LF	\$ 2,403	\$ 72,089	
	16" CLDI Flg Straight Tee In Place - Plant	16"	6	EA	\$ 12,578	\$ 75,468	
	Total Dual Force Main						\$ 147,557
TOTAL							\$ 1,418,000
Electrical	Electrical & Instrumentation		40%			\$ 567,200	
	Total Electrical & Instrumentation						\$ 567,000
Odor Control	Odor control biofilters		10%			\$ 141,800	
	Total Odor Control						\$ 142,000
Painting & Coating	Painting & Coatings		10%			\$ 141,800	
	Total Painting & Coating						\$ 142,000
	Total cost excluding landscaping and security						\$ 2,269,000
	Landscaping cost		1%			\$ 23,000	\$ 23,000
	Security costs for smaller capacity systems		1	EA	\$ 56,000	\$ 56,000	\$ 56,000
	TOTAL DIRECT COST						\$ 2,348,000
	Contractor Overhead		10%	%			\$ 235,000
	Construction Profit		6%	%			\$ 141,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%	%			\$ 197,000
	General Conditions		10%	%			\$ 235,000
	Bypass pump costs		10%	%			\$ 235,000
	TOTAL CONSTRUCTION COSTS						\$ 3,391,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

5 mgd Lift Station

Project: 2024 Integrated Water Master Plan
Client: City of Goodyear

		Capacity (MGD)	Number of Pump Trains				
		5	3				
	DESCRIPTION	SIZE	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
Site Work	8' H Double Swing Gate, Chain Link, 20' Opening	20'	1	EA	\$ 44,171	\$ 44,171	
	Standard Concrete Block, 8"	8'	2400	SF	\$ 25	\$ 59,718	
	Site grading with 2" ABC finish		35	CY	\$ 133	\$ 4,655	
	Concrete work/drive pad	8'x16'x12"	5	CY	\$ 500	\$ 2,500	
	4" AC Paving ON 6" ABC	20'	85	SY	\$ 98	\$ 8,366	
	Wetwell excavation		260	CY	\$ 19	\$ 4,862	
	Bollard		10	EA	\$ 1,560	\$ 15,600	
	Medium Site Grading		1	LS	\$ 38,880	\$ 38,880	
	Total Site Work						\$ 178,752
Structural Work	12" Reinforced Concrete	10'x20'x12"	8	CY	\$ 500	\$ 4,000	
	18" Structural Flat Mat On Grade	15'x20'x18"	12	CY	\$ 500	\$ 6,000	
	12" Reinforced Concrete	10'x30'x12"	12	CY	\$ 500	\$ 6,000	
	Concrete Wet Well	8'x16'x27'	1	LS	\$ 105,000	\$ 105,000	
	Electrical and chemical pre-cast building	10'x30'	1	LS	\$ 280,000	\$ 280,000	
	Lift station access hatch	60"	2	EA	\$ 4,550	\$ 9,100	
	Stainless steel pump rails		12	EA	\$ 2,162	\$ 25,939	
	Pole & base		1	LS	\$ 1,500	\$ 1,500	
	Davitt pump removal crane		1	EA	\$ 2,266	\$ 2,266	
	Total Structural Work						\$ 439,805
Pump Train	8" Push-On Joint Ductile Iron Pipe - Plant	8"	30	LF	\$ 1,200	\$ 36,000	
	8" Flex Cplg, Above Ground	8"	3	EA	\$ 889	\$ 2,668	
	10"- 200 PSI CI FXF Swing Check Valve	8"	3	EA	\$ 4,665	\$ 13,996	
	8" FXF Cast Iron Plug Valve W/Handwheel Op	8"	3	EA	\$ 4,936	\$ 14,808	
	30" Pipe Support	30"	9	EA	\$ 894	\$ 8,050	
	3" 300 PSI Combination Air Valve Stainless Steel	3"	3	EA	\$ 3,280	\$ 9,840	
	8" CLDI Flg Straight Tee In Place - Plant	8"	15	EA	\$ 2,236	\$ 33,535	
	Total Pump Train						\$ 118,898
Mechanical	20" Push-On Joint Ductile Iron Pipe - Plant	20"	50	LF	\$ 3,000	\$ 150,000	
	75 HP submersible pumps (duty and standby)	1736 gpm	3	EA	\$ 110,550	\$ 331,650	
	20" FXF Cast Iron Plug Valve W/Handwheel Op	20"	5	EA	\$ 23,376	\$ 116,880	
	30" Pipe Support	30"	7	EA	\$ 894	\$ 6,261	
	4" 300 PSI Combination Air Valve Stainless Steel	4"	1	EA	\$ 4,280	\$ 4,280	
	20" Adder For Restrained Joints	20"	50	LF	\$ 89	\$ 4,426	
	Total Mechanical						\$ 613,497
Dual Force Main	18" Push-On Joint Ductile Iron Pipe - Plant	18"	30	LF	\$ 2,700	\$ 81,000	
	18" CLDI Flg Straight Tee In Place - Plant	18"	6	EA	\$ 7,511	\$ 45,068	
	Total Dual Force Main						\$ 126,068
	TOTAL						\$ 1,477,000
Electrical	Electrical & Instrumentation		40%			\$ 590,800	
	Total Electrical & Instrumentation						\$ 591,000
Odor Control	Odor control biofilters		10%			\$ 147,700	
	Total Odor Control						\$ 148,000
Painting & Coating	Painting & Coatings		10%			\$ 147,700	
	Total Painting & Coating						\$ 148,000
	Total cost excluding landscaping and security						\$ 2,364,000
	Landscaping cost		1%			\$ 24,000	\$ 24,000
	Security costs for smaller capacity systems		1	EA	\$ 56,000	\$ 56,000	\$ 56,000
	TOTAL DIRECT COST						\$ 2,444,000
	Contractor Overhead		10%	%			\$ 244,000
	Construction Profit		6%	%			\$ 147,000
	Sales Tax (Applied to 65% of Total Direct Cost)		8%	%			\$ 205,000
	General Conditions		10%	%			\$ 244,000
	Bypass pump costs		10%	%			\$ 244,000
	TOTAL CONSTRUCTION COSTS						\$ 3,528,000

Notes: This cost estimate is a Class V estimate as defined by the American Association of Costing Engineers

APPENDIX 7C

WATER CIP FIGURES

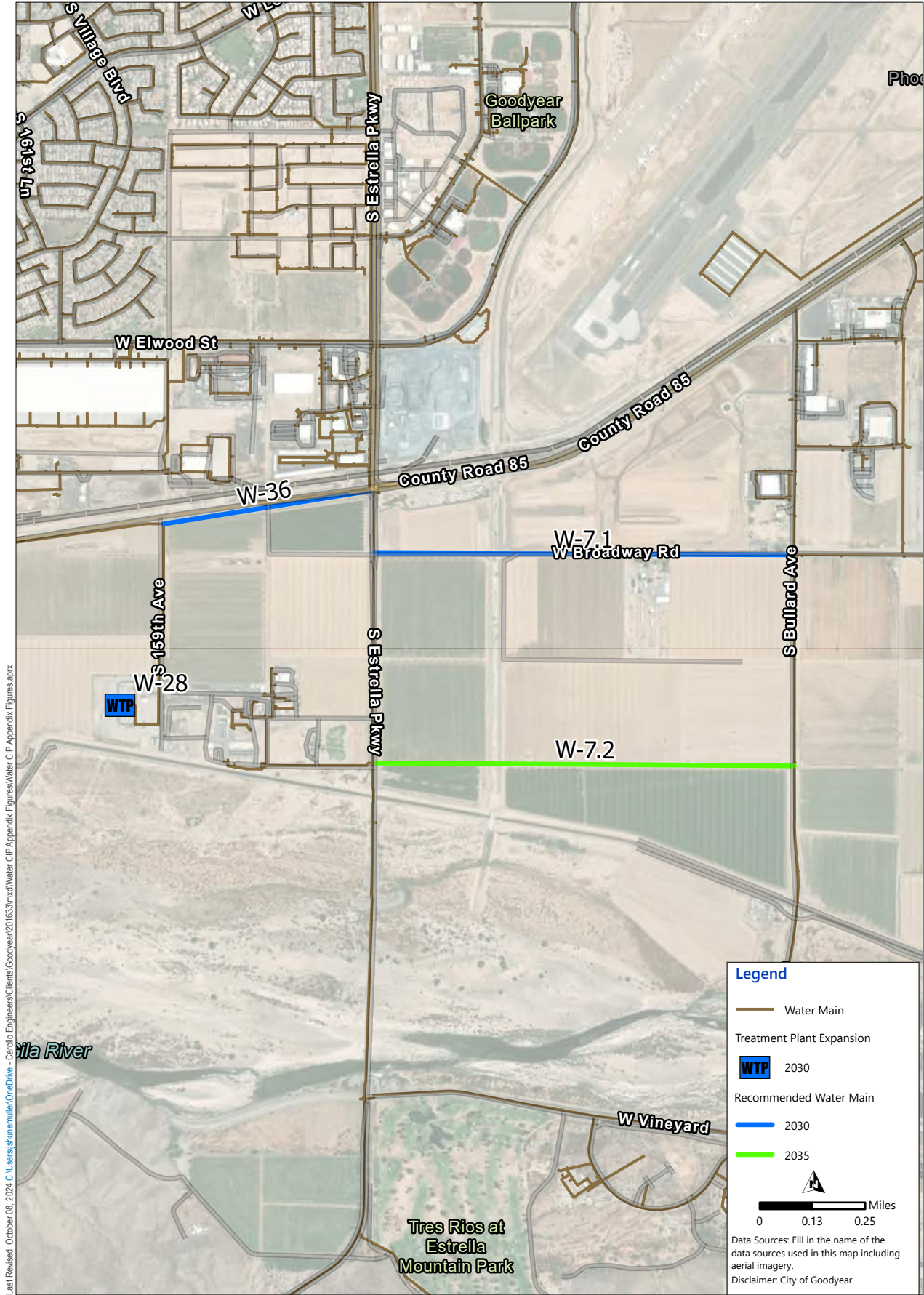


Figure 7C.1 Map of Capital Projects W-7, W-28, and W-36
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

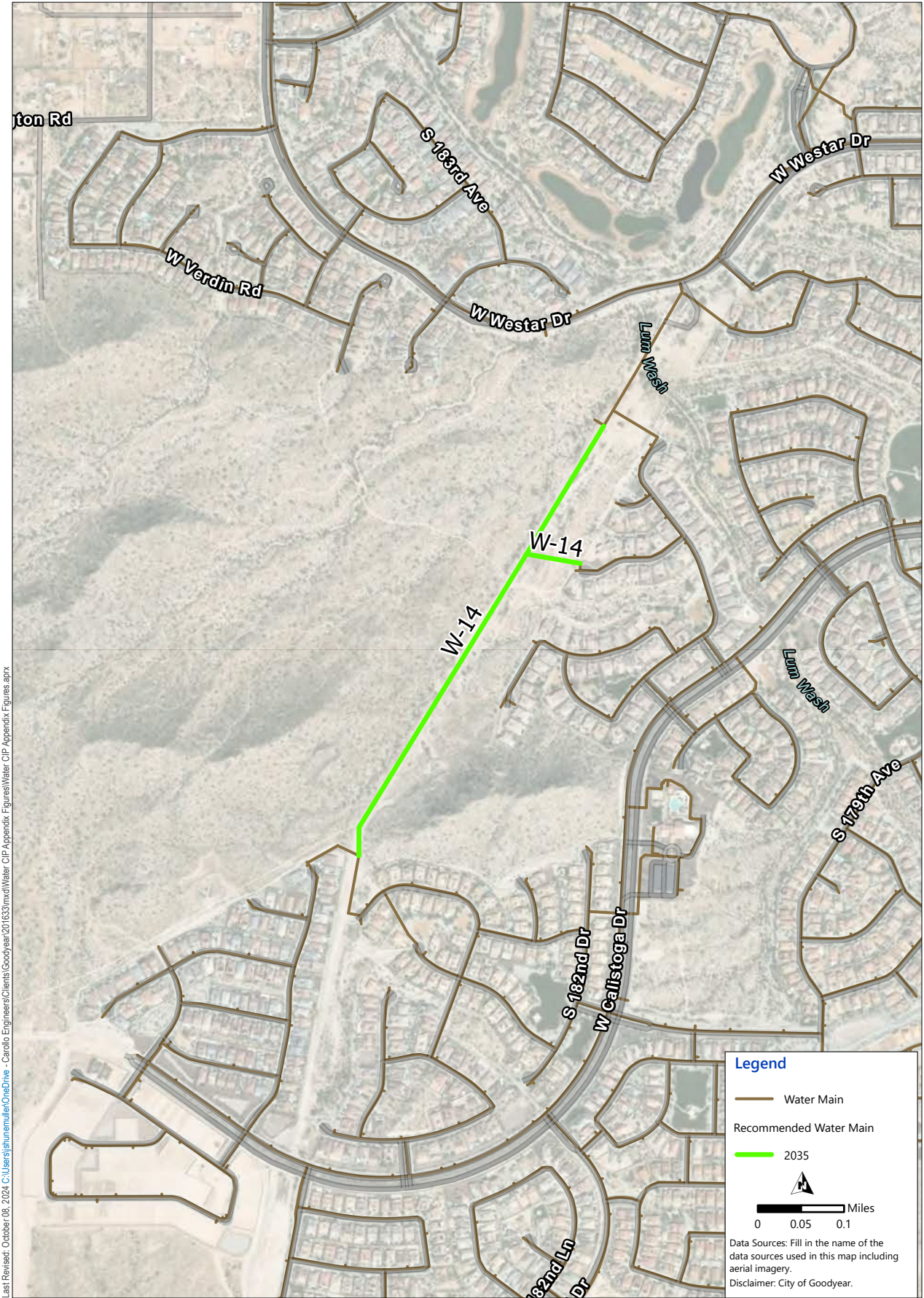


Figure 7C.2 Map of Capital Projects W-14
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

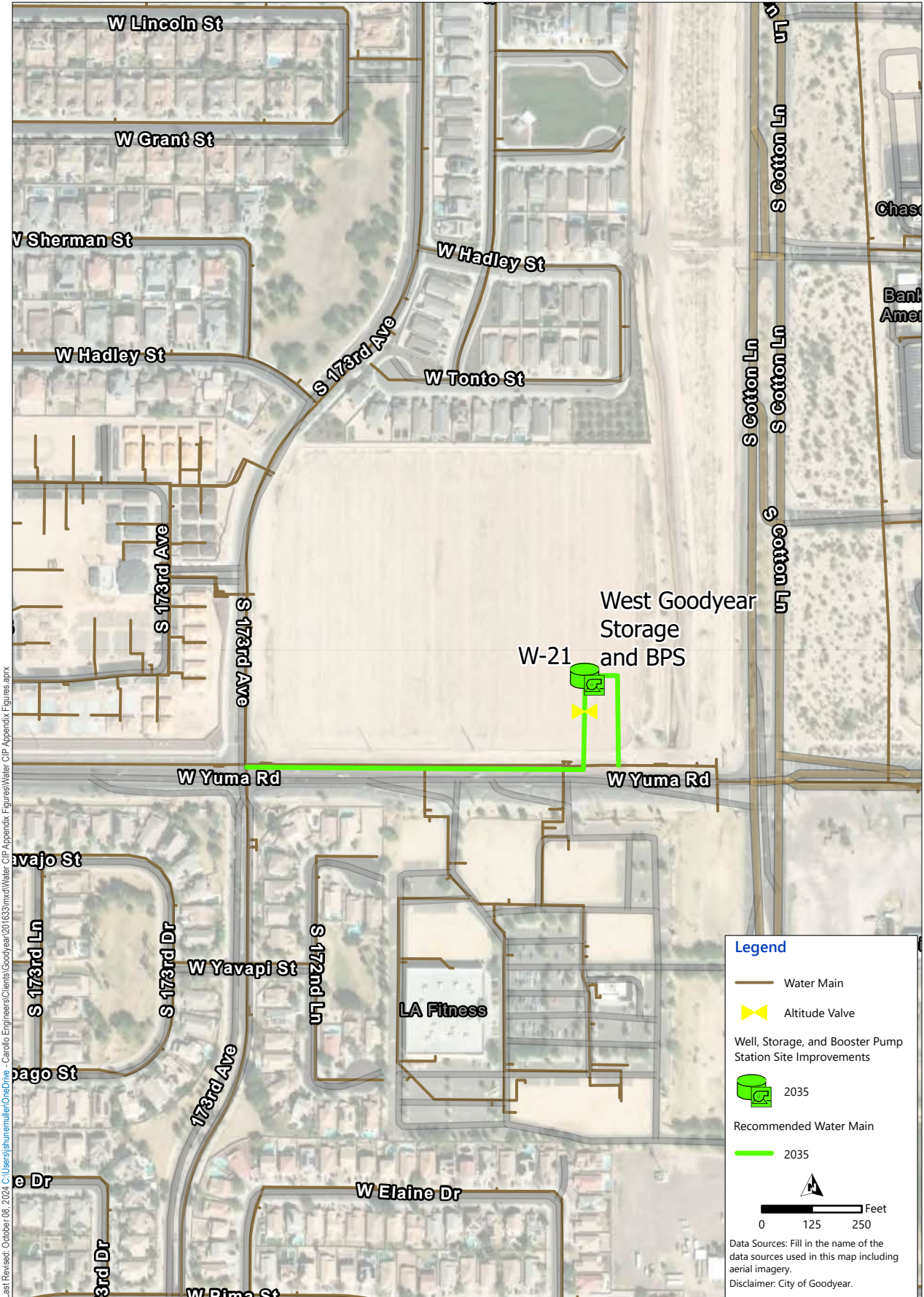


Figure 7C.3 Map of Capital Projects W-21
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

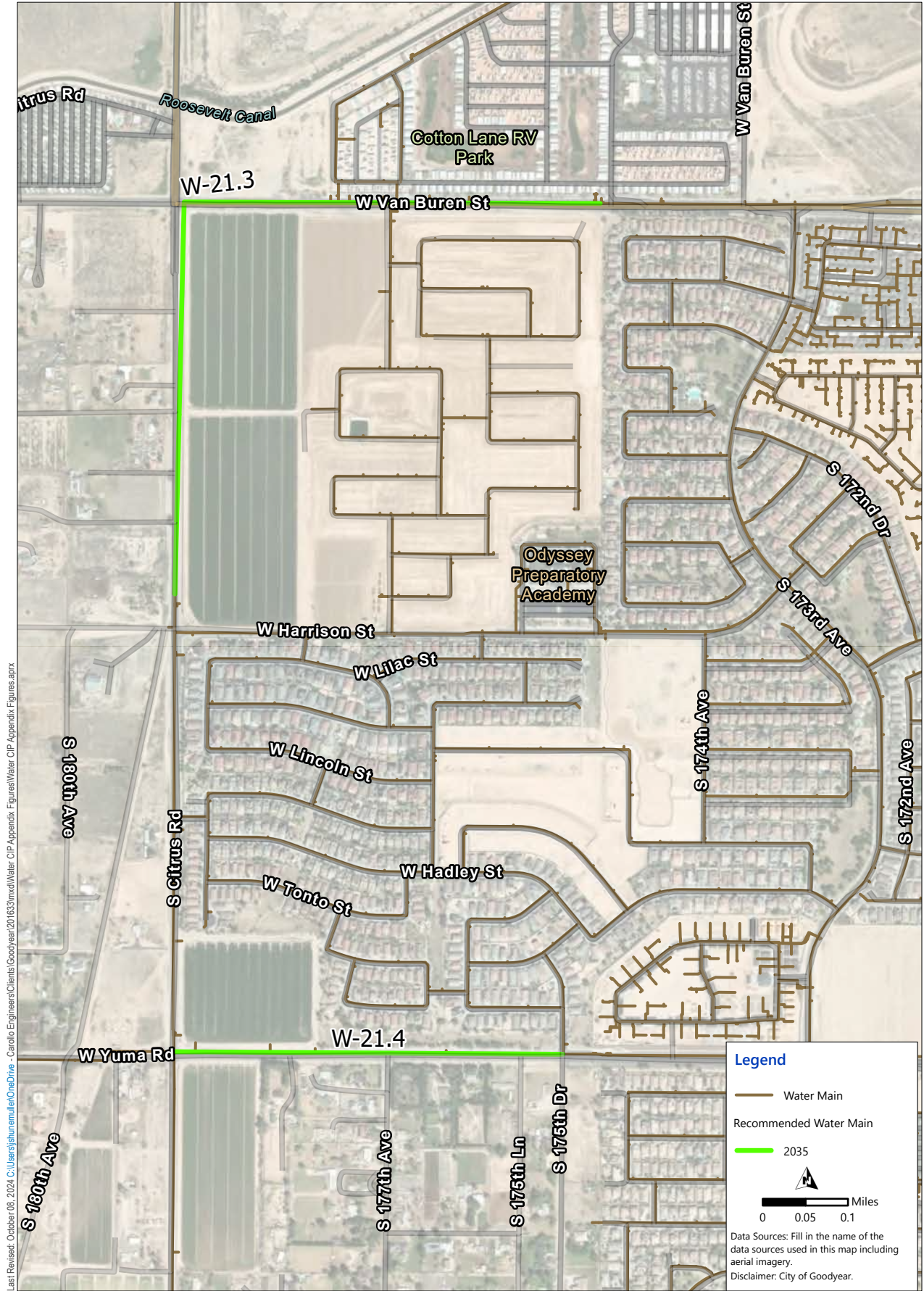


Figure 7C.4 Map of Capital Projects W-21.3 and W-21.4
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

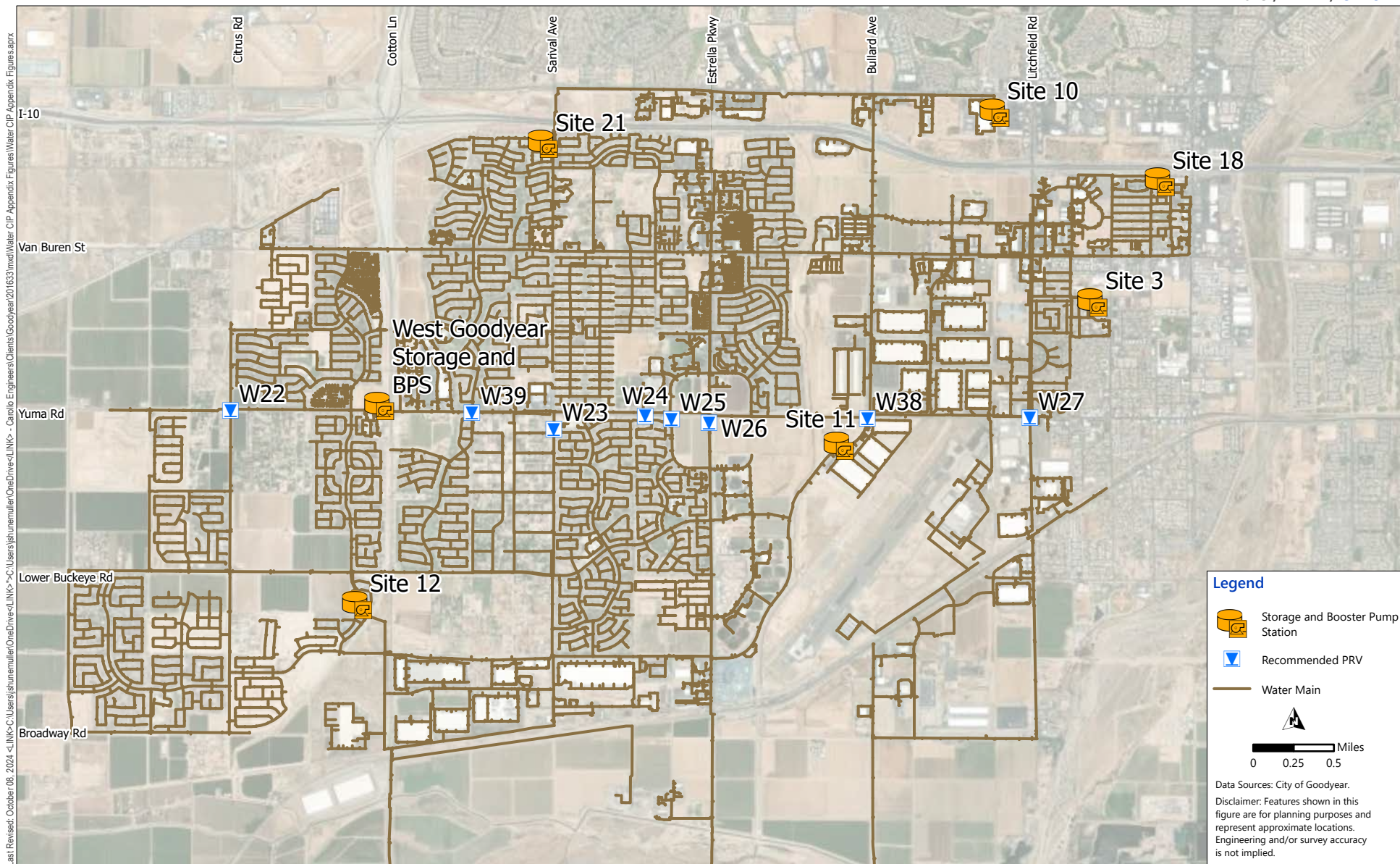
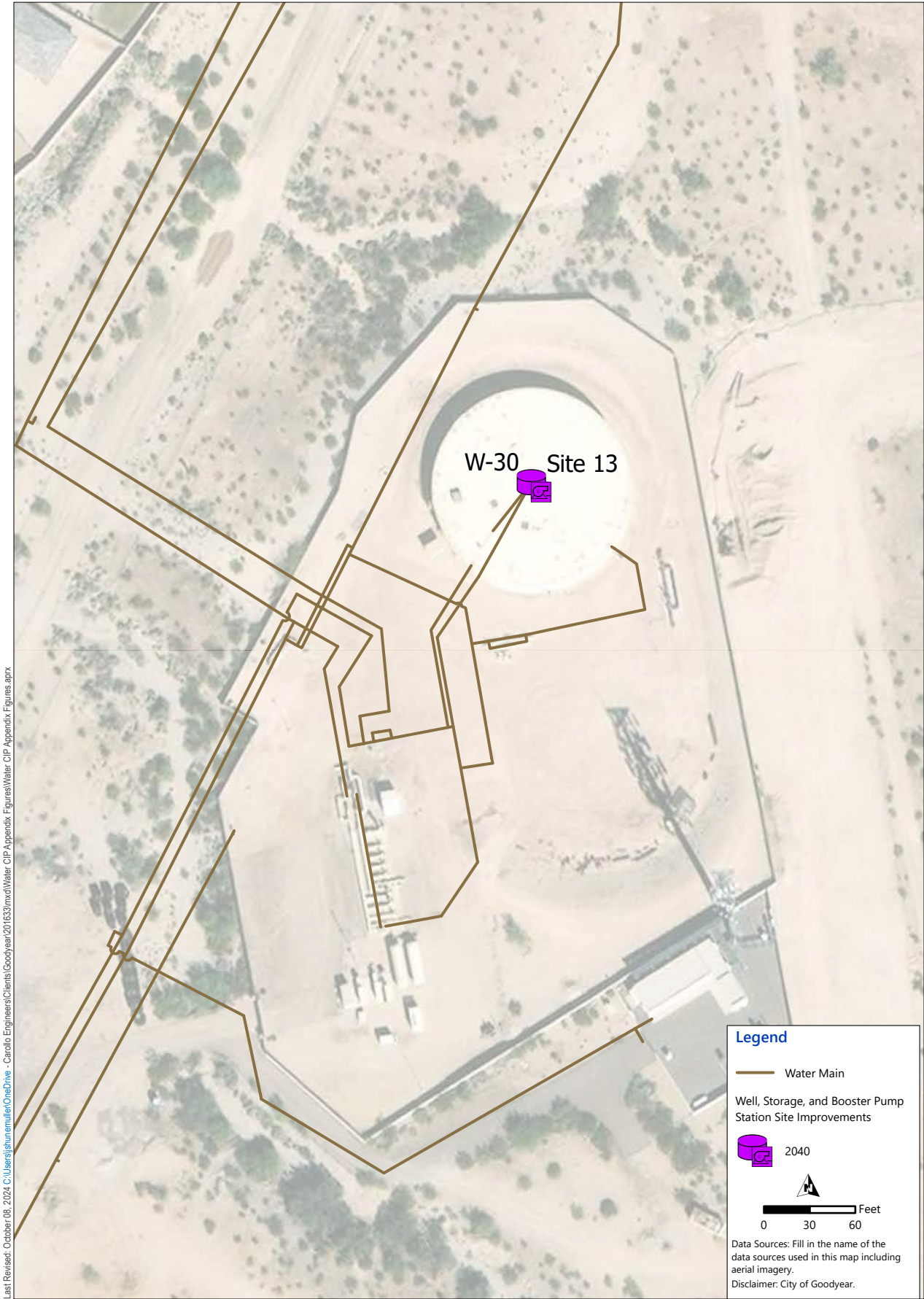


Figure 7C.5 Map of Capital Projects W-22, W-23, W-24, W-25, W-26, W-27, W-38, and W-39
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN



Last Revised: October 08, 2024 C:\Users\jshumiller\OneDrive - Carollo Engineers\Clients\Goodyear\201633\mxd\Water CIP Appendix Figures\Water CIP Appendix Figures.aprx

Figure 7C.6 Map of Capital Project W-30
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

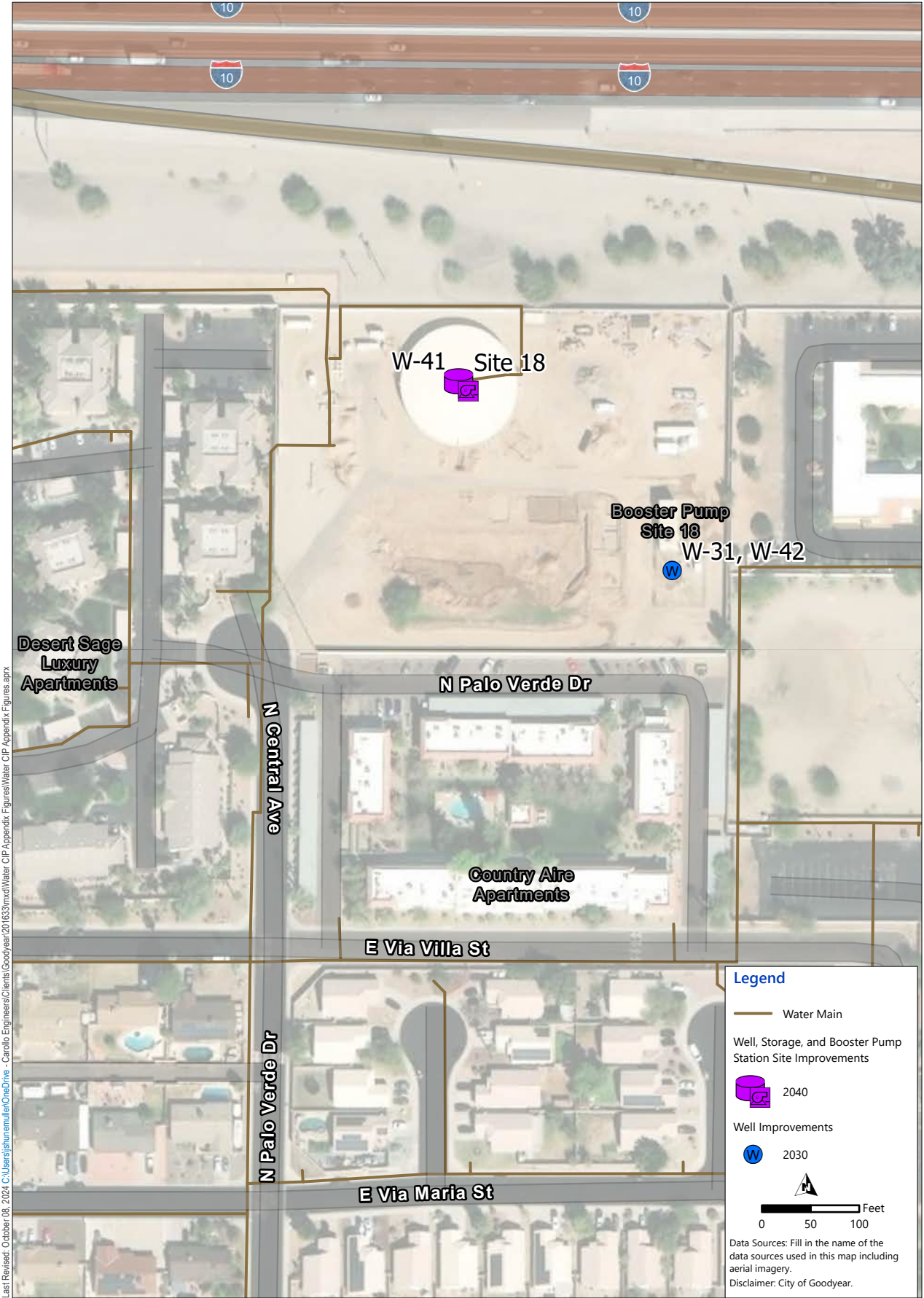




Figure 7C.8 Map of Capital Project W-32
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

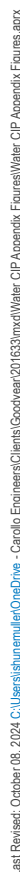


Figure 7C.9 Map of Capital Projects W-33 and W-34
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

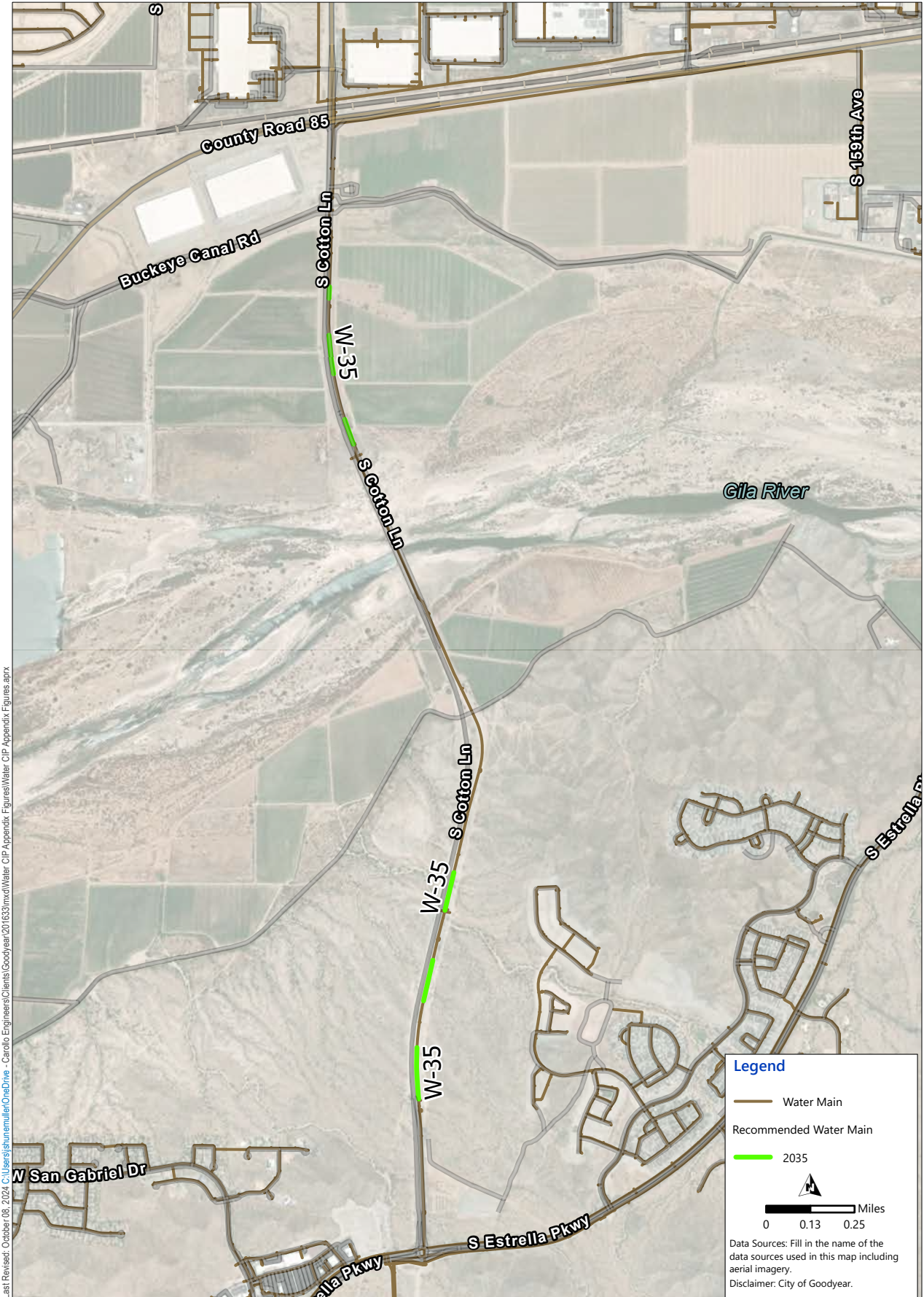


Figure 7C.10 Map of Capital Project W-35
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN



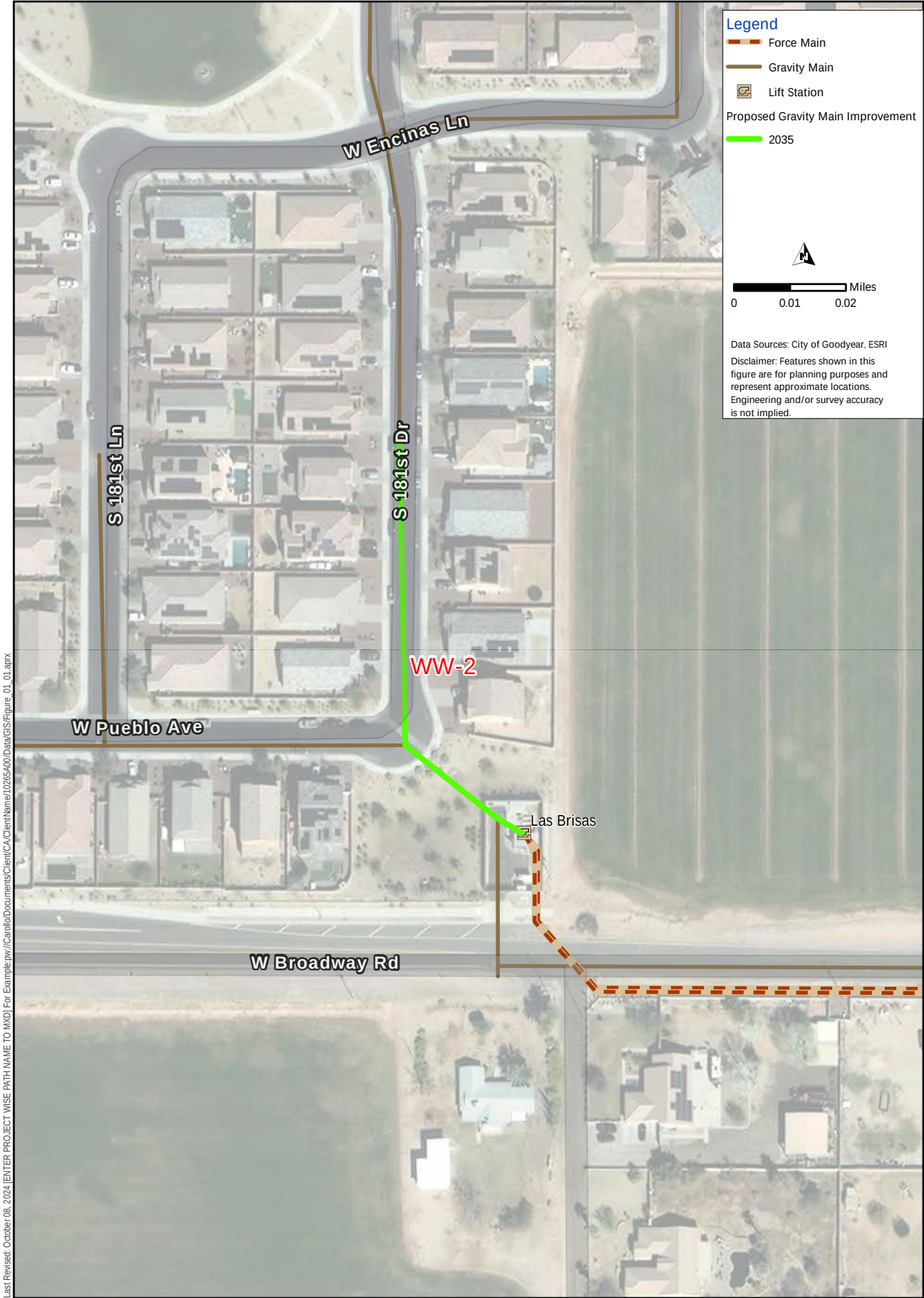
Figure 7C.11 Map of Capital Project W-37
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

APPENDIX 7D

WASTEWATER CIP FIGURES

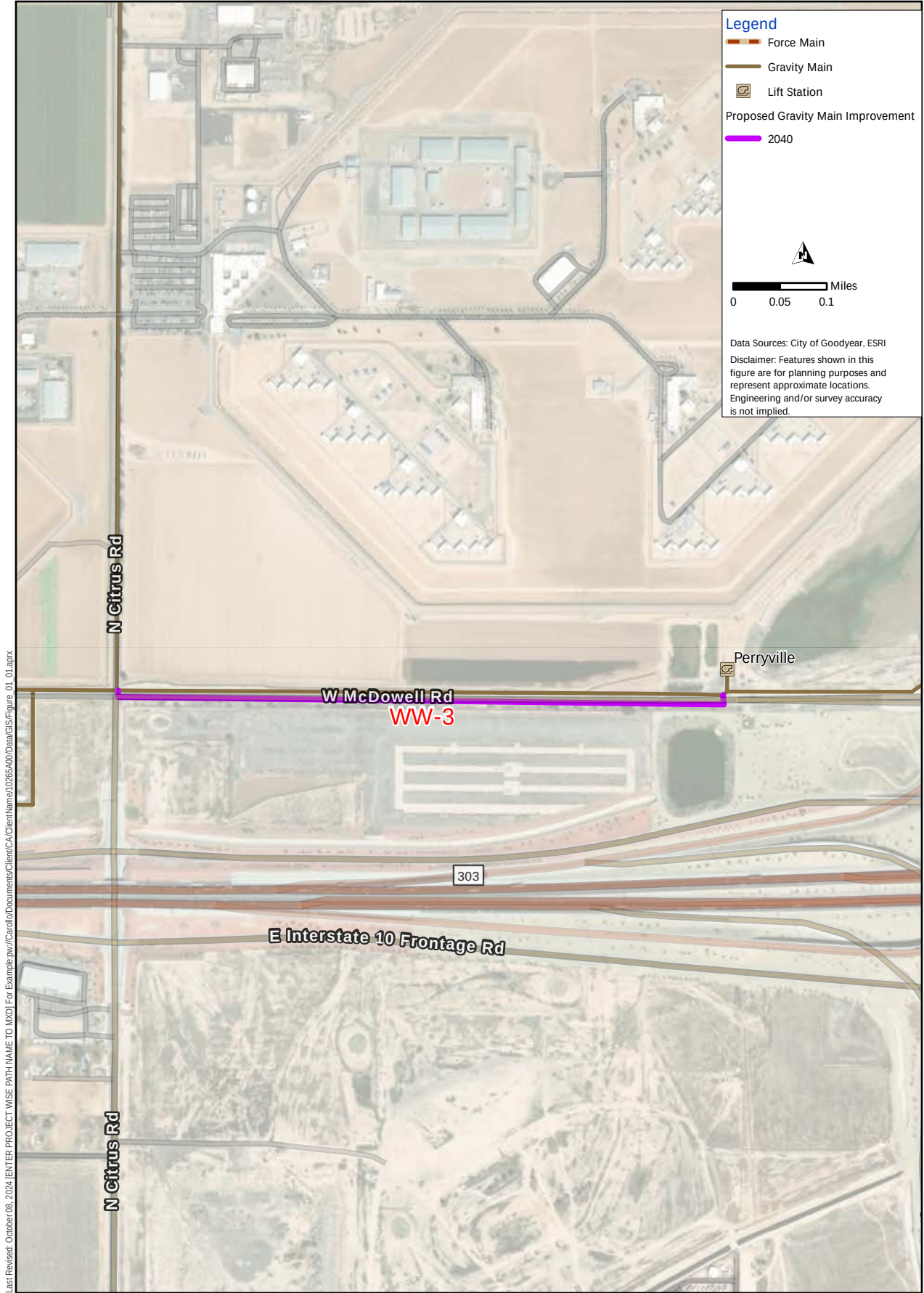


Figure 7D.1 Map of Capital Project WW-1
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN



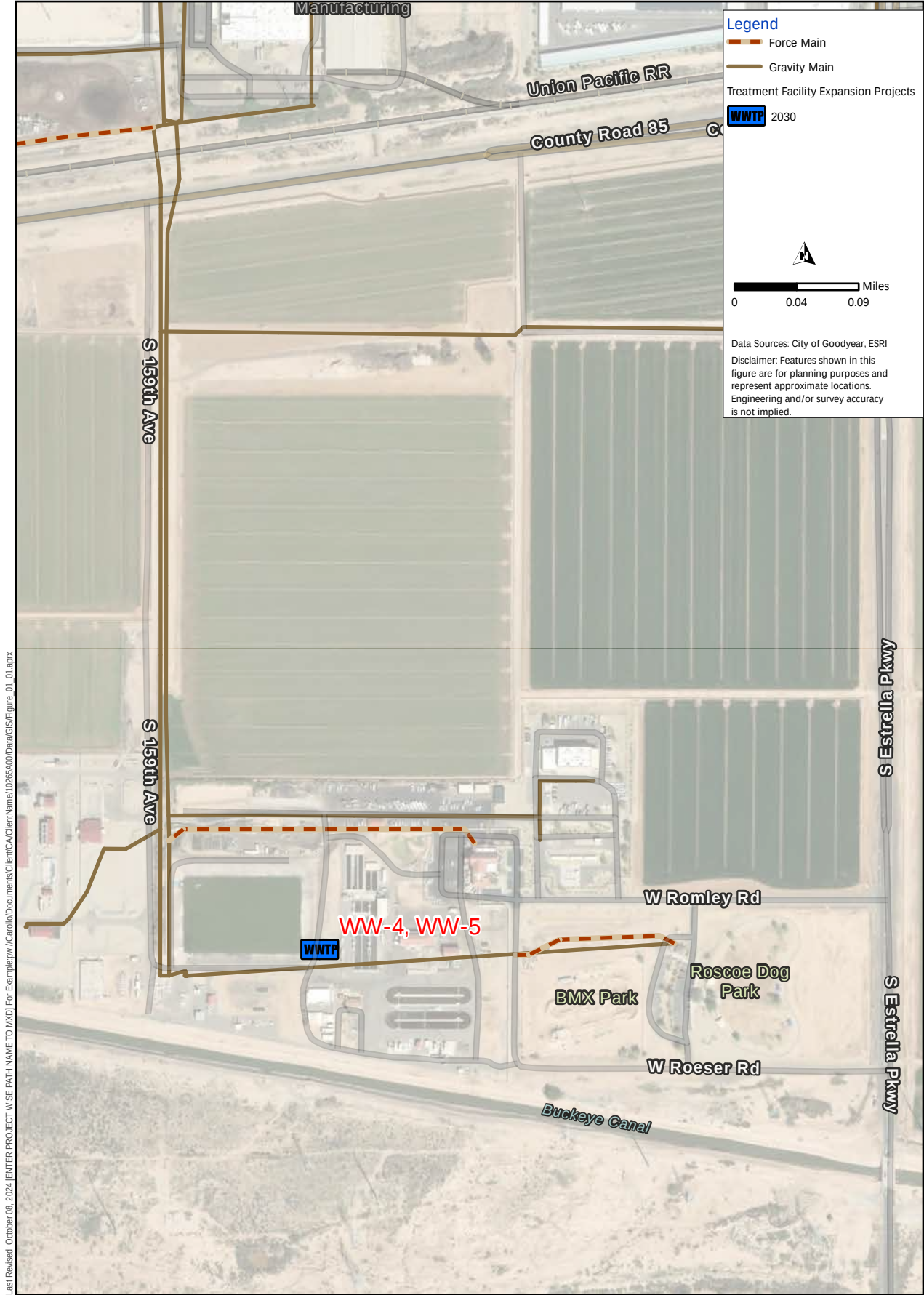
Last Revised: October 08, 2024 [ENTER PROJECT WISE PATH NAME TO MAD] For Example: pw://Carollo/Documents/Client/CA/ClientName/10265400/Data/GIS/Figure 01_01.aprx

Figure 7D.2 Map of Capital Project WW-2
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN



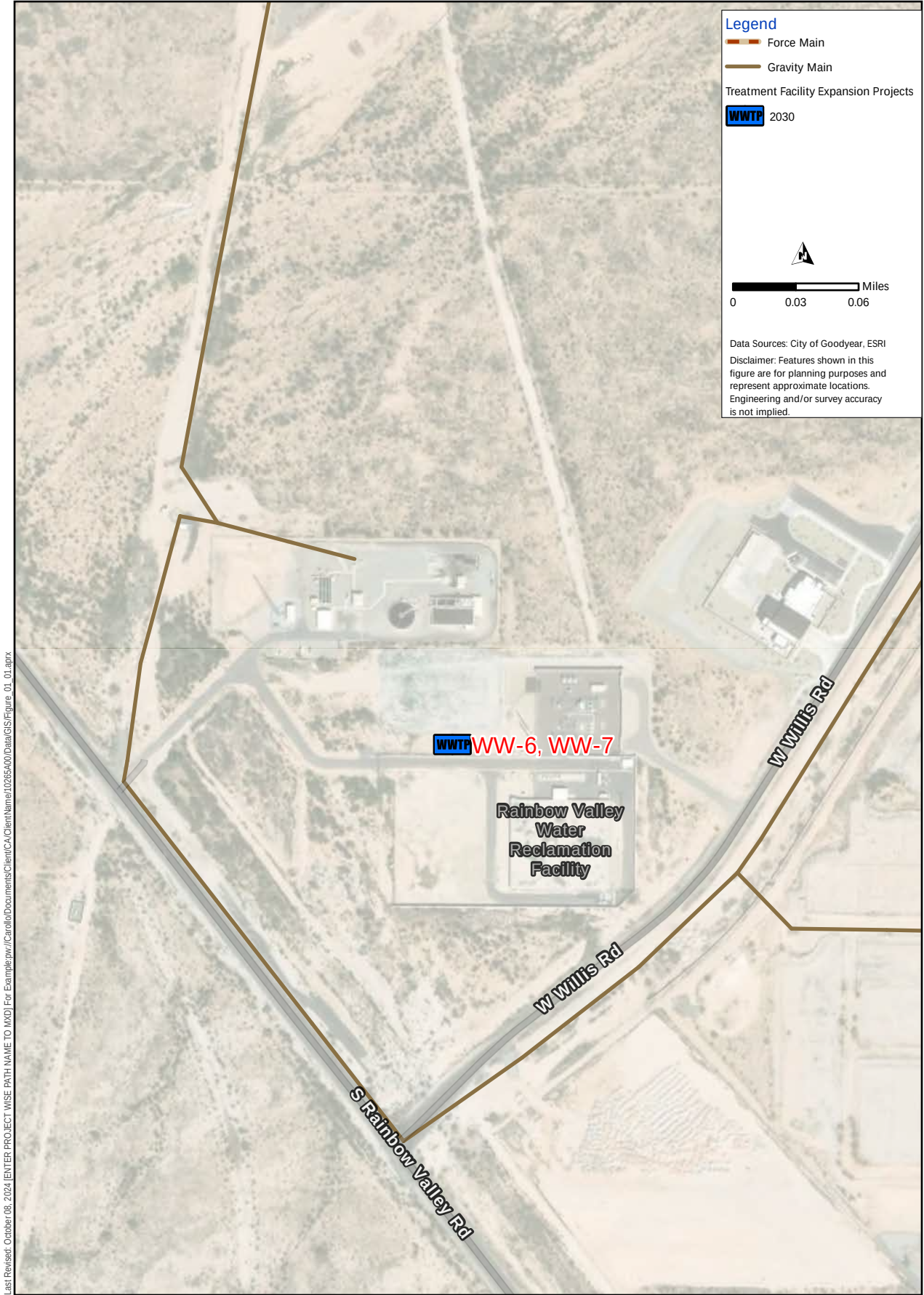
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Figure 7D.3 Map of Capital Project WW-3
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN



Last Revised: October 08, 2024 [ENTER PROJECT WISE PATH NAME TO MAD] For Example: pw://Carollo/Documents/Client/CA/ClientName/10265400/Data/CIS/figure 01_01.aprx

Figure 7D.4 Map of Capital Projects WW-4 and WW-5
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN



Last Revised: October 08, 2024 [ENTER PROJECT WISE PATH NAME TO MAD] For Example: pw://Carollo/Documents/Client/CA/ClientName/10265400/Data/CIS/Figure 01_01.aprx

Figure 7D.5 Map of Capital Projects WW-6 and WW-7
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

APPENDIX 7E

RECLAIMED WATER CIP FIGURES



CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN

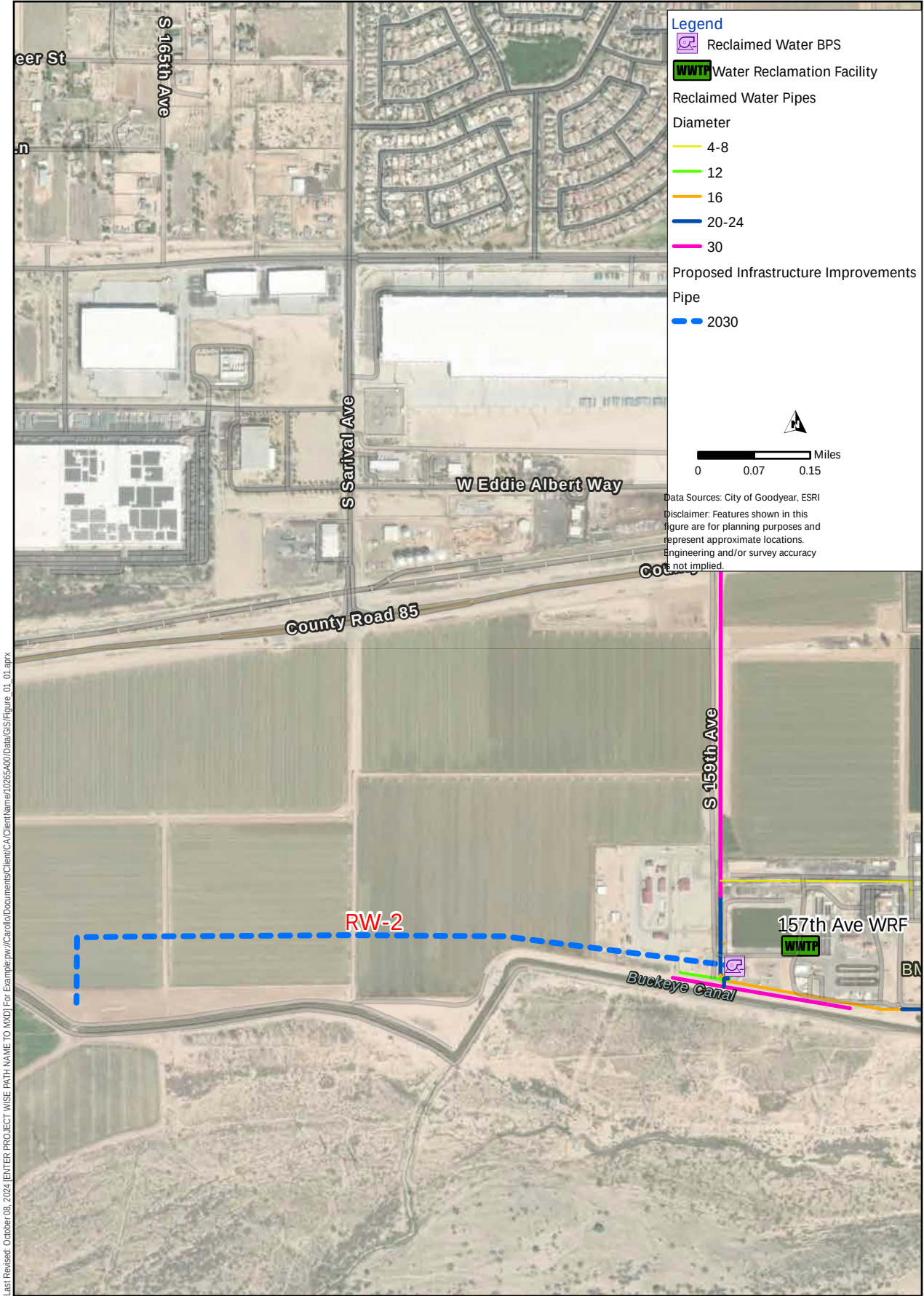
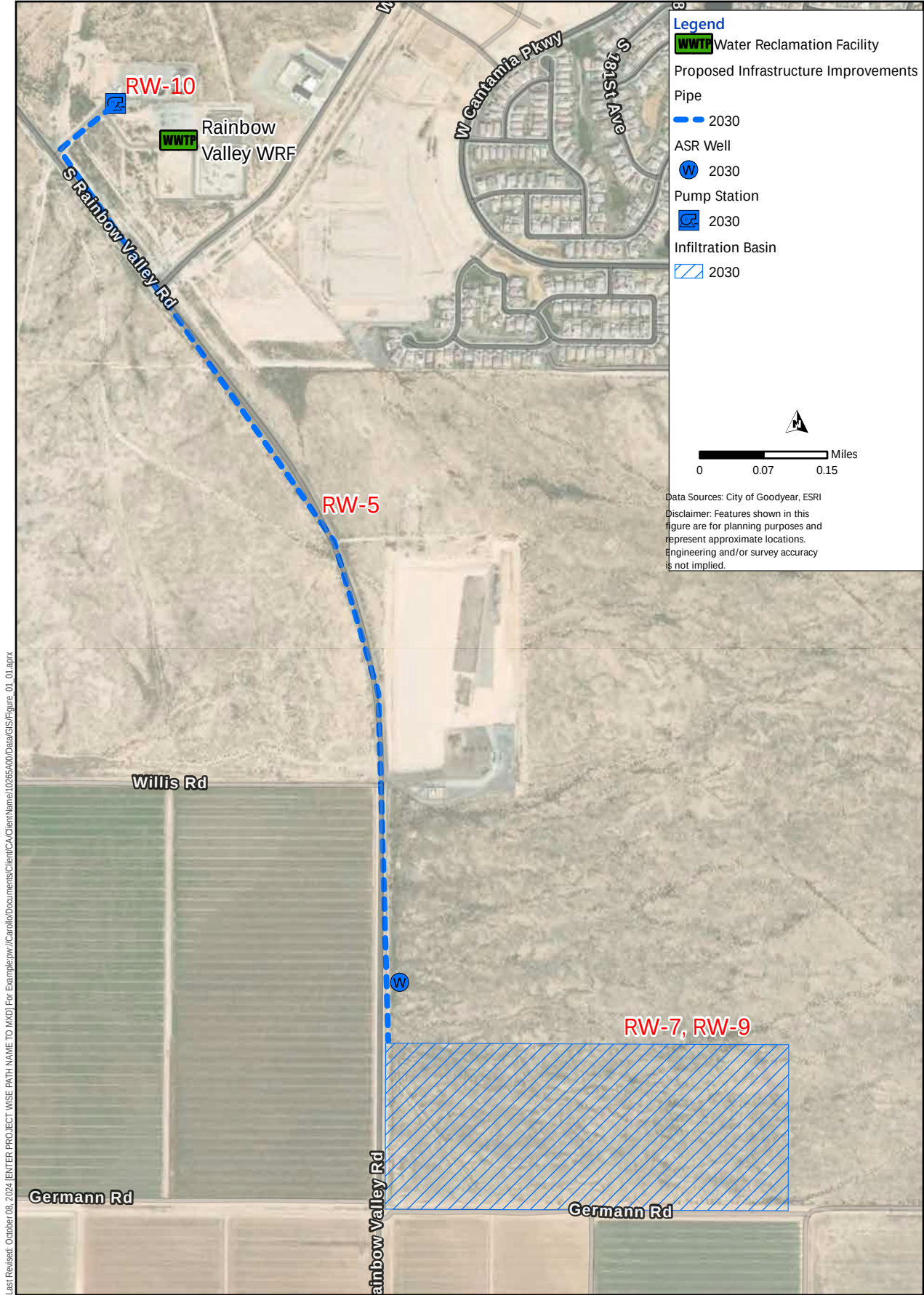


Figure 7E.2 Map of Capital Project RW-2
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN



Last Revised: October 08, 2024 [ENTER PROJECT WISE PATH NAME TO MAD] For Example: pw://Carollo/Documents/Client/CA/ClientName/10265400/Data/CIS/Figure_01_01.aprx

Figure 7E.3 Map of Capital Projects RW-5, RW-7, RW-9, and RW-10
CITY OF GOODYEAR
2024 INTEGRATED WATER MASTER PLAN