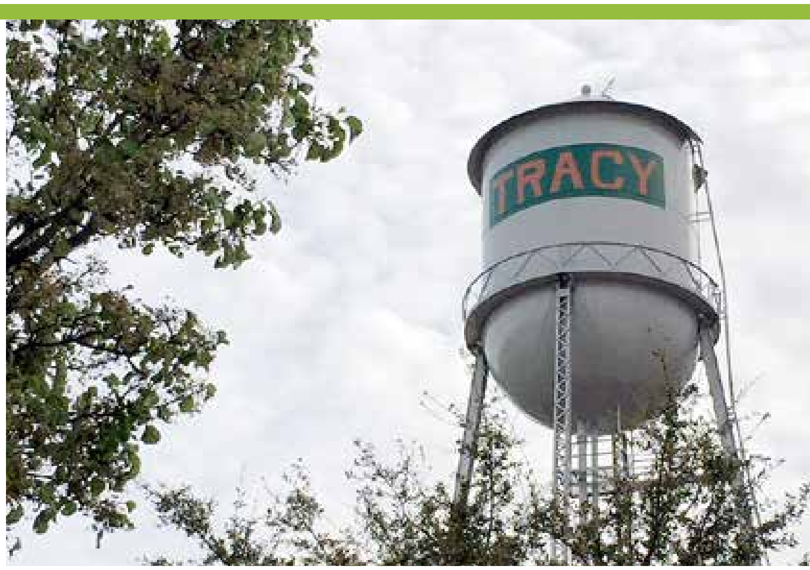
CITY OF TRACY

Citywide Water System Master Plan Update

FINAL REPORT

MARCH 2022



WEST YOST ASSOCIATES

FINAL REPORT | MARCH 2022

Citywide Water System Master Plan Update

Prepared for

City of Tracy

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List of Acronyms and Abbreviations

2018 Bay-Delta Water Quality Control Plan	2018 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary
AB	Assembly Bill
AC	Asbestos Cement
ADUs	Accessory Dwelling Units
af/ac/yr	Acre-Feet Per Acre Per Year
af/yr	Acre Feet Per Year
ASR	Aquifer Storage and Recovery
AWWA	American Water Works Association
BBID	Byron Bethany Irrigation District
BCID	Banta-Carbona Irrigation District
BMOs	Basin Management Objectives
BMP	Best Management Practices
BPS	Booster Pump Station
CARB	California Air Resources Board
CBSC	California Building Standards Commission
CFC	California Fire Code
CI	Cast Iron
CIP	Capital Improvement Program
City	City of Tracy
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
DDW	Division of Drinking Water
DI	Ductile Iron
DMC	Delta-Mendota Canal
DWR	Department of Water Resources
EIRs	Environmental Impact Reports
EPA	Environmental Protection Agency
FAR	Floor to Area Ratios
fps	Feet Per Second

ft/kft	Feet Per Thousand Feet
GEI	GEI Consultants
GHG	Greenhouse Gas
GIS	Geographic Information System
GMO	Growth Management Ordinance
GMP	Groundwater Management Plan
gpcd	Gallons Per Capita Per Day
gpm	Gallons Per Minute
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IPC	International Park of Commerce
JJWTP	John Jones Water Treatment Plant
K/J/C	Kennedy/Jenks/Chilton
LEED	Leadership in Energy and Environmental Design
Legislature	California State Legislature
lf	Linear Feet
M&I	Municipal & Industrial
MG	Million Gallons
mgd	Million Gallons per Day
MOA	Memorandum of Agreement
MSR	Municipal Service Review
MWELO	Model Water Efficient Landscape Ordinance
NEI	Northeast Industrial Area
NFPA	National Fire Protection Association
NRW	Non-Revenue Water
O&M	Operations and Maintenance
PPBP	Patterson Pass Business Park
PRS	Pressure Regulating Station
PRV	Pressure Reducing Valve
psi	Pounds Per Square Inch
PSV	Pressure Sustaining Valve
R&R	Renewal and Replacement
RGA	Residential Growth Allotment
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SB X7-7	Water Conservation Act of 2009
SCADA	Supervisory Control and Data Acquisition
SCS	Sustainable Community Strategy
SCWSP	South County Water Supply Project
SED	Substitute Environmental Document
SGMA	Sustainable Groundwater Management Act
SOI	Sphere of Influence
SSJID	South San Joaquin Irrigation District
SWRCB	State Water Resources Control Board

TDS	Total Dissolved Solids
Tracy Subbasin	San Joaquin Valley Groundwater Basin-Tracy Subbasin
UAFW	Unaccounted-for Water
USBR	United States Bureau of Reclamation
UWMP	Urban Water Management Plan
VFD	Variable Frequency Drive
VVH	VVH Consulting Engineers
WSCP	Water Shortage Contingency Plan
WSID	West Side Irrigation District
WSMP	Water System Master Plan
WWTP	Wastewater Treatment Plant

CITYWIDE WATER SYSTEM MASTER PLAN UPDATE EXECUTIVE SUMMARY

PURPOSE FOR THE CITYWIDE WATER SYSTEM MASTER PLAN UPDATE

The purpose of this Citywide Water System Master Plan Update for the City of Tracy (City) is to provide an evaluation of the required backbone potable water and recycled water system facilities required to serve existing and future needs. The City's last Citywide Water System Master Plan was completed in 2012 (2012 WSMP) and was based on projected land uses included in the City's 2011 General Plan. Since that time, significant new residential and commercial development has occurred in the City (including the International Park of Commerce within the Cordes Ranch Specific Plan area, Tracy Ellis, Tracy Hills and numerous smaller projects) and planning for future developments has been refined. Also, during that same time, the State endured five years of drought starting in 2012, including the driest four consecutive years in California history. These unprecedented conditions led to statewide mandated water conservation, significant surface water supply reductions and curtailments and legislation establishing new water efficiency standards.

All of these factors have led to a need to reevaluate the City's potable water and recycled water needs, the projected availability and reliability of the City's water supplies and the required water system infrastructure improvements to ensure a safe and reliable water supply for the City's residents and businesses.

OBJECTIVES OF THE CITYWIDE WATER SYSTEM MASTER PLAN UPDATE

This Citywide Water System Master Plan Update has been prepared based on the following overall water system objectives and goals:

- Ensure safe, adequate and reliable water supplies for the City's existing and future residents and businesses
- Support the goals, objectives and policies of the City's General Plan, particularly those contained in the Public Facilities and Services Element
- Comply with existing and future legislation and regulations for both potable and non-potable (recycled) water supplies

Based on the City's water system objectives, the objectives of this Citywide Water System Master Plan Update are to:

- Evaluate existing water demands to understand current water use patterns and trends and project future water demands for near-term (2025), future (2040) and General Plan buildout conditions
- Provide an updated evaluation of the availability and reliability of the City's existing and future water supplies and their ability to meet existing and future water demands considering recent changes in projected supply reliability

- Review and refine performance and operational criteria under which the potable and recycled water systems will be analyzed and recommendations for future facilities will be formulated
- Evaluate the need for new backbone potable water facilities (including pipelines, storage facilities and pumping facilities) to serve buildout of the City's General Plan
- Evaluate the need for new backbone recycled water facilities (including pipelines, storage facilities and pumping facilities) to serve buildout of the City's General Plan
- Develop a capital improvement program for recommended potable and recycled water system facilities

KEY CHANGES FROM THE 2012 CITYWIDE WATER SYSTEM MASTER PLAN

This Cityside Water System Master Plan Update incorporates and considers several changed conditions, new water system facilities, and new water supply opportunities from what was included in the 2012 Citywide Water System Master Plan. A summary of these is provided below:

- Changes in Projected Land Use: Compared to the projected land use in 2012 Citywide Water System Master Plan, there has been a significant shift in the City's projected land use composition towards residential development and away from commercial and industrial development. However, when compared to the City's historical and existing land uses, which were primarily residential, the projected land uses for new development are more heavily skewed to non-residential uses (with almost 60 percent of the projected acres of new development being non-residential uses). The future industrial, commercial, and retail growth anticipated in the City's Sphere of Influence is reflective of the City's goal to bring jobs and economic growth and improve the City's jobs-housing balance (see Chapter 3 for additional information).
- Reduction in Unit Water Demands: Due to changes in water use trends and habits resulting from improved water use efficiency, unit water demand factors have been reduced for most land use categories (see Chapter 4 for additional information).
- Reduction in Maximum Day and Peak Hour Demand Factors: Due to changes in water use trends and habits from improved water use efficiency, maximum day and peak hour demand factors have been reduced (see Chapter 4 for additional information).
- Changes in Recycled Water System Planning: Previously, the City was considering implementing the proposed Gateway Exchange Program, under which recycled water service would be extended to most of the existing parks and large irrigated areas in the City to offset the potable water demands from the Gateway development (now called Westside). The Gateway Exchange Program is no longer being considered, and it is projected that only a few existing parks and irrigated areas will receive recycled water supply. Expansion of the recycled water system will focus on extending service to newly developed areas (see Chapters 4 and 9 for additional information).

- Reduction in Surface Water Supply Reliability: Due to unprecedented drought conditions from 2011 through 2017 and new flow restrictions resulting from the 2018 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, projected reliabilities of surface water supplies from the Central Valley Project (CVP) and South San Joaquin Irrigation District (SSJID) have been significantly reduced, particularly in dry years. The City has entered into discussions with the Contra Costa Water District and the San Luis & Delta-Mendota Water Authority to explore the City's potential participation in the Phase 2 Los Vaqueros Reservoir Expansion Project to increase the City's water supply reliability by providing storage of supplies for use in dry years (see Chapter 5 for additional information).
- Proposed Recycled Water Exchange Agreement: The City is evaluating the potential for indirect reuse of its available recycled water through an exchange agreement with the United States Bureau of Reclamation (USBR) whereby a portion of the City's tertiary-treated wastewater (recycled water) would be discharged to the Delta Mendota Canal (DMC) and a like amount of water (i.e., a one-to-one exchange) could then be diverted from the DMC by the City for treatment at the City's John Jones Water Treatment Plant (JJWTP) for potable use. Such supplies would be 100 percent reliable and would not be subject to drought cutbacks. With the potential reduction in reliability of the City's surface water supplies from the CVP and SSJID, this proposed recycled water exchange agreement will be a critical component of the City's future water supply portfolio (see Chapter 5 for additional information).
- Reduction in Emergency Storage Requirement: The 2012 WSMP used an emergency storage volume requirement of two (2) times the average day demand. After reviewing emergency storage criteria for other similar water systems within the region, and taking into account the City's redundant sources of supply (CVP, SSJID, and groundwater), it is recommended that the City reduce the minimum quantity of emergency storage volume required to 1.5 times the average day demand for this Citywide Water System Master Plan Update (see Chapter 6 for additional information).
- Addition of New Water System Facilities: Several new water system facilities have been recently completed which provide for added water system capabilities. These include the Cordes water storage tank and pump station, the Tracy Hills water storage tank and pump station (nearing completion as of September 2021), new pump stations at the City's JJWTP to serve the City's Pressure Zone 3 and initial phases of the Tracy Hills development, and a recycled water pump station and pipeline on the west side of the City to distribute recycled water supplies from the City's Wastewater Treatment Plant to recycled water users on the western side of the City (see Chapters 7 and 9 for additional information).

- Renaming of Potable Water Pressure Zones: To minimize confusion when referring to the City's primary potable water system pressure zones, the potable water system pressure zones have been renamed as follows:
  - Pressure Zone 1 – no change
  - Pressure Zone 2 – no change
  - City-side Pressure Zone 3 – now referred to as Pressure Zone 3
  - Tracy Hills Pressure Zone 3 – now referred to as Pressure Zone 4
  - Tracy Hills Pressure Zone 4 – now referred to as Pressure Zone 5
  - Tracy Hills Pressure Zone 5 – now referred to as Pressure Zone 6

  The remainder of this Citywide Water System Master Plan Update, and all subsequent water system evaluations and studies, will utilize these new pressure zone designations.

EXISTING AND PROJECTED FUTURE WATER DEMANDS

The City of Tracy currently serves a population of about 96,000 people. Total potable water production in 2020 was 18,687 acre-feet per year (af/yr), not including water treated and wheeled to the Patterson Pass Business Park, which equates to a per capita water use of about 174 gallons per capita per day (gpcd). This per capita water use is significantly lower than the City's historical per capita water use which was as high as 300 gpcd in the early 1980s. Per capita water use was as low as 144 gpcd in 2015 due to extreme drought conditions which resulted in voluntary and mandatory water conservation. The per capita water use has increased somewhat in recent years as water use restrictions have been lifted and customers have resumed more typical water use behavior.

As described in Chapter 4, future water demands for buildout of the City's General Plan were projected based on revised unit water demand factors reflecting recent water use patterns and trends for the City's various land uses, consistency with the Model Water Efficient Landscape Ordinance (MWELO) for landscape irrigation water use and the use of recycled water for landscape irrigation for selected land use designations.

With the planned buildout of the City's sphere of influence (SOI), the City's population is projected to increase to about 160,600 people. At buildout, potable water demands are projected to be about 33,500 af/yr, while recycled water demands (for irrigation of landscaped areas) are projected to be 6,300 af/yr. As noted in the City's 2012 WSMP, the City's future use of recycled water for non-potable uses such as landscape irrigation is key to the reduction (offset) of the City's future potable water demand, and the City's ability to meet future demands using existing and future available water supplies.

A summary of the projected future water demands and water production at 2025 (near-term), at 2040, and at buildout, is provided in Table ES-1.

Table ES-1. Summary of Future Projected Water Production[a,b,c]

Demand Category	2025 (Near Term) Potable Water, af/yr	2025 (Near Term) Recycled Water, af/yr	2040 Potable Water, af/yr	2040 Recycled Water, af/yr	Buildout Potable Water, af/yr	Buildout Recycled Water, af/yr
Future	3,000	900	10,900	4,100	15,700	6,200
Existing - City[d]	17,800	100	17,800	100	17,800	100
Total to be Met by City Water Supply Contracts and Rights	**20,800**	**1,000**	**28,700**	**4,200**	**33,500**	**6,300**
Existing - PPBP Wheeled Water[e]	600	0	600	0	600	0
Total to be Delivered by City Distribution System	**21,400**	**1,000**	**29,300**	**4,200**	**34,100**	**6,300**

(a) Refer to Appendix A for detailed water demand calculations.
(b) Includes unaccounted for water.
(c) Totals rounded to the nearest hundred.
(d) Includes water delivered to existing buildings in the International Park of Commerce (IPC).
(e) Does not include water delivered to existing buildings in IPC.

As the City continues to develop, potable water consumption between customer classes is expected to shift due to changes in the City's projected land use composition. A comparison of the historical average and projected potable water consumption by customer class is shown in Table ES-2. As shown, the residential customer classes are expected to decrease their overall potable water consumption proportion as water use shifts towards non-residential customer classes. This trend is primarily due to large industrial developments such as Cordes Ranch, West Side Industrial, East Side Industrial, UR 3, and Tracy Hills Phase 5, among others.

Table ES-2. Historical and Projected Potable Water Consumption by Customer Class

Customer Class	Historical Average Annual Consumption[a]	Projected Annual Consumption in 2025[b]	Projected Annual Consumption in 2040[b]	Projected Annual Consumption at Buildout[b]
Single Family Residential[c]	60.1%	58.0%	54.0%	53.3%
Multi-Family Residential[d]	6.7%	7.6%	6.9%	8.5%
Residential Subtotal	66.8%	65.6%	60.9%	61.7%
Commercial[e]	15.4%	13.5%	14.2%	14.2%
Industrial	4.9%	9.3%	16.4%	17.6%
Irrigation[f]	12.9%	11.6%	8.4%	6.5%
Total	**100%**	**100%**	**100%**	**100%**

(a) Refer to Table 4-4.
(b) Includes existing and projected future potable demands.
(c) Includes projected future residential demands (excluding irrigation) for Residential - Very Low Density, Residential - Low Density, and Residential - Medium Density land use types.
(d) Includes projected future residential demands (excluding irrigation) for Residential - High Density and Residential - Very High Density land use types.
(e) Includes projected future demands (excluding irrigation) for Commercial, Office, and Institutional land use types.
(f) Includes projected future irrigation demands to be served by potable water. Accounts for planned conversions of irrigation services to recycled water use.

Landscape irrigation water use is projected to be a much smaller proportion of the City's potable water use at buildout because many new development areas will be served by the recycled water system at buildout, and some of the City's existing irrigated areas will be converted to recycled water use.

EXISTING AND PROJECTED FUTURE WATER SUPPLIES

Chapter 5 of this Citywide Water System Master Plan Update describes updates to the City's water supply availability and reliability which have occurred since the completion of the 2012 WSMP and the City's 2015 Urban Water Management Plan (2015 UWMP). The water supply availability and reliability described in Chapter 5 is consistent with the City's 2020 UWMP, which was adopted in June 2021.

Existing Water Supplies

The City currently receives water supplies from the following sources:

- Untreated surface water from the DMC (CVP) (treated at the City's John Jones Water Treatment Plant (JJWTP))
- Untreated surface water from Byron Bethany Irrigation District (BBID) pre-1914 rights (treated at the City's JJWTP)
- Treated surface water from the Stanislaus River via the South County Water Supply Project (SCWSP) (treated and delivered to the City by the SSJID)
- Groundwater pumped from eight groundwater wells located within the City

Since the completion of the 2012 WSMP and the 2015 UWMP, the availability and reliability of the City's water supplies have been impacted by drought conditions and associated unprecedented cutbacks in surface water supply deliveries. Also, in recent years new legislation has been passed which will impact future water use and future water supply availability and reliability, including the Sustainable Groundwater Management Act (SGMA), SB 606 and Assembly Bill 1668 Making Water Conservation a California Way of Life and most recently the 2018 amendments to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) which was adopted by the State Water Resources Control Board (SWRCB) in December 2018 and restricts the use of flows from the Lower San Joaquin River and its tributaries (the Stanislaus, Tuolumne and Merced Rivers) to improve conditions for fish and wildlife. Specifically, it restricts the use of flows until 40 percent of unimpaired flows are rededicated for water quality and instream fisheries. The Bay-Delta Plan Amendment, depending on its actual implementation, has potential impacts to the water supplies that the City receives from SSJID.

Also, in 2017, new guidelines and procedures went into effect associated with the updated CVP M&I Water Shortage Policy, which base dry year allocations on a contractor's historical use of CVP supplies, not its contractual amount of CVP supplies.

These changed conditions significantly impact the availability and reliability of the City's surface water supplies in dry years (specifically the City's CVP supplies and SSJID supplies).

Future Water Supplies

The City has a projected potable water supply production requirement of 33,500 af/yr for buildout of the City's General Plan. The City will need to develop future water supplies to meet these projected future demands. This will include expansion of its Aquifer Storage and Recovery Program (up to 1,000 af/yr) and implementation of a proposed Recycled Water Exchange Program (up to 7,500 af/yr) to meet its projected future potable water demands. Furthermore, 6,300 af/yr recycled water will be needed to meet landscape irrigation demands at buildout.

The City's ASR Program should be expanded in the future to provide up to 1,000 af/yr of supply. As described in Chapter 5, an evaluation of potential ASR options and operational scenarios should be conducted as additional ASR wells are planned to determine if dedicated SSJID supply pipelines to the ASR wells will be required if the City's ASR permit cannot be modified to allow for other supplies to be injected.

The proposed Recycled Water Exchange Program would provide for the potential for indirect use of its available recycled water through an exchange agreement with the USBR whereby a portion of the City's tertiary-treated wastewater (recycled water) would be discharged to the DMC and a like amount of water (i.e., a one-to-one exchange) could then be diverted from the DMC by the City for treatment at the City's JJWTP for potable use. Such supplies would be 100 percent reliable and would not be subject to drought cutbacks. The project would require development of a project description, NEPA/CEQA review, approval of an exchange agreement, design and construction of a recycled water pipeline that could discharge recycled water to the DMC downstream of the City's JJWTP intake and expansion of the City's wastewater treatment plant. Additional discussion of the pipeline required for the Recycled Water Exchange Program is provided in Chapter 9. If such a project is approved and implemented, the City anticipates that it would initially provide up to 5,900 af/yr of additional potable water supplies to the City, with future expansion as needed to meet future demands.

As shown on Figure ES-1, even with additional supplies, the City may experience water supply shortages in dry years. Table ES-3 provides a summary of the projected water supply needs to meet the single dry year conditions (the most critical hydrologic condition) under the City's projected near-term (2025), future (2040) and buildout demand conditions. As shown, the projected potable water supplies are less than the projected potable water demands, indicating that the City would need to implement its Water Shortage Contingency Plan to reduce water demands and/or develop additional water supplies to meet the projected water demands. Chapter 5 provides a summary of the City's water management strategies and options, including participation in the Phase 2 Los Vaqueros Reservoir Expansion Project, as described in the City's 2020 UWMP.

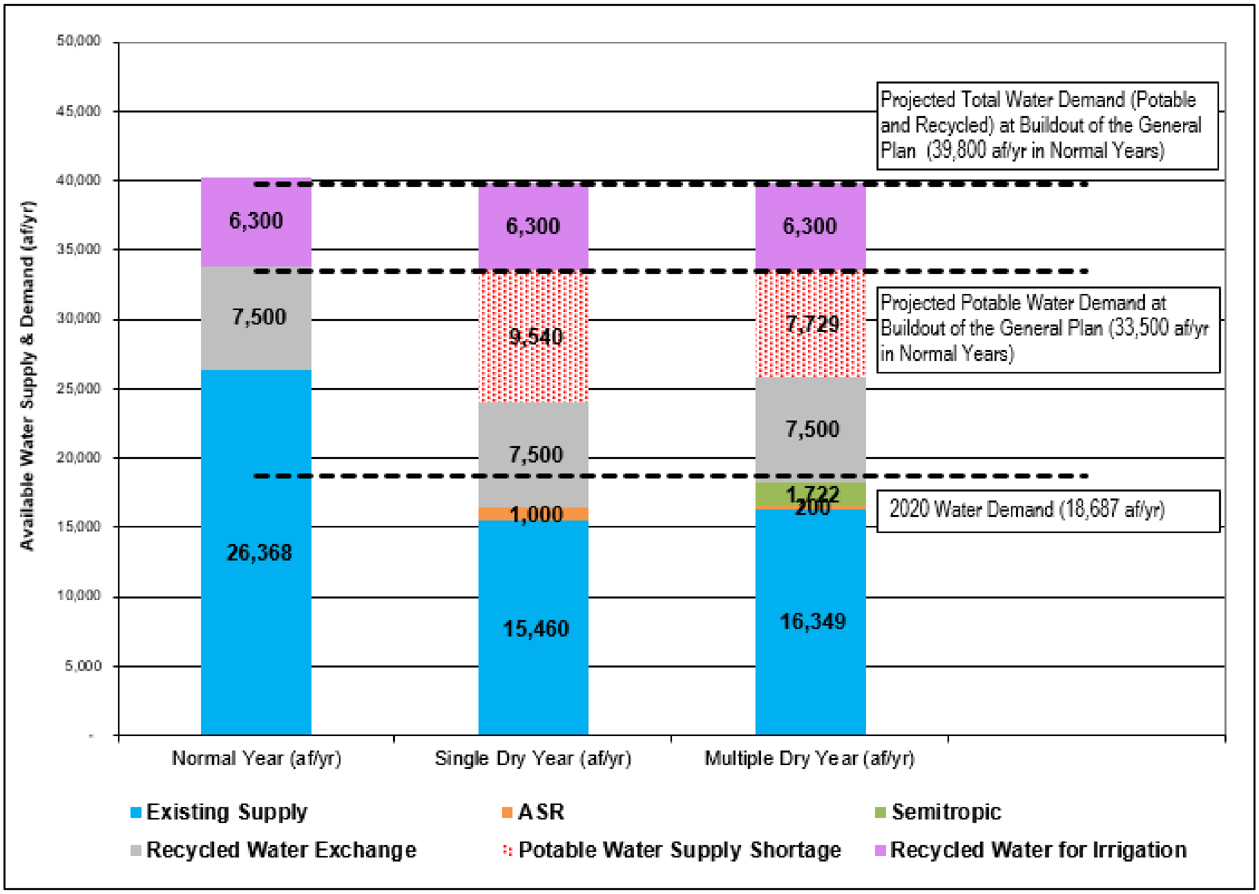


Figure ES-1. Existing and Planned Future Water Supplies vs. Water Demand at Buildout

Table ES-3. Future Water Supply Needs under Single Dry Year Conditions				
	Near-Term (2025), af/yr	Future (2040), af/yr	Buildout, af/yr	Comments
Existing Potable Water Supplies				
CVP Surface Water Supplies	1,483	1,483	1,483	Based on 25% of historical use
SSJID Surface Water Supplies	9,974	6,177	6,177	2025 supply includes temporary contract with City of Escalon (which ends in 2025) and a 76% allocation; 2040 and buildout supply assumes a 56% allocation
BBID Pre-1914 (to meet Tracy Hills demand)	800	2,500	3,300	Based on projected potable water demand at Tracy Hills; see Appendix A
Groundwater	4,500	4,500	4,500	Increased from normal year supply of 2,500 af/yr
Total Existing Potable Water Supplies	16,757	14,660	15,460	
Existing Dry Year Water Supplies				
Semitropic Dry Year Supply	0	0	0	Assumed to not be available in Single Dry Years
ASR Dry Year Supply	700	1,000	1,000	Existing capability is 700 af/yr for Well 8; additional ASR wells would be needed for expansion of the ASR program
Total Existing Dry Year Water Supplies	700	1,000	1,000	
Future Potable Water Supplies				
Recycled Water Exchange	0	5,000	7,500	
Total Future Potable Water Supplies	0	5,000	7,500	
Total Potable Water Supplies	**17,457**	**20,660**	**23,960**	
Potable Water Demand	**20,800**	**28,700**	**33,500**	See Table 4-16 in Chapter 4
Recycled Water				
Recycled Water Demand for Landscape Irrigation	**1,000**	**4,200**	**6,300**	See Table 4-16 in Chapter 4
Total Recycled Water Needed, af/yr	1,000	9,200	13,800	As needed to meet needs for Recycled Water Exchange and Landscape Irrigation
Total Recycled Water Needed (average day), mgd	0.9	8.2	12.3	

Subsequent revisions to the projected potable water demand and/or the water supply availability and reliability assumptions may change the required quantities and timing of the proposed Recycled Water Exchange Program. However, even if the required quantities or timing are modified in the future, the direct use of recycled water for landscape irrigation demands and indirect use of recycled water as part of the proposed Recycled Water Exchange Program will be critical components of the City's future water supply portfolio.

The planned future direct and indirect use of recycled water will also require an expansion of the City's Wastewater Treatment Plant (WWTP) to produce adequate quantities of recycled water to meet both the future Recycled Water Exchange Program needs (indirect use), as well as the landscape irrigation demands (direct use), at buildout.

It should also be noted that supply availability and reliability, and actual water demands, may change in the future. As such, the City may need to acquire additional potable water supplies in the future. The City will need to closely track actual potable water demands and supply availability and reliability as future service areas are approved and developed to determine if existing and future supplies are adequate and/or if and when additional potable or recycled water supplies may be required.

EVALUATION OF EXISTING AND FUTURE POTABLE WATER SYSTEM

Chapters 7 and 8 of this Citywide Water System Master Plan Update identify the improvements necessary to eliminate existing deficiencies and support the City's projected future potable water demands, respectively. Recommended improvements are based on evaluations of the existing and future (2025 and buildout) potable water system's treatment, storage, and pumping capacities, as well as its ability to meet recommended performance and operational criteria under maximum day demand plus fire flow and peak hour demand scenarios.

Facility improvements are identified at a Master Plan level and do not necessarily include all required on-site infrastructure nor constitute design of improvements. Subsequent detailed design is required to determine the sizes and locations of the proposed improvements. Further, the hydraulic model is not an "all pipes" model (i.e., not all smaller diameter pipelines are included), so the hydraulic simulations performed may not identify all necessary water system improvements. West Yost recommends conducting additional hydraulic evaluations as development details become available.

The following recommendations exclude non-backbone facilities that only serve a specific development, instead focusing on backbone facility improvements with more widespread system benefit. These shared facilities are designated program facilities.

Existing Potable Water System

The City's existing potable water system includes the following major facilities: JJWTP, eight groundwater wells, clearwells and storage tanks, booster pump stations, pressure regulating stations, and transmission and distribution system pipelines. The City's existing distribution system is divided into four pressure zones. Significant new infrastructure has been constructed in recent years to serve new development projects, including new pump stations at the JJWTP to serve Pressure Zones 3 and 4, a new storage tank and pump station in the Cordes Ranch area, and a new storage tank and pump station in Tracy Hills.

Recommendations for the existing potable water distribution system are shown on Figure ES-2 and described below. These existing system improvements are recommended based on existing water demands, and are not triggered by future new development. The existing water system infrastructure in the areas listed below is insufficient to meet the fire flow requirements based on existing land use and water demands. As such, planning and design for these improvements should be prioritized.

Pipeline Improvements

The following pipeline improvements are recommended:

- Improvement #1:
  - — Replace the existing pipelines in 20th Street between Bessie Avenue and Parker Avenue, Wall Street between Lowell Avenue and 20th Street, Emerson Avenue between Bessie Avenue and Holly Drive, Court Drive between Whittier Avenue and Lowell Avenue, and Lowell Avenue between Parker Avenue and Holly Drive with approximately 6,000 linear feet (lf) of new 8-inch diameter pipelines
- Improvement #2:
  - — Install approximately 515 lf of 12-inch diameter pipeline in Ninth Street between School Street and Tenth Street
- Improvement #3:
  - — Replace approximately 485 lf of existing 4-inch diameter pipeline in Tracy Boulevard north of Mount Diablo Avenue with new 12-inch diameter pipeline

2025 Potable Water System

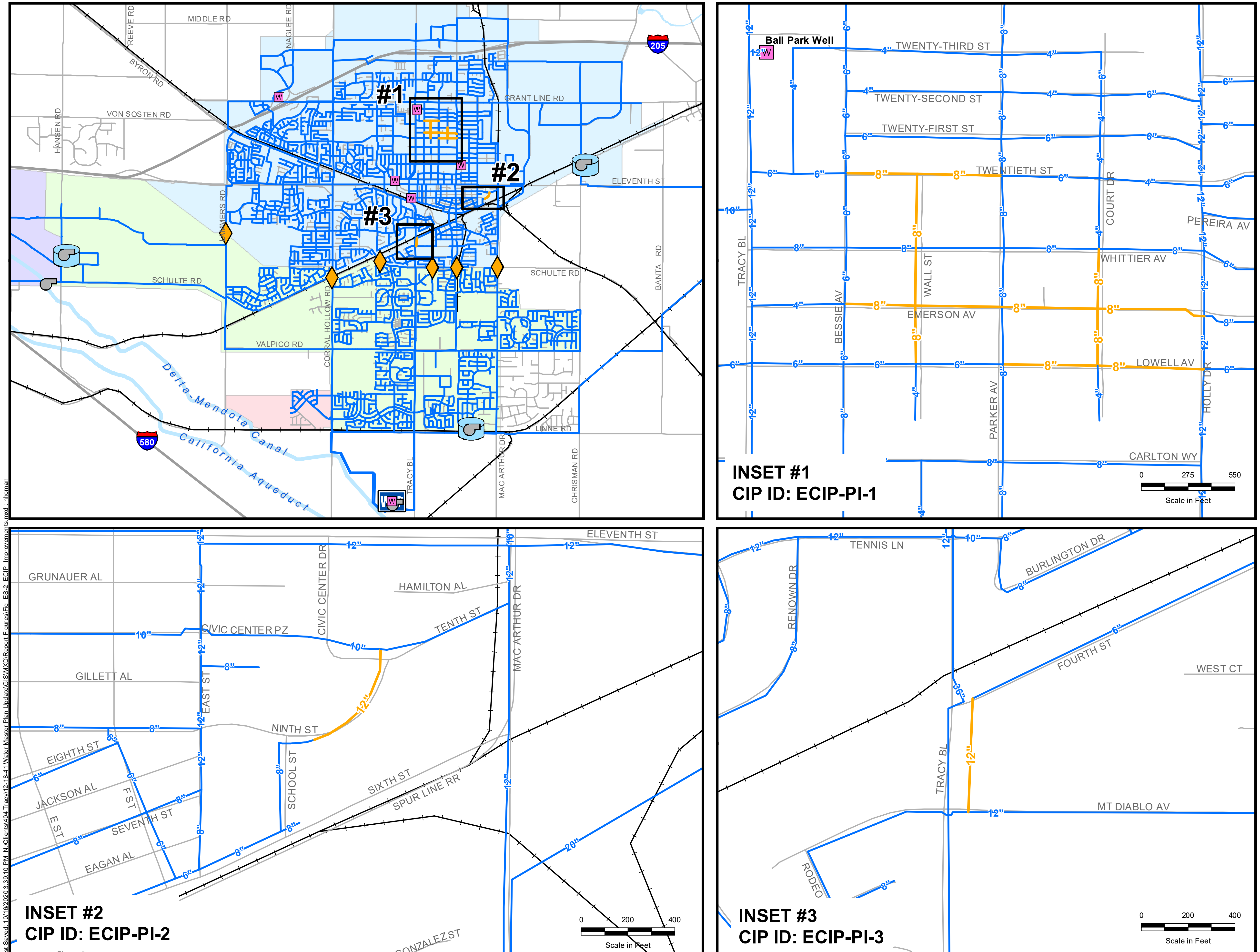
Program facility recommendations for the 2025 potable water system are shown on Figure ES-3 and described below. A complete listing of recommended potable water system improvements (both program and non-program) to serve projected 2025 potable water demands is provided in Chapter 8 along with recommendations for their timing.

Pipeline Improvements

- To serve 2025 potable water demands, replace existing pipelines in Sixth Street, Tracy Boulevard, and Eleventh Street with approximately 1,390 linear feet of new 18-inch and 24-inch diameter pipelines

New Potable Water Pipelines

- To serve 2025 potable water demands, install approximately 43,010 lf of new pipelines ranging in diameter from 12 to 24 inches



Symbology

- Existing Pipeline
- Pipeline Improvement
- Pressure Regulating Station
- Booster Pump Station
- Groundwater Well
- Storage Tank
- John Jones Water Treatment Plant

Pressure Zone

- Zone 1
- Zone 2
- Zone 3 (IPC/PPBP)
- Ellis Reduced Zone

Notes:
1. The City's existing hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.

Figure ES-2

Recommended Existing Potable Water System Improvements

City of Tracy
Water System Master Plan Update

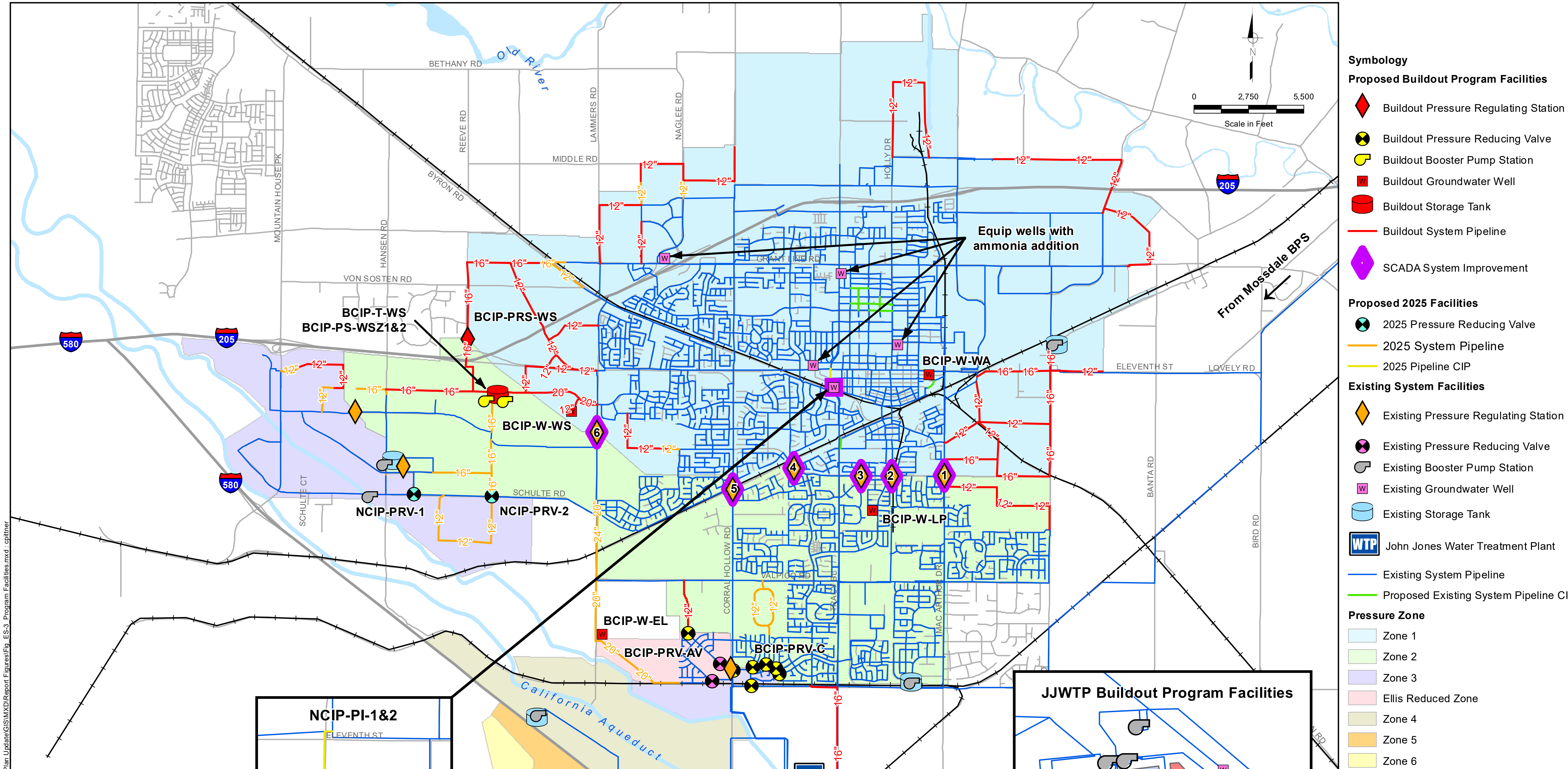


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Figure ES-3

Recommended Future Potable Water System Program Improvements

City of Tracy
Water System Master Plan Update

Interconnections

- Install PRVs at Schulte Road and Bud Lyons Way and at Schulte Road and Pavillion Parkway before the transmission main in Schulte Road is re-zoned to Zone 3

Re-zoning

- Re-zone the existing transmission mains in Lammers Road, Schulte Road, and Hansen Road from Zone 2 to Zone 3 as described in Appendix D

Groundwater Wells

- Provide ammonia addition for existing City wells (Lincoln Well, Lewis Manor Well, Park & Ride Well and Ball Park Well) (as noted below under Buildout System Improvements, all future wells are also recommended to be equipped with ammonia addition)
- A feasibility study is recommended to develop an implementation plan for future ASR expansion

Buildout Potable Water System

Program facility recommendations for the buildout potable water system are shown on Figure ES-3 and described below. A complete listing of recommended potable water system improvements (both program and non-program) to serve projected buildout potable water demands is provided in Chapter 8 along with recommendations for their timing.

Storage Reservoirs

Planning and design of these new storage facilities should be conducted so that the proposed facilities are constructed and operational in time to serve their respective service areas (e.g., Westside, Zone 5 or Zone 6). Because of the additional operational flexibility that Clearwell #3 would provide, it is recommended that Clearwell #3 be constructed as soon as possible. As noted above, no additional storage facilities are required by 2025, but it is recommended that Clearwell #3 be constructed by no later than 2030.

- Westside Tank: Install a new storage tank with a minimum active storage capacity of 1.0 million gallons (MG)
- JJWTP Clearwell #3: Install a new clearwell with a minimum active storage capacity of 1.0 MG to provide storage for Zone 3

Groundwater Wells

Planning and design of these new groundwater wells should be phased so that the City's ASR Program can be expanded as needed to meet the City's water supply needs, particularly in dry years. A feasibility study for the expansion of the City's ASR Program is included under the 2025 Potable Water System recommendations listed above.

- Westside: Install a new ASR well with a minimum firm pumping capacity of 2,500 gallons per minute (gpm)
- Wainwright: Install a new ASR well with a minimum firm pumping capacity of 2,500 gpm
- Larsen Park: Install a new ASR well with a minimum firm pumping capacity of 2,500 gpm
- Ellis: Install a new ASR well with a minimum firm pumping capacity of 1,000 gpm

Booster Pump Stations

Planning and design of these new booster pumping facilities should be coordinated with the construction of other related facilities (e.g., associated storage tanks) and the timing of new development.

- Zone 3 BPS (JJWTP): Install additional Zone 3 booster pumps at the JJWTP with a minimum firm pumping capacity of 1,500 gpm
- Westside Zone 1 Tank: Install a new booster pump station with a minimum firm pumping capacity of 4,500 gpm
- Westside Zone 2 Tank: Install a new booster pump station with a minimum firm pumping capacity of 2,400 gpm

New Potable Water Pipelines

Planning and design of these new pipelines should be coordinated with the timing of new development.

- To serve buildout potable water demands, install approximately 131,280 lf of new pipelines (in addition to the proposed 2025 pipelines) ranging in diameter from 12 to 20 inches

Interconnections

Planning and design of these new interconnections should be coordinated with the timing of new development in the respective pressure zones.

- Install the following interconnections between pressure zones to provide supply during peak demands and/or emergency conditions:
  - Westside Pressure Regulating Station (PRS) (from Zone 2 into Zone 1)
  - Avenues Pressure Reducing Valve (PRV) (from Ellis Reduced Zone into Zone 2)
- To provide adequate pressure to the Plan C area and prevent the accumulation of stagnant water in dead-end mains, installation of six (6) PRVs is recommended before the Plan C re-zoning occurs (to be funded through Plan C)

Re-zoning

Planning and design of this rezoning should be coordinated with the timing of the new Zone 3 pipeline from the JJWTP.

- Re-zone the Plan C area from Zone 2 to Zone 3 (to be funded through Plan C)

System Control and Data Acquisition (SCADA) System and Backup Power

Planning and design of the recommended SCADA system improvements and backup power should be prioritized and completed as soon as possible, as these improvements will improve operational flexibility and reliability.

- Install SCADA system monitoring of flows and pressures at PRS #1-#6 to provide operators with additional understanding and flexibility in system operations
- Add remote operation of Well 8 from the SCADA system to provide additional operational flexibility
- Install SCADA system monitoring of flows and pressures at each new water supply facility to provide operators with real-time system data and flexibility in system operations
- Install on-site backup power to any proposed buildout system pumping facility to improve supply reliability

JJWTP Expansion

- A future additional 10 mgd expansion of the JJWTP (for a total treatment capacity of 40 mgd) is recommended to provide the City with additional water treatment capacity, as well as operational flexibility and reliability.

Participation in Phase 2 Los Vaqueros Reservoir Expansion Project

- The City's participation in the Phase 2 Los Vaqueros Reservoir Expansion Project would increase the City's water supply reliability by providing storage of supplies for use in dry years.
- The estimated cost for 5,000 acre-feet of storage for the City will be approximately $10 million plus an additional $1.5 million for implementation and will be shared by existing rate payers and new development.

Water Master Plan Updates

- Regular updates of this Citywide Water System Master Plan are recommended to evaluate potable water and recycled water infrastructure needs to reflect any changes in future development plans, water use trends and patterns, and water supply availability and reliability, as well as new regulations and operational needs as new potable water and recycled water system infrastructure is constructed. It is recommended that updates be prepared at least once every 10 years, or more often if changing conditions warrant more frequent updates. For purposes of this Citywide Water System Master Plan Update, three future updates are planned.

EVALUATION OF FUTURE RECYCLED WATER SYSTEM

Chapter 9 of this Citywide Water System Master Plan Update identifies the improvements necessary to support the City's projected future recycled water demands and the recycled water exchange agreement. Recommended improvements are based on evaluations of the future (2025 and buildout) recycled water system's treatment, storage, and pumping capacities, as well as its ability to meet recommended performance and operational criteria under maximum day demand plus fill and peak hour demand scenarios.

Recycled water facility improvements are identified at a Master Plan level and do not necessarily include all required on-site infrastructure nor constitute design of improvements. Subsequent detailed design is required to determine the sizes and locations of the proposed improvements. Further, the recycled water hydraulic model is not an "all pipes" model (i.e., not all smaller diameter pipelines are included), so the hydraulic simulations performed may not identify all necessary system improvements. West Yost recommends conducting additional hydraulic evaluations as development details become available.

The following recommendations exclude non-backbone facilities that only serve a specific development, instead focusing on backbone facility improvements with more widespread system benefit. These shared facilities are designated program facilities.

2025 Recycled Water System

Program facility recommendations for the 2025 recycled water system are shown on Figure ES-4 and described below. A complete listing of recommended recycled water system improvements (both program and non-program) to serve projected 2025 recycled water demands is provided in Chapter 9 along with recommendations for their timing.

Booster Pump Stations

- Zone C Booster Pump Station (BPS): Install a new booster pump station with a minimum pumping capacity of 1,700 gpm

New Recycled Water Pipelines

- To serve 2025 recycled water demands, install approximately 11,370 lf of new pipelines ranging in diameter from 8 to 30 inches
- To deliver recycled water to the DMC as part of the City's planned recycled water exchange program, install approximately 23,680 lf of new, 30-inch diameter pipeline (as described above, the exchange program is an essential part of the City's projected future water supply portfolio and should be implemented as soon as possible)

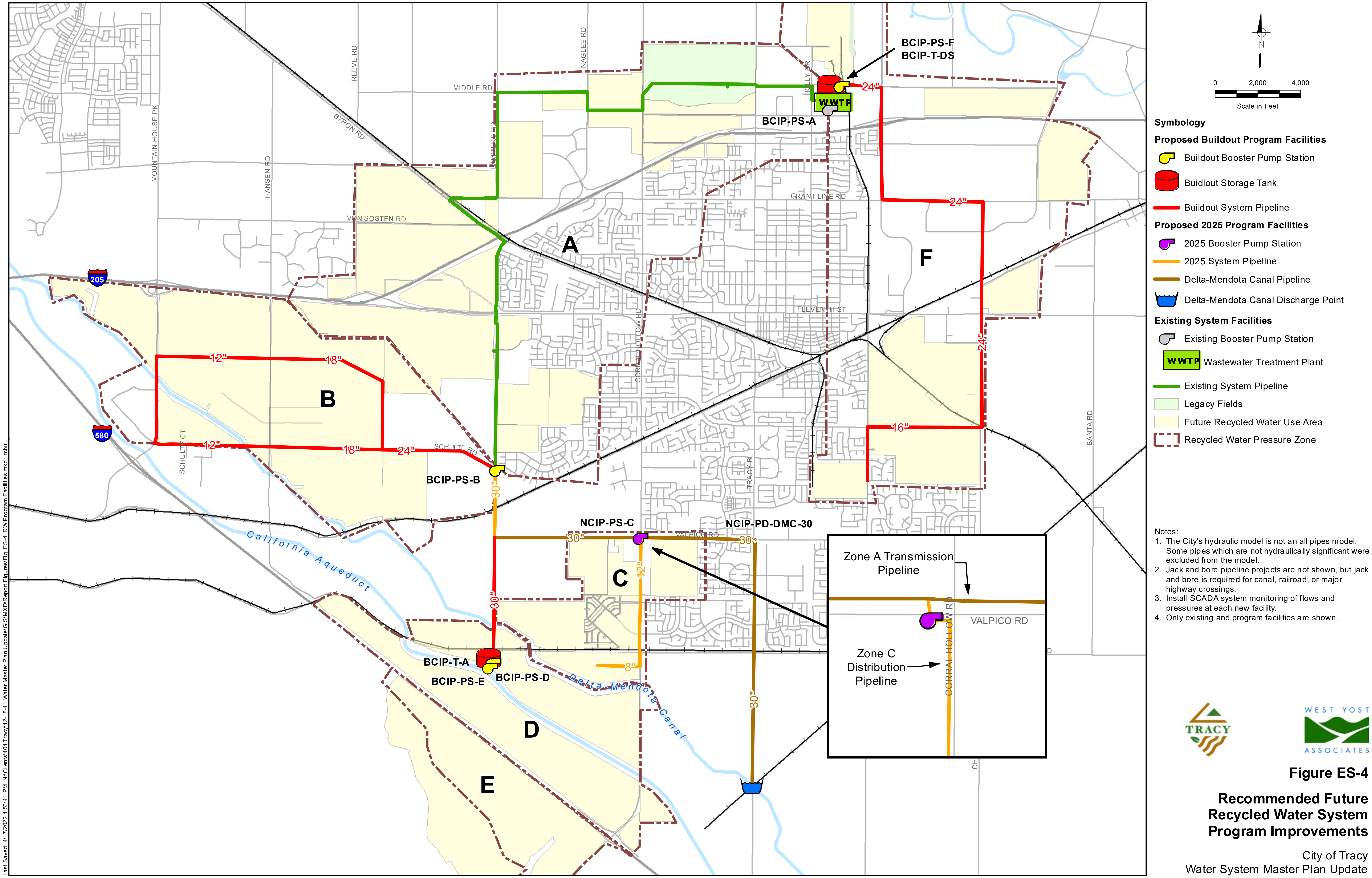
Buildout Recycled Water System

Program facility recommendations for the buildout recycled water system are shown on Figure ES-4 and described below. A complete listing of recommended recycled water system improvements (both program and non-program) to serve projected buildout recycled water demands is provided in Chapter 9 along with recommendations for their timing.

As described in Chapter 9, planning and design for these improvements should be conducted so that these improvements can be constructed and operational as soon as possible, as funding is available, so that recycled water supplies can be used to meet landscape irrigation and other non-potable water demands to minimize the use of potable water supplies for these uses.

Storage Reservoirs

- Zone A Tank: Install an above ground, welded steel storage tank with a minimum active storage capacity of 5.7 MG
- WWTP Diurnal Tank: Install a partially buried, prestressed concrete diurnal storage tank at the WWTP with a minimum active storage capacity of 2.3 MG; the need for this storage will depend on WWTP diurnal flow patterns, and it is recommended that the City re-evaluate the required diurnal storage at the WWTP by performing a diurnal flow study in 2040



Notes:

1. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
2. Jack and bore pipeline projects are not shown, but jack and bore is required for canal, railroad, or major highway crossings.
3. Install SCADA system monitoring of flows and pressures at each new facility.
4. Only existing and program facilities are shown.

TRACY

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Figure ES-4

Recommended Future Recycled Water System Program Improvements

City of Tracy
Water System Master Plan Update

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Booster Pump Stations

- Zone A BPS Expansion: Install additional booster pumps with a minimum pumping capacity of 3,472 gpm
- Zone B: Install a new booster pump station with a minimum pumping capacity of 5,780 gpm
- Zone D BPS: Install a new booster pump station with a minimum pumping capacity of 2,700 gpm
- Zone E BPS: Install a new booster pump station with a minimum pumping capacity of 2,000 gpm
- Zone F: Install a new booster pump station with a minimum pumping capacity of 4,400 gpm

New Recycled Water Pipelines

- To serve buildout recycled water demands, install approximately 42,790 lf of new pipelines (in addition to the proposed 2025 pipelines) ranging in diameter from 16 to 30 inches

SCADA System

- Install SCADA system monitoring of flows and pressures at each new water supply facility to provide operators with real-time system data and flexibility in system operations

RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

Chapter 10 of this Citywide Water System Master Plan Update presents the recommended Capital Improvement Program (CIP) for the City’s existing and future (2025 and buildout) potable water system and proposed future (2025 and buildout) recycled water system to support the City’s projected buildout potable water and recycled water demands, respectively. These costs are summarized in Table ES-4. A detailed breakdown of the costs is provided in Chapter 10.

Costs exclude non-backbone facilities that only serve a specific development, as costs associated with those facilities will be borne solely by the corresponding developers. Table ES-4 only includes costs for program facilities.

Table ES-4. Summary of Probable Construction Costs for Recommended Potable and Recycled Water System Improvements[a]

Recommended Improvements	CIP Cost (includes mark-ups)[b,c]
Potable Water System	
Existing Potable Water System CIP (see Table 10-1)	$1,960,000
2025 Potable Water System CIP (see Table 10-2)	$21,988,000
Buildout Potable Water System CIP (see Table 10-3)[d]	$157,113,000
Previous Water Treatment Plant Expansion Buy-in Cost[e]	$27,000,000
Total Potable Water System CIP	**$208,061,000**
Recycled Water System	
2025 Recycled Water System CIP (see Table 10-4)	$27,924,000
Buildout Recycled Water System CIP (see Table 10-5)	$65,528,000
Total Recycled Water System CIP	**$93,452,000**

(a) Includes only costs for program facilities; improvements benefiting only specific developments (e.g., Tracy Hills) are excluded.

(b) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

(c) CIP cost includes mark-ups equal to 40 percent (General Contingency: 15 percent; Design and Planning: 10 percent; Construction Management: 10 percent; and Program Administration: 5 percent) and are based on 2020 dollars.

(d) Includes cost for participation in Phase 2 Los Vaqueros Reservoir Expansion Project which is to be shared between existing rate payers and new development.

(e) The JJWTP was last expanded in 2008. The cost presented in this line item represents the buy-in cost for the portion of the expanded capacity to be utilized by new developments (estimated to be 9 mgd). The cost for the recommended additional 10 mgd expansion of the JJWTP is included in the Buildout Potable Water System CIP (see Table 10-3).

CHAPTER 1
Introduction

1.1 CITYWIDE WATER SYSTEM MASTER PLAN UPDATE PURPOSE

The purpose of this Citywide Water System Master Plan Update for the City of Tracy (City) is to provide an evaluation of the required backbone potable water and recycled water system facilities required to serve existing and future needs. The City's last Citywide Water System Master Plan was completed in 2012 and was based on projected land uses included in the City's 2011 General Plan. Since that time, significant new residential and commercial development has occurred in the City (including the International Park of Commerce within the Cordes Ranch Specific Plan area, Tracy Ellis, Tracy Hills and numerous smaller projects) and planning for future developments has been refined. Also, during that same time, the State endured five years of drought starting in 2012, including the driest four consecutive years in California history. These unprecedented conditions led to statewide mandated water conservation, significant surface water supply reductions and curtailments and legislation establishing new water efficiency standards.

All of these factors have led to a need to reevaluate the City's potable water and recycled water needs, the projected availability and reliability of the City's water supplies and the required water system infrastructure improvements to ensure a safe and reliable water supply for the City's residents and businesses.

1.2 WATER MASTER PLAN OBJECTIVES

The objectives of this Citywide Water System Master Plan Update are to:

- Evaluate existing water demands to understand current water use patterns and trends and project future water demands for near-term (2025), future (2040) and General Plan buildout conditions
- Provide an updated evaluation of the availability and reliability of the City's existing and future water supplies and their ability to meet existing and future water demands considering recent changes in projected supply reliability
- Review and refine performance and operational criteria under which the potable and recycled water systems will be analyzed and recommendations for future facilities will be formulated
- Evaluate the need for new backbone potable water facilities (including pipelines, storage facilities and pumping facilities) to serve buildout of the City's General Plan
- Evaluate the need for new backbone recycled water facilities (including pipelines, storage facilities and pumping facilities) to serve buildout of the City's General Plan
- Develop a capital improvement program for recommended potable and recycled water system facilities

1.3 KEY CHANGES FROM THE 2012 CITYWIDE WATER SYSTEM MASTER PLAN

This Cityside Water System Master Plan Update incorporates and considers several changed conditions, new water system facilities, and new water supply opportunities from what was included in the 2012 Citywide Water System Master Plan (WSMP). A summary of these is provided below:

- Changes in Projected Land Use: Compared to the projected land use in 2012 Citywide Water System Master Plan, there has been a significant shift in the City's projected land use composition towards residential development and away from commercial and industrial development. However, when compared to the City's historical and existing land uses, which were primarily residential, the projected land uses for new development are more heavily skewed to non-residential uses (with almost 60 percent of the projected acres of new development being non-residential uses). The future industrial, commercial, and retail growth anticipated in the City's Sphere of Influence is reflective of the City's goal to bring jobs and economic growth and improve the City's jobs-housing balance (see Chapter 3 for additional information).
- Reduction in Unit Water Demands: Due to changes in water use trends and habits resulting from improved water use efficiency, unit water demand factors have been reduced for most land use categories (see Chapter 4 for additional information).
- Reduction in Maximum Day and Peak Hour Demand Factors: Due to changes in water use trends and habits from improved water use efficiency, maximum day and peak hour demand factors have been reduced (see Chapter 4 for additional information).
- Changes in Recycled Water System Planning: Previously, the City was considering implementing the proposed Gateway Exchange Program, under which recycled water service would be extended to most of the existing parks and large irrigated areas in the City to offset the potable water demands from the Gateway development (now called Westside). The Gateway Exchange Program is no longer being considered, and it is projected that only a few existing parks and irrigated areas will receive recycled water supply. Expansion of the recycled water system will focus on extending service to newly developed areas (see Chapters 4 and 9 for additional information).
- Reduction in Surface Water Supply Reliability: Due to unprecedented drought conditions from 2011 through 2017 and new flow restrictions resulting from the 2018 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, projected reliabilities of surface water supplies from the Central Valley Project (CVP) and South San Joaquin Irrigation District (SSJID) have been significantly reduced, particularly in dry years. The City has entered into discussions with the Contra Costa Water District and the San Luis & Delta-Mendota Water Authority to explore the City's potential participation in the Phase 2 Los Vaqueros Reservoir Expansion Project to increase the City's water supply reliability by providing storage of supplies for use in dry years (see Chapter 5 for additional information).

- Proposed Recycled Water Exchange Agreement: The City is evaluating the potential for indirect reuse of its available recycled water through an exchange agreement with the United States Bureau of Reclamation (USBR) whereby a portion of the City's tertiary-treated wastewater (recycled water) would be discharged to the Delta Mendota Canal (DMC) and a like amount of water (i.e., a one-to-one exchange) could then be diverted from the DMC by the City for treatment at the City's John Jones Water Treatment Plant (JJWTP) for potable use. Such supplies would be 100 percent reliable and would not be subject to drought cutbacks. With the potential reduction in reliability of the City's surface water supplies from the CVP and SSJID during dry years, this proposed recycled water exchange agreement will be a critical component of the City's future water supply portfolio (see Chapter 5 for additional information).
- Reduction in Emergency Storage Requirement: The 2012 WSMP used an emergency storage volume requirement of two (2) times the average day demand. After reviewing emergency storage criteria for other similar water systems within the region, and taking into account the City's redundant sources of supply (CVP, SSJID, and groundwater), it is recommended that the City reduce the minimum quantity of emergency storage volume required to 1.5 times the average day demand for this Citywide WSMP Water System Master Plan Update (see Chapter 6 for additional information).
- Addition of New Water System Facilities: Several new water system facilities have been recently completed which provide for added water system capabilities. These include the Cordes water storage tank and pump station, the Tracy Hills water storage tank and pump station (nearing completion as of September 2021), new pump stations at the City's JJWTP to serve the City's Pressure Zone 3 and initial phases of the Tracy Hills development, and a recycled water pump station and pipeline on the west side of the City to distribute recycled water supplies from the City's Wastewater Treatment Plant to recycled water users on the western side of the City (see Chapters 7 and 9 for additional information).
- Renaming of Potable Water Pressure Zones: To minimize confusion when referring to the City's primary potable water system pressure zones, the potable water system pressure zones have been renamed as follows:
  - Pressure Zone 1 – no change
  - Pressure Zone 2 – no change
  - City-side Pressure Zone 3 – now referred to as Pressure Zone 3
  - Tracy Hills Pressure Zone 3 – now referred to as Pressure Zone 4
  - Tracy Hills Pressure Zone 4 – now referred to as Pressure Zone 5
  - Tracy Hills Pressure Zone 5 – now referred to as Pressure Zone 6

  The remainder of this Citywide Water System Master Plan Update, and all subsequent water system evaluations and studies, will utilize these new pressure zone designations.

1.4 REPORT ORGANIZATION

This Citywide Water System Master Plan Update is organized into the following chapters:

Chapter 1:	Introduction
Chapter 2:	Water Supply and Infrastructure System Objectives, Goals and Recommendations
Chapter 3:	Land Use Assumptions
Chapter 4:	Existing and Future Water Demands
Chapter 5:	Existing and Future Water Supplies
Chapter 6:	System Performance and Operational Criteria
Chapter 7:	Existing Potable Water System Evaluation
Chapter 8:	Future Potable Water System Evaluation
Chapter 9:	Recycled Water System Evaluation
Chapter 10:	Recommended Capital Improvement Program

The following appendices to this Citywide Water System Master Plan Update contain additional technical information, assumptions and calculations:

Appendix A:	Land Use Assumptions and Projected Water Demands for New Developments
Appendix B:	JJWTP Expansion Project Site Plan, Process Schematic, and Hydraulic Profile
Appendix C:	Existing Potable Water System Hydraulic Grade Schematic
Appendix D:	Lammers Road and Hood Way Design Recommendation Technical Memoranda
Appendix E:	Cost Estimating Assumptions
Appendix F:	Proposed Future Potable Water System Facility Improvements
Appendix G:	Proposed Future Recycled Water System Facility Improvements

1.5 ACKNOWLEDGEMENTS

The development of this Citywide Water System Master Plan Update would not have been possible without the focused involvement and assistance of City staff. In particular, the following staff provided comprehensive information, significant input and important insights throughout development of this Citywide Water System Master Plan Update:

- Robert Armijo, City Engineer/Assistant Director of Development Services
- Steve Bayley, Project Specialist
- Wayne Bogart, Public Works Superintendent
- Aleck Cheney, Engineer
- Veronica Child, Management Analyst II
- Bill Dean, Assistant Director of Development Services
- Lea Emmons, Water Treatment Plant Superintendent
- Vicki Lombardo, Senior Planner
- Ilene Macintire, Associate Civil Engineer
- Andrew Malik, Director of Development Services
- Stephanie Reyna-Hiestand, Water Resources Analyst
- Lemar Saffi, Assistant Engineer
- Karin Schnaider, Director of Finance
- Don Scholl, Director of Public Works
- Kul Sharma, Director of Utilities
- Paul Verma, Senior Civil Engineer
(Project Manager for the Citywide Water System Master Plan Update)
- Thomas Ward, Construction Inspector

CHAPTER 2
Water Supply and Infrastructure System Objectives, Goals, and Recommendations

2.1 OVERVIEW

The recent California drought conditions, environmental restrictions in the San Joaquin Delta, increasing population, and limited water resources are serious problems affecting water agencies statewide. Many water agencies have adopted ordinances and taken other measures to ensure a reliable water supply for their customers. Unfortunately, the challenge of sustaining a water supply for future generations is becoming more and more challenging each year.

This chapter presents an overview of the City's water supply and infrastructure system objectives and goals, describes existing policies, and provides recommendations for future measures to help the City meet those objectives and goals.

2.2 OVERALL WATER SYSTEM OBJECTIVES AND GOALS

This Citywide Water System Master Plan Update has been prepared based on the following overall water system objectives and goals:

- Ensure safe, adequate and reliable water supplies for the City's existing and future residents and businesses
- Support the goals, objectives and policies of the City's General Plan, particularly those contained in the Public Facilities and Services Element
- Comply with existing and future legislation and regulations for both potable and non-potable (recycled) water supplies including, but not limited to, the following:
  - — Support the City's compliance with legislation related to reducing greenhouse gases (Assembly Bill (AB) 32[1] and Senate Bill (SB) 375[2]) by improving the efficiency of water system facility operations when feasible.
  - — Comply with the California Green Building Standards Code, and other "green" building guidelines, as they relate to standards for interior and exterior water use, to promote more efficient use of the City's water supplies.

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[1] AB 32 California Global Warming Solutions Act of 2006: Signed into law September 27, 2006; requires the California Air Resources Board (CARB) to develop regulations and market mechanisms that will ultimately reduce California's greenhouse gas (GHG) emissions by 25 percent (to 1990 levels) by 2020.

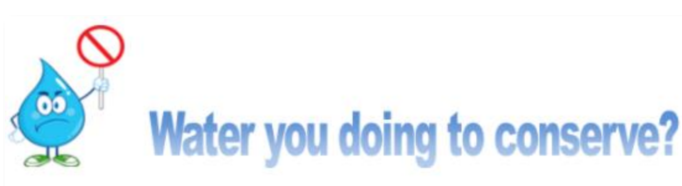
[2] SB 375: Signed into law September 30, 2008; requires each metropolitan region to adopt a "sustainable community strategy" (SCS) in its regional transportation plans to encourage compact development that aligns with regional GHG emissions reduction targets set by the CARB; enhances the CARB's ability to reach AB 32 goals; intended to promote more environmentally-friendly communities, more sustainable developments, less time people spend in their cars, and more alternative transportation options.

- Comply with the Water Conservation Act of 2009 (SB X7-7) which was passed in November 2009 to increase water use efficiency by reducing per capita water use statewide with a goal to increase the sustainability and extend the longevity of the City's existing water supplies. Per SB X7-7, the City's adopted per capita water use targets are 204 gallons per capita per day (gpcd) (2015 interim target) and 181 gpcd (2020 final target). The City's per capita water use in 2015 was 142 gpcd, which was well below the City's 2015 interim target. The City's per capita water use in 2020 was 181 gpcd, equal to the City's 2020 final target. Additional discussion on the City's per capita water use and compliance with SB X7-7 is provided in Chapter 4.
- Comply with the Sustainable Groundwater Management Act (SGMA) which became effective in January 2015 with the passage of comprehensive groundwater legislation contained in SBs 1168 and 1319, and AB 1739. The legislative intent of SGMA is to provide sustainable management of groundwater basins, enhance local management of groundwater, establish minimum standards for sustainable groundwater management, and provide local groundwater agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater. Discussion on the City's compliance activities related to SGMA is provided in Chapter 5.
- Comply with SB 606 and AB 1668 which were passed in May 2018 and established new statewide water use efficiency standards for indoor residential water use, outdoor residential water use, commercial, industrial and institutional irrigation of landscaped areas and distribution system water loss. A primer entitled "Making Water Conservation a California Way of Life" was developed to be a reference document for the implementation of the complex 2018 legislation. Discussion on the City's compliance with SB 606 and AB 1668 is provided in Chapter 4.

The following sections of this chapter describe the City's existing policies and recommended measures for water conservation, recycled and non-potable water, and water system facility operations, to help meet these overall water system objectives and goals.

2.3 CITY OF TRACY WATER CONSERVATION PROGRAMS

2.3.1 Existing Water Conservation Programs



The City has an on-going water conservation program that includes residential surveys, public and school education programs, rebates for water-efficient appliances and other specific programs. These programs have been successful in reducing water use, especially during the recent drought. In the late 1980's and early 1990's, the City's overall per capita water use was about 300 gpcd. However, since the late 1990's, the City's overall per capita water use has been significantly reduced. Since 2008, the City's average overall per capita water use has been 170 gpcd.

In 2015 and 2016, which were dry years, and years in which overall water demands were affected by water conservation measures and water use restrictions, the City's per capita water use dropped to 142 and 146 gpcd, respectively.

The City also has a Water Shortage Contingency Plan (WSCP) which was originally developed in 1992. The City's WSCP was updated in June 2015 to incorporate mandatory prohibitions on water use required by State Water Resources Control Board (SWRCB), and again updated in early 2021 in conjunction with the City's 2020 Urban Water Management Plan (UWMP) based on new requirements for WSCPs. The WSCP includes mandatory water use prohibitions and restrictions which are always in effect, triggers for implementation of various stages of the WSCP based on various water supply shortage scenarios, and specific water use restrictions for each stage of the WSCP, which are intended to reduce the City's water demand by up to 50 percent and greater than 50 percent in the event of a water supply emergency or a drought condition. Water use restrictions in each stage of the WSCP become increasingly restrictive as needed to reduce the City's water demand.

The City's current WSCP is included in Section 8 of the City's 2020 UWMP. The Tracy Municipal Code (Chapter 11.28 Water Management, Article 5 Drought and Other Water Emergency and Article 6 Water Conservation and Rationing Plan, Water Emergency Plan, Variances and Appeals) will be updated in late 2021 to be consistent with the latest updates to the WSCP.

2.3.2 Water Efficient Landscape Ordinance

About half of the urban water is used for landscape irrigation in California. Large water savings can be gained by efficient landscape design, installation, and maintenance. New development and retrofitted landscape water efficiency standards are governed by the State Model Water Efficient Landscape Ordinance (MWELO) which is codified in the California Code of Regulations Title 23 Waters, Division 2 Department of Water Resources, Chapter 2.7 Model Water Efficient Landscape Ordinance. All agencies must adopt, implement, and enforce the MWELO or a more stringent ordinance. The City has adopted MWELO and it is included in the Tracy Municipal Code Chapter 11.28 Water Management, Article 8 Water Efficient Landscape Ordinance.

Key components of MWELO include requirements for the following:

- Landscape design plans (e.g., plant selection, slopes, guidelines for water features, etc.)
- Irrigation design plans (e.g., separate meters for large landscape areas, automatic irrigation controllers utilizing evapotranspiration or soil moisture sensor data, use of rain sensors, etc.)
- Grading design plans (e.g., erosion and runoff protection)
- Irrigation scheduling and the development of a maximum applied water allowance (e.g., allowable water days and times, landscape water budgets, etc.)
- Landscape and irrigation maintenance scheduling
- Irrigation audits, irrigation surveys and irrigation water use analysis
- Use of recycled water (e.g., landscape irrigation, decorative water features)

2.4 RECYCLED AND NON-POTABLE WATER ORDINANCE

In 2002, the City adopted a Recycled and Non-Potable Water Ordinance which established the policy that recycled water may be used for non-potable uses within the City's designated recycled water use areas (as defined in the Tracy Municipal Code in Chapter 11.30 Recycled and Non-Potable Water). Specific provisions include the following:

> *11.30.030 (b) Each subdivision for which a tentative map or parcel map is required under Government Code section 66426 and located within designated recycled water use areas is required to install a recycled water distribution system to provide recycled water to the common areas[3] of the subdivision and for any industrial cooling or processing uses in the subdivision.*

The intent of this existing City policy is to require new development to use recycled water for landscape irrigation on professionally managed and maintained landscapes located within the City, such as golf courses, parks, greenbelts, and landscaped streets and medians, and for any applicable industrial cooling or processing purposes. This applies to all land use designations within the City's General Plan including, but not limited to, residential, commercial, industrial, and institutional. The only exception is landscaped areas within residential land uses which are maintained by private homeowners (e.g., private backyards or front yards which are not considered common areas); recycled water will not be required for landscape irrigation in these privately maintained areas.

To further encourage and expand the future use of recycled and/or non-potable water within the City, the following additional measures should be considered:

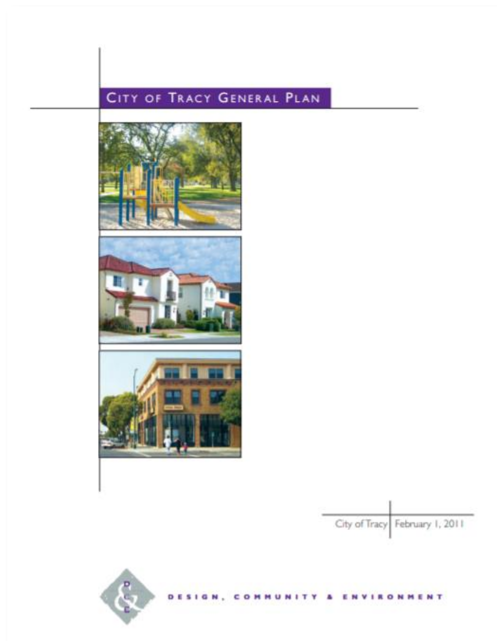
- Require the use of recycled or non-potable water for all decorative water features and artificial lakes
- Require that existing large landscaped areas currently irrigated with potable water supplies, such as City parks and sports fields, be converted to recycled or non-potable water use as opportunities for construction of recycled or non-potable water facilities to serve these existing areas occur

[3] "Common areas" shall include, but not be limited to, golf courses, parks, greenbelts, landscaped streets, and landscaped medians.

- Require that existing facilities with evaporative cooling systems and other industrial cooling processes currently using potable water supplies be converted to recycled or non-potable water use as opportunities for construction of recycled or non-potable water facilities to serve these existing areas occur

As described further in Chapters 4, 5, and 9, the City has begun construction of a recycled water distribution system to deliver recycled water supplies to designated use areas.

2.5 CITY OF TRACY GENERAL PLAN WATER SERVICE GOALS, OBJECTIVES AND POLICIES



The City's General Plan, last updated in 2011, includes a Public Facilities and Services Element that provides information and policy guidance to ensure provision of facilities and services that will support existing and new development in the City. It addresses the changing public services and infrastructure needs of Tracy and provides for their logical and timely extension to keep pace with growth. Policies supporting well-maintained infrastructure are essential to achieve broader development objectives and support the future envisioned by the residents of Tracy. Specific goals, objectives and policies for water services are included in the Public Facilities and Services Element.

The General Plan goal for the City's water service is to provide "adequate supplies of water for all types of users" (General Plan Goal PF-6). Specific General Plan objectives and policies associated with this goal are summarized in Table 2-1.

Table 2-1. City of Tracy General Plan Objectives and Policies for Water Service

Objectives	Policies
Objective PF-6.1 Ensure that reliable water supply can be provided within the City's service area, even during drought conditions, while protecting the natural environment.	P1. The City shall promote water conservation by implementing the Best Management Practices contained in the UWMP. P2. The City shall continue to acquire additional sources of water supplies to meet the City's future demands. P3. To the extent feasible, the City shall use surface water supplies to meet daily water needs and reduce reliance on groundwater supplies. P4. The City shall establish water demand reduction standards for new development and redevelopment to reduce per capita and total demand for water.
Objective PF-6.2 Provide adequate water infrastructure facilities to meet current and future populations.	P1. The City shall maintain water storage, conveyance and treatment infrastructure in good working condition in order to supply domestic water to all users with adequate quantities, flows and pressures. P2. Storage reservoirs should be buried or partially buried depending on local groundwater conditions to allow for the joint use of the site with parks or recreational facilities, unless reservoirs are elevated to provide a gravity flow system, in which case the reservoirs shall be screened by landscaping and/or earthen berms.
Objective PF-6.3 Promote coordination between land use planning and water facilities and service.	P1. Structures with plumbing that are located within the City limits shall connect to the City water supply system. P2. New developments shall dedicate land for utility infrastructure such as treatment facilities, tanks, pump stations and wells as needed to support the development of their project. P3. The City shall be responsible for constructing new transmission water lines, as needed to meet future needs. Individual development projects shall be responsible for the construction of all water transmission means. P4. All new water facilities shall be designed to accommodate expected capacity for buildout of areas served by these facilities but may be constructed in phases to reduce initial and overall costs. P5. The availability of sufficient, reliable water shall be taken into account when considering the approval of new development. P6. Costs for water service expansion shall be distributed among new water users fairly and equitably.
Objective PF-6.4 Design and manage water system facilities for reliability during catastrophic events such as fires, power outages, droughts and earthquakes.	P1. Groundwater supplies should be reserved for emergency use during water treatment shutdowns, short-term shortages of surface water supplies or during droughts. P2. Backup emergency power systems shall be provided at all essential water facilities that rely on electric power. P3. Storage reservoir facilities should be located at naturally high topographic locations to capitalize on gravity flow, whenever possible. P4. Future water systems and facilities shall be designed to minimize the likelihood of damage from vandalism or terrorist activity.
Objective PF-6.5 Use recycled water to reduce non-potable water demands whenever practicable and feasible.	P1. The City shall provide recycled water systems, including pipelines, pump stations and storage facilities, to serve primarily City-owned facilities, schools and parks as funding becomes available. P2. Recycled water piping systems ("purple pipe") shall be constructed as appropriate in all new development projects to facilitate the distribution and use of recycled water. The specific location and size of the recycled water systems shall be determined during the development review process. P3. Recycled water shall be used for all public properties and large private open spaces or common areas to the extent feasible. P4. The City shall plan for recycled water infrastructure in the City's Infrastructure Master Plans and, to the extent feasible, recycled water should be utilized for non-potable uses, such as landscape irrigation, dust control, industrial uses, cooling water and irrigation of agricultural lands.

2.6 COMPLIANCE WITH CALIFORNIA GREEN BUILDING STANDARDS CODE

The California Green Building Standards Code, also known as CALGreen, was the first-in-the-nation mandatory green building standards code. In 2007, the California Building Standards Commission (CBSC) developed green building standards in an effort to meet the goals of California's landmark initiative AB 32 California Global Warming Solutions Act of 2006, which established a comprehensive program of cost-effective reductions of GHG to 1990 levels by 2020.

The 2008 CALGreen Code was first published in Part 11 of California's Title 24 Code and became effective on August 1, 2009. It included primarily voluntary green building standards for non-residential buildings, and mandatory standards for low-rise residential buildings. The 2010 CALGreen Code established mandatory and voluntary provisions for residential and non-residential construction. The 2016 CALGreen Code and later code supplements updated these provisions with an effective date of July 1, 2018. The 2019 CALGreen Code was published July 1, 2019 with an effective date of January 1, 2020.

The City adopted the 2019 CALGreen Code on November 19, 2019.

The key mandatory provisions of CALGreen are as follows:

- Residential Mandatory Measures:
  - — Reduce indoor potable water use by installing ultra-low-flow fixtures and appliances (e.g., 1.8 gallons per minute (gpm) showerheads, 1.8 gpm kitchen faucets, 1.28 gallons/flush toilets, 0.125 gallons/flush wall-mounted urinals)
  - — Residential developments with a total landscape area equal to or greater than 500 square feet shall establish landscape irrigation water budgets which conform to the local water efficient landscaping ordinance or to the State MWELO where no local ordinance is applicable
  - — Newly constructed residential developments may be required to have recycled water supply systems installed where disinfected tertiary recycled water is available from a municipal source
- Non-Residential Mandatory Measures:
  - — For buildings in excess of 50,000 square feet, provide separate submeters for each individual leased, rented or other tenant space within the building projected to consume more than 100 gallons per day
  - — Reduce indoor potable water use by 20 percent by installing ultra-low-flow fixtures and appliances (e.g., 1.8 gpm showerheads, 1.8 gpm kitchen faucets, 1.28 gallons/flush toilets, and 0.125 gallons/flush wall-mounted urinals)
  - — Establish landscape irrigation water budgets which conform to the local water efficient landscaping ordinance or to the State's MWELO where no local ordinance is applicable

— Newly constructed non-residential developments are required to have a recycled water supply system installed where a disinfected tertiary recycled water supply pipeline from a municipal source is within 300 feet of the construction site boundary

Voluntary measures included in the CALGreen Code include further reductions in indoor water use in both residential and non-residential buildings, installation of low-water consumption irrigation systems, installation of rainwater systems, installation of graywater systems, landscaping with noninvasive species, and installation of dual plumbing systems.

2.7 RECOMMENDATIONS FOR NEW DEVELOPMENT AND NEW WATER SYSTEM FACILITIES

In addition to the various guidelines described above, and to allow the City to meet its water conservation goals and maintain the long-term sustainability of its water resources, the following recommendations should be considered for new development projects and new water system facilities in the City:

- Require new development projects to offset or mitigate its water demands if demands exceed those accounted for in the Citywide Water System Master Plan Update based on buildout of the City's adopted General Plan. The offset or mitigation may be achieved by reducing the water demands within the project (through the implementation of water conservation measures and/or incorporation of recycled water use) and/or participating in a project to reduce potable water demands in another portion of the City to offset the potable water demands of the proposed project.
- Establish designated utility corridors within new development areas to be within public rights-of-way to minimize or eliminate the need for utility easements within private property
- Install solar power systems, or alternative power sources, at existing and new pump stations and other water system facilities, as feasible, to reduce electrical power consumption
- Increase the frequency of routine operations and maintenance (O&M) activities for existing pump stations and wells to maintain pump efficiencies and reduce power demands

2.8 PRINCIPLES FOR SUSTAINABLE INFRASTRUCTURE IN THE CITY OF TRACY

In November 2009, the City developed a list of principles for sustainable infrastructure for use in developing its 2012 Infrastructure Master Plans[4]. Principles were developed for storm drainage, water, wastewater, recycled water, and roadways and transportation and, for the most part, remain applicable for this Citywide Water System Master Plan Update.

The principles related to water infrastructure are summarized as follows:

- Energy efficient design and control systems should be used in all new facilities to minimize power consumption. Look for opportunities to use solar generation facilities
- Promote and encourage, where feasible, the use of recycled water for non-potable uses in existing and future public landscaped areas
- Establish and adopt interior and exterior water conservation requirements which are consistent with recommended State guidelines, to the degree possible
- Require existing City customers to participate in water conservation activities that will enable the City to meet or exceed statewide water conservation requirements
- Create a water rate structure that supports and provides incentives for water conservation.
- Encourage and create incentives to convert high water use outdoor landscaping to more drought-resistant plantings to facilitate water conservation among existing water users

As applicable, these sustainability principles are incorporated into this Citywide Water System Master Plan Update as described in the following chapters.

[4] See Chapter 2 and Appendix A of the 2012 Citywide Water System Master Plan.

CHAPTER 3
Land Use Assumptions

3.1 OVERVIEW

The purpose of this Citywide Water System Master Plan Update is to evaluate the required potable water and recycled water infrastructure to serve buildout of the City's General Plan and Sphere of Influence (SOI). In this Citywide Water System Master Plan Update, the term "buildout" is used to refer to full development of approved projects, additional planned developments, and miscellaneous infill, as identified by the City's Planning Division. However, as it is unclear when buildout will actually occur, no specific year is identified for the buildout condition. Two interim time frames are evaluated in this Citywide Water System Master Plan Update: Year 2025 (near-term) and Year 2040, to help provide prioritization of future system improvements in the period prior to buildout. The following sections present the land use assumptions for the City at 2025, 2040, and buildout time frames.

3.2 CITY OF TRACY GENERAL PLAN AND SPHERE OF INFLUENCE

The City's General Plan is the principal policy document for guiding future planning and development of the City of Tracy, including the SOI, which is the area outside of the City limits that the City expects to annex and urbanize in the future. The SOI area in the City's General Plan is about 16 square miles (existing City limits are approximately 26 square miles, for a total General Plan area of about 42 square miles). The City's most recent General Plan was adopted by City Council on February 1, 2011 and is used as the basis for the City's Infrastructure Master Plans, including this Citywide Water System Master Plan Update. Figure 3-1 illustrates the SOI boundary and the land uses included in the General Plan.

As shown on Figure 3-1, some of the areas outside of the City limits, but within the SOI, are designated as Urban Reserve. Proposed future development within these Urban Reserve areas includes a variety of land uses, such as Residential, Commercial, and Industrial.

Due to the nature of the planning and development process, actual development within the SOI may not conform to the planned land uses shown in the General Plan. Where available, more recent land use data from the City's Planning Division, specific plans, and other available planning documents were used preferentially over the General Plan land uses.

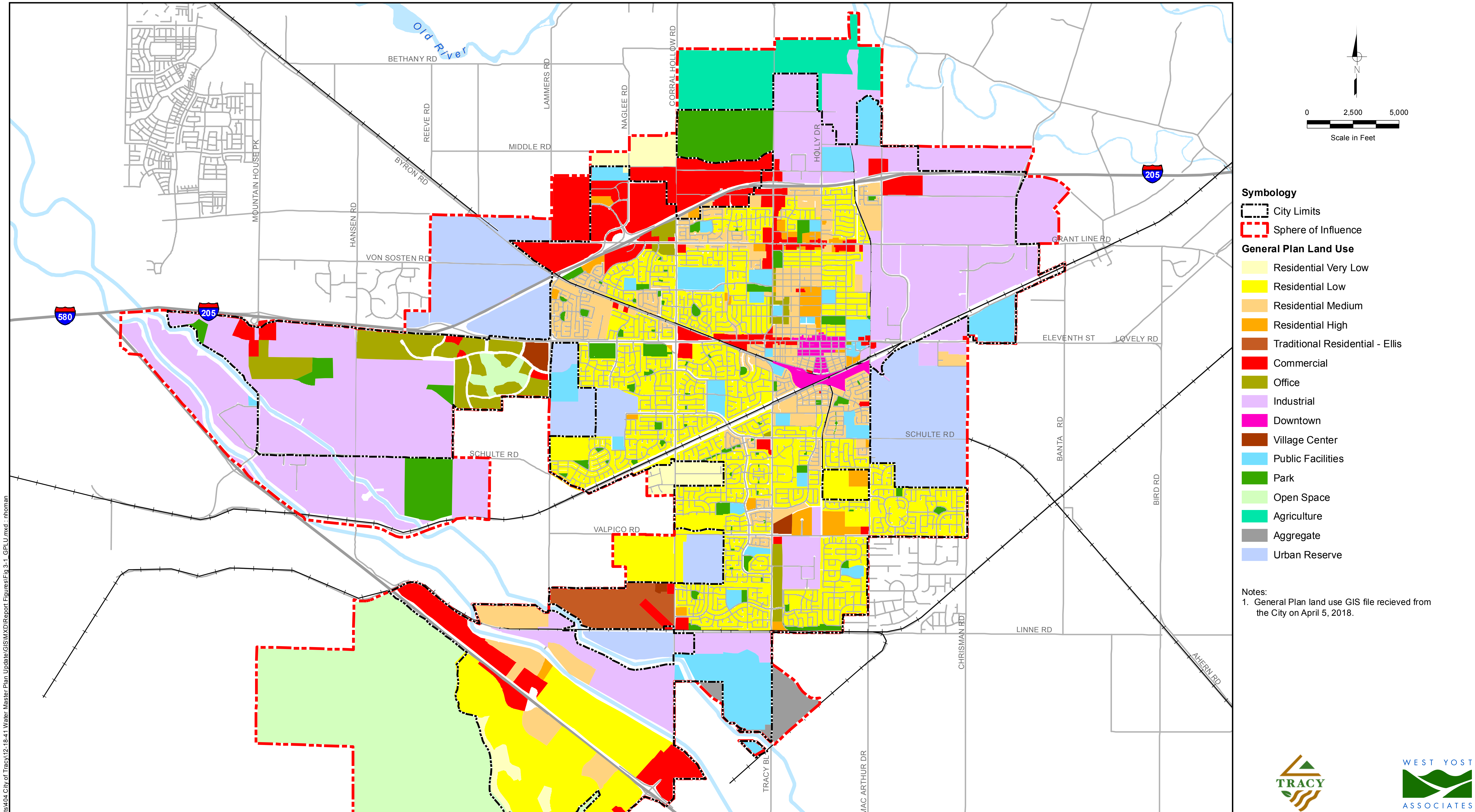


Figure 3-1

General Plan Land Use

City of Tracy
Water System Master Plan Update

3.3 EXISTING AND PLANNED DEVELOPMENT OF THE CITY'S SPHERE OF INFLUENCE

Development of the City's SOI will include the following land use components:

- Existing developed land uses within the City limits
- Approved projects
- Additional planned development
- Miscellaneous infill located in existing developed areas
- Annexation of the Mountain View area

Each of these land use components is discussed in more detail below.

3.3.1 Existing Developed Land Uses

Existing developed land use within the City consists primarily of low-density residential land use. With some exceptions, existing developed land use within the City limits conforms to the General Plan. Water demands from the existing developed land uses will be included in the future water demand projections.

3.3.2 Approved Projects

Approved projects are developments which are far along in the planning process. Future land use can be projected with greater certainty in these areas due to available tentative maps, Environmental Impact Reports (EIRs), hydraulic evaluations, or other planning documents which have been prepared for these developments. Figure 3-2 shows the location of the approved projects in the City.

Table 3-1 summarizes the approved projects in the City. Many of the areas listed in Table 3-1 are partially developed, including the Cordes Ranch, Ellis, and Tracy Hills Specific Plan areas, which have ongoing and rapid development occurring within them.

As discussed in Chapter 4, water demands for the developed portions of these projects are included in the City's existing water demands[5]. Land use data regarding the number of residential dwelling units and non-residential acres remaining to be developed within each of these approved projects were obtained from the data sources listed in Table 3-1. This data was then used to estimate the anticipated additional future water demands associated with completion of these specific plans and projects, which are included in the future water demand projections.

[5] Water meter billing data from 2017 were used as the basis for the existing water system. Land use for development which occurred after 2017 is presented as future land use in this Water System Master Plan Update.

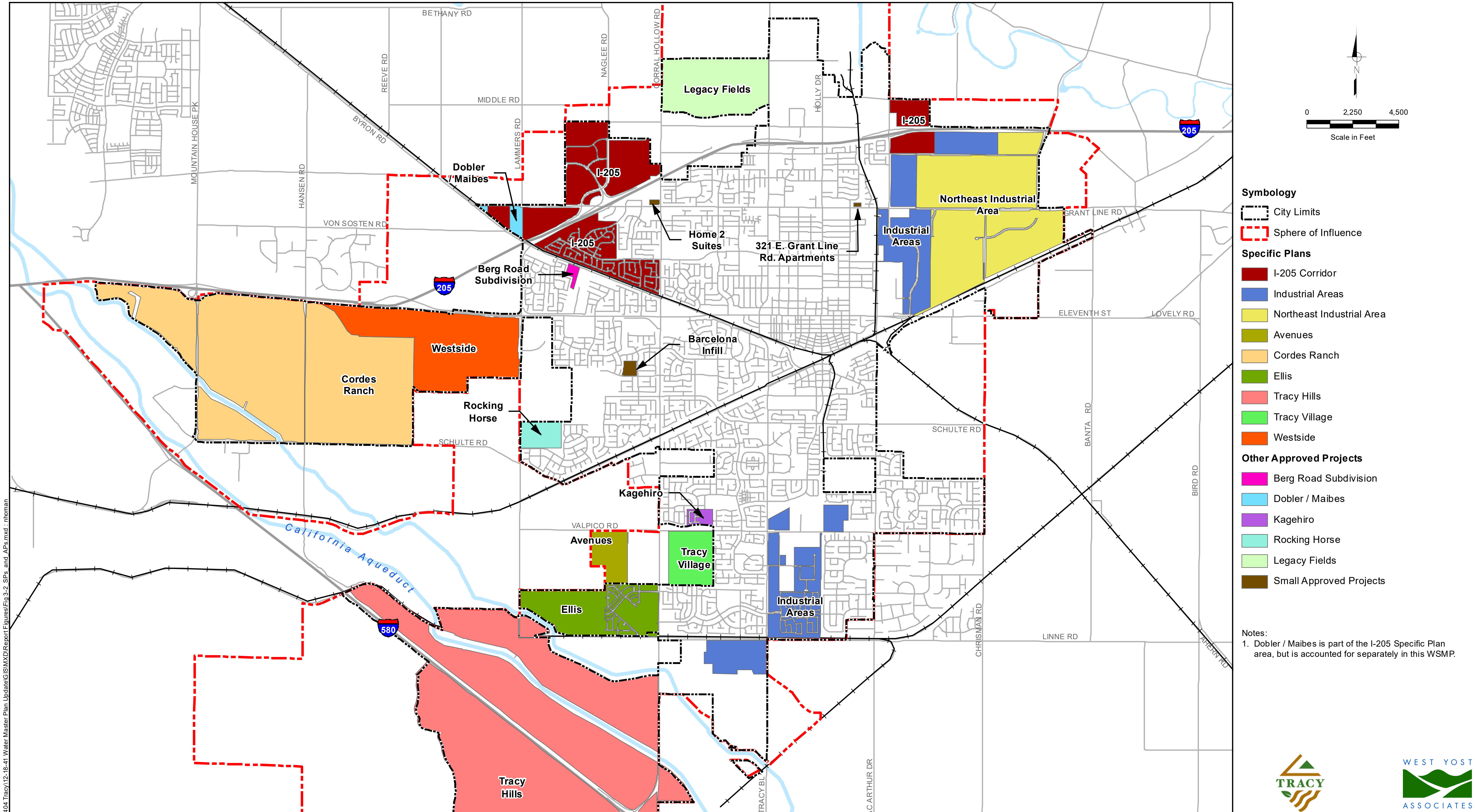


Figure 3-2

Approved Projects

City of Tracy
Water System Master Plan Update

Table 3-1. Summary of Approved Projects

Project Name	Primary Planning Document(s)	Source(s) of Land Use Data Used
I-205 Corridor Specific Plan	Specific Plan dated February 1991	Previous hydraulic evaluations[(a)]; Data from Planning Division[(b)]
Industrial Areas Specific Plan (North and South)	Specific Plan dated June 1988; major Specific Plan amendment dated 1999	Data from Planning Division[(b)]
Northeast Industrial Specific Plan (Phases 1, 2, and 3)	Specific Plan dated July 2012	Hydraulic Evaluation of Northeast Industrial Area (NEI) Specific Plan, West Yost Associates, September 2018
Avenues Specific Plan	Specific Plan dated May 2018	Hydraulic Evaluation of Avenues Specific Plan, West Yost Associates, April 2018
Cordes Ranch Specific Plan	Specific Plan dated September 2013	Previous hydraulic evaluations[(c)]; Data from Planning Division[(b)]
Ellis Specific Plan	Specific Plan dated January 2013	Hydraulic Evaluation of Ellis Specific Plan Phase 2 - The Gardens, West Yost Associates, December 2016; Hydraulic Evaluation of Ellis Specific Plan Phase 3 - Draft TM, West Yost Associates, July 2019
Tracy Hills Specific Plan	Specific Plan dated April 2016	Peer Review and Hydraulic Evaluation for Tracy Hills Phase 1B and 1C, West Yost Associates, May 2020; Data from Planning Division[(b)]
Tracy Village Specific Plan	Specific Plan dated May 2018	Hydraulic Evaluation of Tracy Village Specific Plan, West Yost Associates, February 2018
Westside Specific Plan	Specific Plan area was previously included in the Gateway Specific Plan; Draft EIR is currently being prepared for the Westside Specific Plan	Preliminary tables from Draft EIR
Berg Road Subdivision	-	Berg Road Properties Development Water Distribution System Analysis, Black Water, January 2016
Dobler / Maibes[(d)]	Included in the I-205 Corridor Specific Plan	Data from Planning Division[(b)]
Kagehiro	-	Data from Planning Division[(e)]
Rocking Horse	Initial Study and Mitigated Negative Declaration dated December 2015	Hydraulic Evaluation of South Lammers Road Development, West Yost Associates, May 2015
Legacy Fields (Holly Sugar Sports Park)	Final EIR dated June 2010	2013 City of Tracy Parks Master Plan
Small Approved Projects[(f)]	-	Previous hydraulic evaluations

(a) Land use data from previous hydraulic evaluations was used for the following development projects within the I-205 Corridor Specific Plan area: Sierra Hills, Grant Line Road Apartments, Aspire II, and Harvest.
(b) *Land Uses with TAZ Estimates_06_25_2021_2025_2040_BU_Independent.xlsx*, received from the City on June 25, 2021.
(c) Hydraulic Evaluation of International Park of Commerce (IPC) Buildings 3, 4, and 12, West Yost Associates, May 2017; Hydraulic Evaluation of International Park of Commerce (IPC) Building 25, West Yost Associates, July 2017; Hydraulic Evaluation of International Park of Commerce (IPC) Buildings 22, 23, and Thermo Fisher, West Yost Associates, October 2017; Hydraulic Evaluation of International Park of Commerce (IPC) Buildings 9, 10, and 14, West Yost Associates, May 2018; Hydraulic Evaluation of IPC Building 19A Draft TM, West Yost Associates, August 2019.
(d) Dobler / Maibes is part of the I-205 Corridor Specific Plan area but is accounted for separately in this WSMP Update.
(e) Correspondence from City staff received on August 7, 2019.
(f) Includes Home 2 Suites, 321 E. Grant Line Road Apartments, and Barcelona Infill.

3.3.3 Additional Planned Development

In addition to the approved projects, the City has also identified many additional planned development areas within the City's SOI which will be served by the City in the future. As described above, some of these additional planned development areas are designated as Urban Reserve in the City's General Plan. Projections of future land use in these areas are less certain than those for the approved projects, as there are few, if any, planning documents available. Many of these additional planned development areas are located outside of the existing City limits. As future developments within the City's SOI, but outside the City limits, are approved, they will be annexed and served by the City. Figure 3-3 shows the locations of these additional planned development areas.

Land use projections for additional planned development areas were provided by the City's Planning Division[6]. This data was then used to estimate the anticipated additional future water demands associated with development of the additional planned development areas, which are included in the future water demand projections.

3.3.4 Miscellaneous Infill Development

Vacant parcels that are not covered by any of the areas previously discussed may be developed as miscellaneous infill. Land use projections for development of miscellaneous infill parcels were provided by the City's Planning Division[2]. This data was used to estimate the anticipated additional future water demands associated with development of the infill parcels, which are included in the future water demand projections.

It should be noted that in more urbanized cities throughout California, there has been a recent increase in applications for Accessory Dwelling Units (ADUs), also known as guest houses or granny suites. An ADU is defined as an attached or detached residential dwelling unit built on the same parcel as an existing primary single-family dwelling, which provides complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation. Discussions with City staff acknowledge the possibility of an increase in development of ADUs in the future. However, due to the uncertainty in the timing and extent of ADU development in the City, they were not included in the future water demand projections.

3.3.5 Mountain View Annexation

As stated in the City's 2019 Municipal Service Review (MSR), the area of rural residential land use near the intersection of Mountain View Road and Corral Hollow Road may be annexed and served by the City in the future. The location of the Mountain View Annexation is shown on Figure 3-3.

Although the Mountain View area is already developed, extending water service to these homes would increase the City's water demands. Data from the MSR was used to estimate the anticipated additional future water demands associated with extending service to the Mountain View area, which are included in the future water demand projections.

[6] *Land Uses with TAZ Estimates_06_23_2021_2025_2040_BU_Independent.xlsx*, received from the City on June 25, 2021.

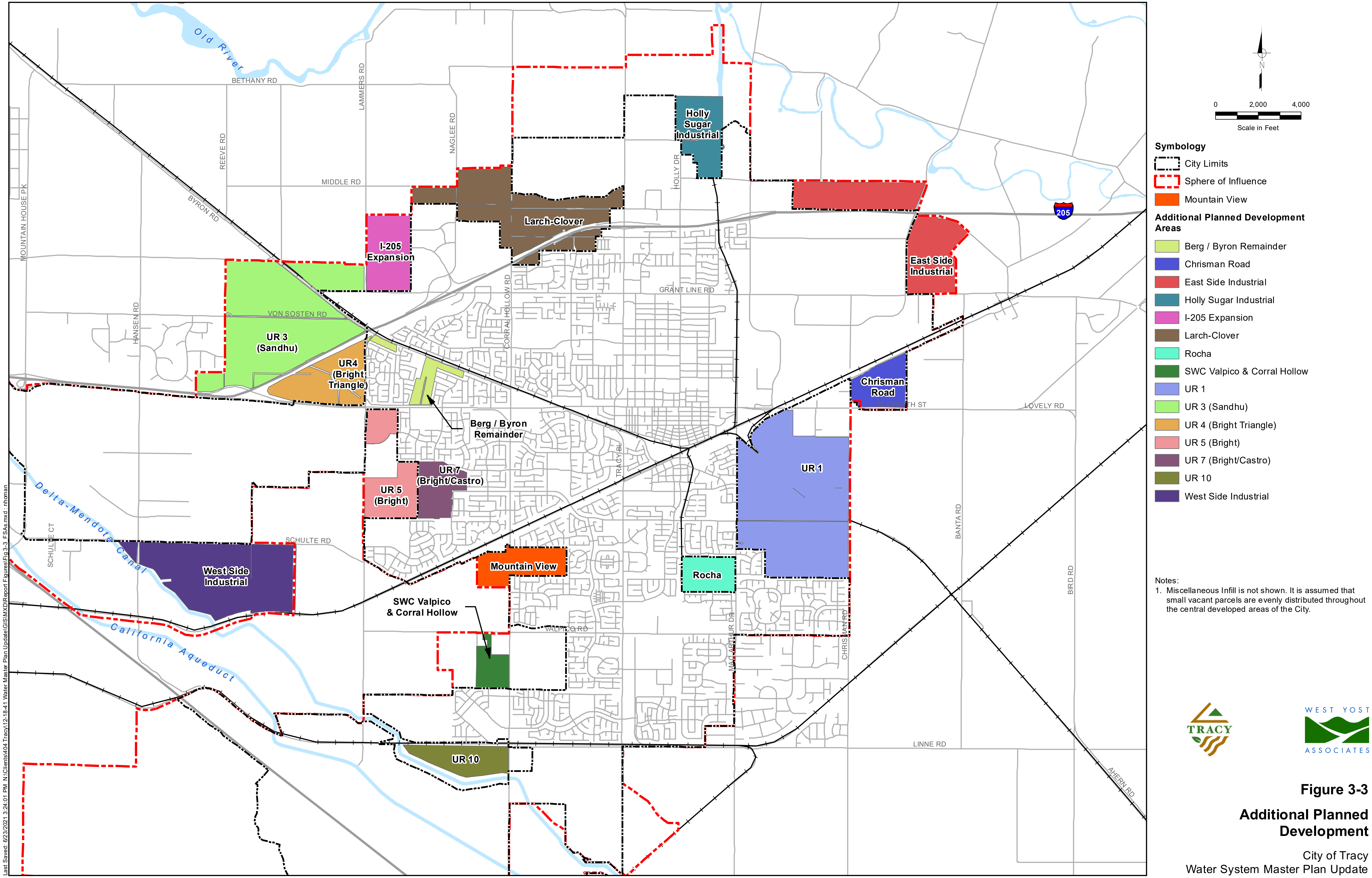


Figure 3-3

Additional Planned Development

City of Tracy
Water System Master Plan Update

3.4 DEVELOPMENT TIME FRAMES EVALUATED IN THIS WATER SYSTEM MASTER PLAN UPDATE

Three development time frames are evaluated in this Water System Master Plan Update:

- 2025 (Near-Term)
- 2040
- Buildout

Assumptions for each development time frame are described below. Projections for timing of development were provided by the City's Planning Division.

3.4.1 2025 (Near-Term) Development of the City's Sphere of Influence

Most of the near-term development is projected to occur in the areas covered by the approved projects discussed above. Except for the Westside Specific Plan, Avenues Specific Plan, and Dobler/Maibes projects, all of the approved projects listed in Table 3-1 are expected to begin development soon or continue developing through 2025. A small portion of the near-term development is projected to occur within the UR 7 (Bright/Castro), UR 1, Westside Industrial, Larch-Clover, and Berg/Byron Remainder development areas. In addition, approximately 44 acres of miscellaneous vacant parcels are projected to develop by 2025.

3.4.2 2040 Development of the City's Sphere of Influence

Except for the Tracy Hills Specific Plan and Cordes Ranch Specific Plan it was assumed that all of the other approved projects listed in Table 3-1 will be completely developed by 2040. Only a small portion of the Cordes Ranch Specific Plan was assumed to be developed after 2040. Significant development is projected to occur in many of the additional planned development areas by 2040; only the UR 10, UR 4 (Bright Triangle), UR 3 (Sandhu), Chrisman Road, Rocha, and SWC Valpico & Corral Hollow future service areas are projected to start development after 2040. In addition, approximately 215 acres of miscellaneous vacant parcels are projected to develop by 2040 (171 acres in addition to 2025 development).

3.4.3 Buildout Development of the City's Sphere of Influence

The remaining planning areas assumed to be developed after 2040 were assumed to be part of the buildout development of the City's SOI. In addition, it was assumed that a total of 311 acres of miscellaneous vacant parcels within the City limits will develop by buildout (91 acres in addition to 2040 development). As noted above, actual timing for full buildout of the City's SOI is uncertain as development plans continually change and the City's General Plan is periodically updated.

3.5 SUMMARY OF LAND USE PROJECTIONS

Table 3-2 presents the total projected land use to be developed in the City's SOI by the 2025, 2040, and buildout time frames. Table 3-2 does not include existing developed land within the City, unless it was developed after 2017. Refer to Appendix A for detailed land use assumptions.

Approximately 25,000 new dwelling units and 5,600 new acres of non-residential land use are projected to be developed by buildout. A direct comparison with land use projections from the 2012 WSMP is difficult, as some development has occurred between the completion of the 2012 WSMP and the preparation of this Citywide Water System Master Plan Update. In general, the projection for number of dwelling units at buildout has increased significantly since the 2012 WSMP, while the projection for non-residential acreage at buildout has decreased since the 2012 WSMP. However, when compared to the City's historical and existing land uses, which were primarily residential, the projected land uses for new development are more heavily skewed to non-residential uses (with almost 60 percent of the projected acres of new development at buildout being non-residential uses). The future industrial, commercial, and retail growth anticipated in the City's Sphere of Influence is reflective of the City's goal to bring jobs and economic growth and improve the City's jobs-housing balance.

Table 3-2. Projected Development by Time Frame within the City's Sphere of Influence[(a)]

Land Use Type	Total Projected New Development by 2025		Total Projected New Development by 2040[(b)]		Total Projected New Development at Buildout[(c)]	
	Dwelling Units	Gross Acres	Dwelling Units	Gross Acres	Dwelling Units	Gross Acres
Residential – Very Low Density[(d)]	-	-	265	223	1,292[(e)]	907
Residential – Low Density[(d)]	2,880	647	6,490	1,438	8,375	1,871
Residential – Medium Density[(d)]	253	49	5,444	608	8,150	902
Residential – High Density	1,591	81	3,300	181	7,033	380
Residential – Very High Density	110	3	110	3	110	3
Commercial	-	45	-	549	-	818
Office	-	1	-	115	-	256
Industrial	-	859	-	3,136	-	4,093
Institutional	-	3	-	187	-	187
Identified Parks[(f)]	-	139	-	280	-	280
Total	4,834	1,826	15,609	6,720	24,960	9,698

(a) Includes existing development constructed after 2017.
(b) Includes new development constructed within 2025 and 2040 time frames.
(c) Includes new development constructed within 2025, 2040, and Buildout time frames.
(d) For selected projects and development areas, it was assumed that 11.2% of the total gross acres in the very low, low, and medium density residential land use categories will develop as parks.
(e) Includes existing units from Mountain View Annexation.
(f) Includes park areas identified with the Rocking Horse, Ellis, Avenues, Tracy Hills Phase 1 and Legacy Fields developments.

CHAPTER 4
Existing and Future Water Demands

4.1 OVERVIEW

The purpose of this chapter is to present the existing potable and recycled water demands currently served by the City, as well as the projected future potable and recycled water demands for the 2025 (near-term), 2040, and buildout time frames. Any additional evaluations regarding the timing and phasing of future water demands outside of the specified time frames will be developed as part of separate evaluations and are not included in this Citywide Water System Master Plan Update.

Accurate and detailed potable and recycled water demand data and projections are required to:

1. Develop and calibrate the potable and recycled water system hydraulic models
2. Identify deficiencies in the existing potable and recycled water systems and required improvements
3. Assess the future water system capacity and identify improvements needed to serve proposed development

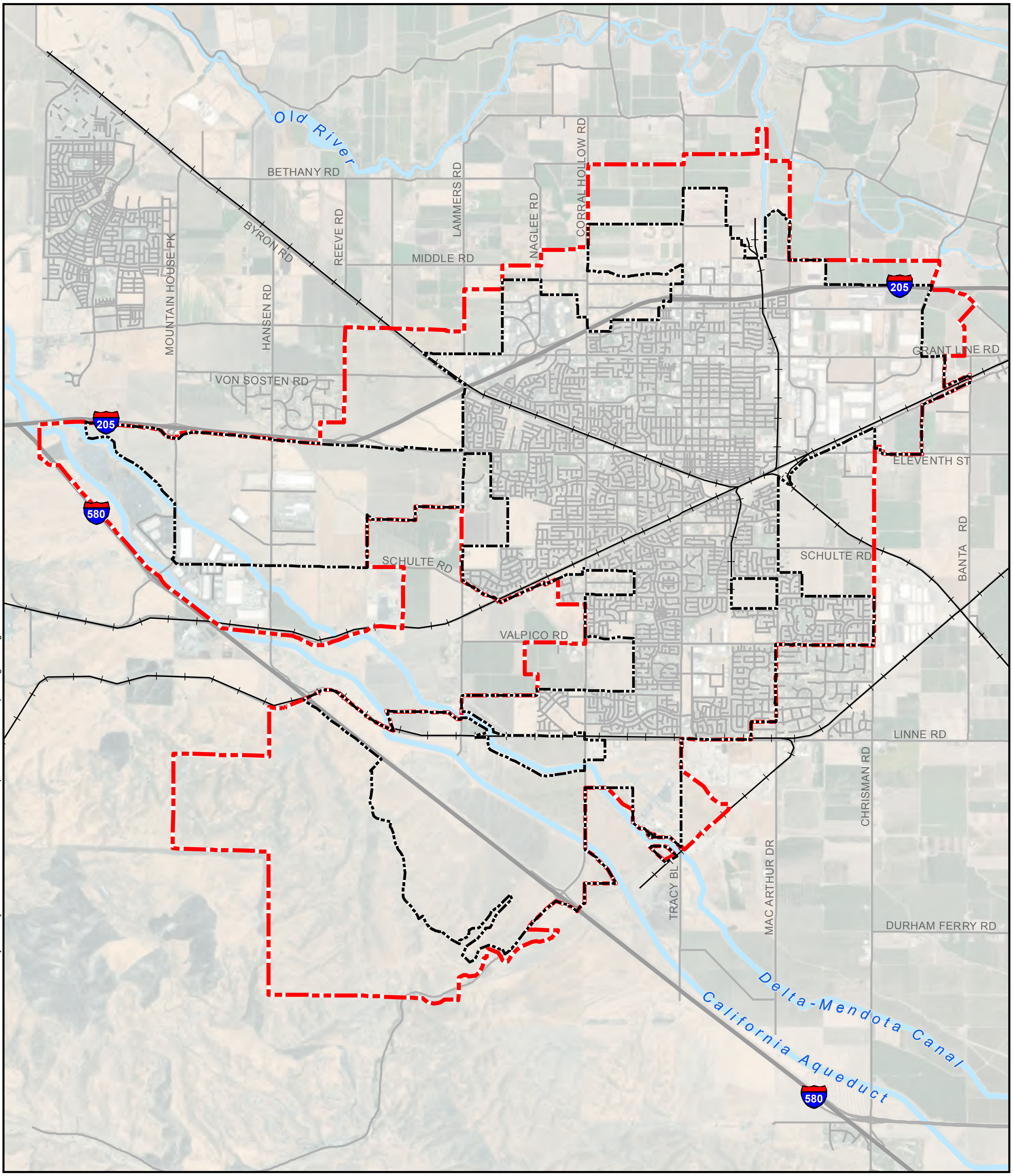
Accurate demand projections also play a key role in helping the City identify and secure sufficient water supplies to serve their customers under various hydrologic conditions. A discussion of the City's existing and future water supplies is provided in Chapter 5 of this Citywide Water System Master Plan Update.

The following sections of this chapter describe the data and methodology used to determine the City's potable and recycled water system demands:

- Existing Service Area
- Population Served
- Historical Potable Water Production and Consumption
- Existing Recycled Water Production and Consumption
- Water Conservation and Water Use Efficiency
- Adopted Peaking Factors
- Future Water Demand Projections
- Future Per Capita Water Use Projections

4.2 EXISTING SERVICE AREA

The City is located in San Joaquin County, California, approximately 70 miles south of Sacramento and 60 miles east of San Francisco. The existing incorporated area of the City (i.e., City limits) encompasses approximately 26 square miles. As described in Chapter 3, the City's SOI is approximately 42 square miles and is 16 square miles larger than the City limits. The SOI encompasses the area outside of and contiguous with the City limits that the City expects to annex and urbanize in the future. Figure 4-1 shows the boundaries of the existing City limits and SOI.



Last Saved: 3/6/2019 2:39:32 PM O:\Clients\404 City of Tracy\12-18-41 Water Master Plan Update\GIS\MXD\Report Figures\Fig 4-1 Service Area.mxd : nhoman

Symbology

City Limits / Existing Water Service Area

Sphere of Influence

N

0 3,750 7,500

Scale in Feet

TRACY

WEST YOST ASSOCIATES

Figure 4-1

Water Service Area

City of Tracy
Water System
Master Plan Update

The City's existing water service area is generally coterminous with the City limits as shown on Figure 4-1. The City currently provides potable water service to all of its residents, as well as approximately 400 residents of the Larch-Clover County Services District and the unincorporated Patterson Pass Business Park. Future growth potential for the City includes completion of ongoing development projects and infill within the City limits, and development of areas outside of the City limits within the SOI boundary. Refer to Chapter 3 for details on future land use within the City's SOI.

4.3 POPULATION SERVED

Approximately 96,000 people live in the City as of January 2020. Population growth was rapid in the City over the 15-year period 1990 through 2005, with the City growing by 139 percent. Between 2005 and 2020, however, growth has slowed relative to historical rates; population increased approximately 68 percent over this 15-year period. The reduction in growth rate has likely been caused by a combination of economic forces, such as the economic downturn of 2008 through 2011, and measures taken by the City to limit growth. In 1987, the City adopted a residential Growth Management Ordinance (GMO), which was amended in 2000 by the voter-initiated Measure A. The objective of the GMO and Measure A was to achieve a steady and orderly growth rate that allows for the adequate provision of services and community facilities and includes a balance of housing opportunities. Under the adopted GMO, builders must obtain a Residential Growth Allotment (RGA) in order to secure a residential building permit.

Table 4-1 and Figure 4-2 summarize the City's population between 1990 and 2020.

Table 4-1. Historical Population Served

Year	Population[a]	Annual Growth	Last 5-yr Average Annual Growth	Last 10-yr Average Annual Growth	Last 30-yr Average Annual Growth
1990[b]	32,450				
1991[c]	35,871	11%			3.7%
1992[c]	38,006	6%			
1993[c]	40,455	6%			
1994[c]	42,111	4%			
1995[c]	44,546	6%			
1996[c]	45,949	3%			
1997[c]	47,428	3%			
1998[c]	48,962	3%			
1999[c]	51,959	6%			
2000[c]	56,070	8%			
2001[d]	61,048	9%			
2002[d]	65,993	8%			
2003[d]	70,060	6%			
2004[d]	74,745	7%			
2005[d]	78,228	5%			
2006[d]	80,152	2%			
2007[d]	80,700	1%			
2008[d]	81,490	1%			
2009[d]	82,040	1%			
2010[d]	82,922	1%			
2011[e]	83,539	1%		1.5%	
2012[e]	84,357	1%			
2013[e]	85,568	1%			
2014[e]	86,061	1%			
2015[e]	87,194	1%			
2016[e]	88,712	2%	1.9%		
2017[e]	90,488	2%			
2018[e]	92,395	2%			
2019[e]	94,326	2%			
2020[e]	95,861	2%			

(a) Does not include Larch Creek Clover CSD service area population which has an estimated total number of accounts (118) and a person per household factor of 3.51 for an estimated population of 414 people.

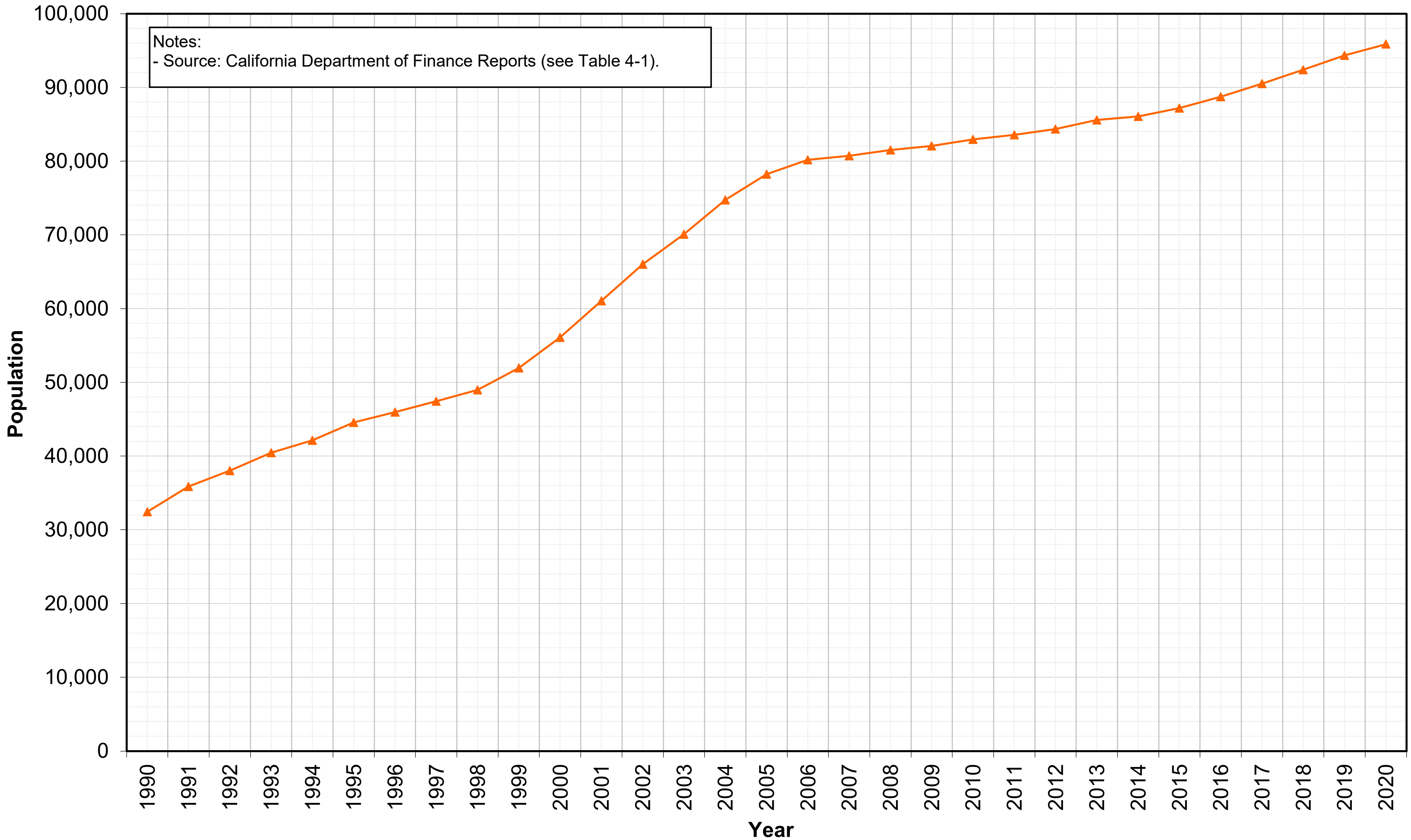
(b) Source: Department of Finance, E-4 Population Estimates for California Cities and Counties, January 1, 1981 to January 1, 1990.

(c) Source: Department of Finance, E-4 Historical Population Estimates for City, County and the State, 1991-2000, with 1990 and 2000 Census Counts, August 2007.

(d) Source: Department of Finance, E-4 Population Estimates for Cities, Counties and the State, 2001–2010, with 2000 and 2010 Census Counts, November 2012.

(e) Source: Department of Finance, E-5 Population and Housing Estimates for Cities, Counties and the State 2011-2021 with 2010 Census Benchmark, May 2021

Figure 4-2. Historical Population Served (1990-2020)



4.4 HISTORICAL POTABLE WATER PRODUCTION AND CONSUMPTION

The City's potable water production is the combined quantity of surface water purchased from the United States Bureau of Reclamation (USBR) and the South San Joaquin Irrigation District (SSJID) plus the groundwater produced by the City's wells[7], while potable water consumption is the quantity of water actually consumed or used by the City's customers. As will be discussed later, the difference between production and consumption is unaccounted-for water (UAFW), also referred to as non-revenue water (NRW).

The City currently tracks all of the surface water purchased from USBR and SSJID plus the groundwater produced by its wells. The City also meters all of its customers' water use and categorizes their water use by customer class. Consequently, the City tracks water use in two ways: production records and meter (consumption) records. Both are discussed in more detail below, along with a discussion on UAFW and per capita water demands.

4.4.1 Historical Potable Water Production

The City meets its customers' potable water demands with a combination of surface water purchased from USBR and SSJID plus groundwater pumped from municipal wells. Table 4-2 presents the historical annual potable water production, by source, from 1990 to 2020.

Table 4-2 indicates that since SSJID began surface water deliveries in 2005, the City has significantly increased its surface water use to meet its customers' water demands, and as a result groundwater production has dramatically decreased. Surface water use in recent years (2010-2020) accounts for over 94 percent of the total annual water production.

The City plans to continue maximizing surface water use because the City's groundwater is heavily mineralized (e.g., high total dissolved solids (TDS)). Consequently, the reduction in groundwater use will ultimately increase the overall quality of the City's drinking water. However, the City will continue to rely on groundwater for peaking, drought, and emergency supplies to meet water demands when surface water supplies may be limited. Detailed discussions on water supplies and their historical use and availability are presented in Chapter 5.

[7] In 2019, the City also began receiving surface water supplies through an agreement with the Byron Bethany Irrigation District (BBID). The BBID surface water supplies are treated at the City's John Jones Water Treatment Plant (JJWTP) and are used to meet potable water demands within the City's Tracy Hills development. Additional discussion on this water supply is provided in Chapter 5.

Table 4-2. Historical Annual City of Tracy Potable Water Production by Source

Year	Surface Water, af/yr			Groundwater, af/yr	City Production, af/yr	City Production, MG	Percent Surface Water	Percent Groundwater
	USBR[a]	SSJID[b]	Total Surface Water					
1990[c]	4,968	-	4,968	5,838	10,806	3,521	46%	54%
1991[c]	4,995	-	4,995	4,815	9,810	3,197	51%	49%
1992[c]	7,148	-	7,148	4,002	11,150	3,633	64%	36%
1993[c]	7,800	-	7,800	4,127	11,927	3,886	65%	35%
1994[c]	7,788	-	7,788	4,901	12,689	4,135	61%	39%
1995[c]	8,387	-	8,387	4,310	12,697	4,137	66%	34%
1996[c]	8,817	-	8,817	4,562	13,379	4,360	66%	34%
1997[c]	7,539	-	7,539	5,789	13,328	4,343	57%	43%
1998[c]	6,282	-	6,282	4,797	11,079	3,610	57%	43%
1999[c]	7,551	-	7,551	5,559	13,110	4,272	58%	42%
2000[c]	7,785	-	7,785	6,548	14,333	4,670	54%	46%
2001[c]	7,302	-	7,302	7,321	14,623	4,765	50%	50%
2002[c]	7,878	-	7,878	7,802	15,680	5,109	50%	50%
2003[c]	10,118	-	10,118	6,847	16,965	5,528	60%	40%
2004[c]	11,187	-	11,187	7,176	18,363	5,984	61%	39%
2005[d]	8,920	3,146	12,066	5,826	17,892	5,830	67%	33%
2006[d]	6,048	8,918	14,966	3,034	18,000	5,865	83%	17%
2007[d]	6,374	9,130	15,504	3,672	19,176	6,249	81%	19%
2008[d]	6,503	8,017	14,520	2,598	17,118	5,578	85%	15%
2009[d]	4,965	10,401	15,366	1,327	16,693	5,439	92%	8%
2010[d]	5,303	10,850	16,153	498	16,651	5,426	97%	3%
2011[d]	4,790	11,793	16,583	292	16,875	5,499	98%	2%
2012[d]	4,878	12,294	17,172	420	17,592	5,732	98%	2%
2013[d]	4,960	13,112	18,072	515	18,587	6,057	97%	3%
2014[d]	4,018	11,515	15,533	680	16,213	5,283	96%	4%
2015[d]	3,193	10,329	13,522	519	14,041	4,575	96%	4%
2016[d]	2,634	11,372	14,006	648	14,654	4,775	96%	4%
2017[d]	4,906	11,464	16,370	995	17,365	5,658	94%	6%
2018[d]	5,184	10,471	15,655	817	16,472	5,367	95%	5%
2019[d]	7,537	8,750	16,287	645	16,932	5,517	96%	4%
2020[d]	5,733	11,773	17,506	1,181	18,687	6,089	94%	6%

(a) Does not include USBR water wheeled to Patterson Pass Business Park and the Safeway Distribution Center.

(b) SSJID began surface water deliveries to the City in 2005.

(c) Source: Figure 7, WSA for the Holly Sugar Sports Park, June 2009.

(d) Source: Annual Production Totals.xls spreadsheets received from the City.

Figure 4-3 presents the total historical annual potable water production for the City. This historical data indicates that annual water production generally increased at about 3 percent per year from 1990 to 2007. Water production decreased in 2008 and remained relatively constant through 2011, likely in response to poor economic conditions that resulted in vacant properties and unoccupied homes. Water production increased in 2012 and 2013 as economic conditions improved, before decreasing dramatically in 2014 and 2015 due to the voluntary and mandatory water conservation efforts that were implemented by the City's water customers during the extended drought. Water production has increased in recent years (2016-2020) as water use restrictions were lifted and new development projects are being constructed. While the City's water production will likely continue to increase as the City expands, the rate at which water production is expected to increase will likely be lower than 3 percent due to the adopted GMO and water conservation and water use efficiency measures implemented in response to the recent drought and recent legislation. Discussions on the City's projected future water production are presented below under *Section 4.8.6 Projected Buildout Water Demands*.

In addition to providing water to its residents, the City also serves water to the Patterson Pass Business Park (PPBP), which is located outside of the City limits. Water supplied to PPBP is not included in the City's production totals as presented in Table 4-2 and Figure 4-3 because the water supply for this area is purchased by PPBP from the Byron Bethany Irrigation District (formerly the Plain View Water District). The City is only responsible for providing water treatment and delivery services to PPBP in accordance with a "treat and wheel" agreement. Table 4-3 presents the historical water wheeled to PPBP by the City under this agreement.

The City's highest monthly water production has historically occurred in either the month of July or August, which corresponds with the high temperatures and minimal rainfall that is experienced in the City during those summer months. The lowest monthly water production has historically occurred in either January or February. These months correspond with the shut-down of the John Jones Water Treatment Plant for maintenance, which typically occurs in the winter months (e.g., December, January, and/or February).

Figure 4-3. Historical Annual Water Production (1990-2020)

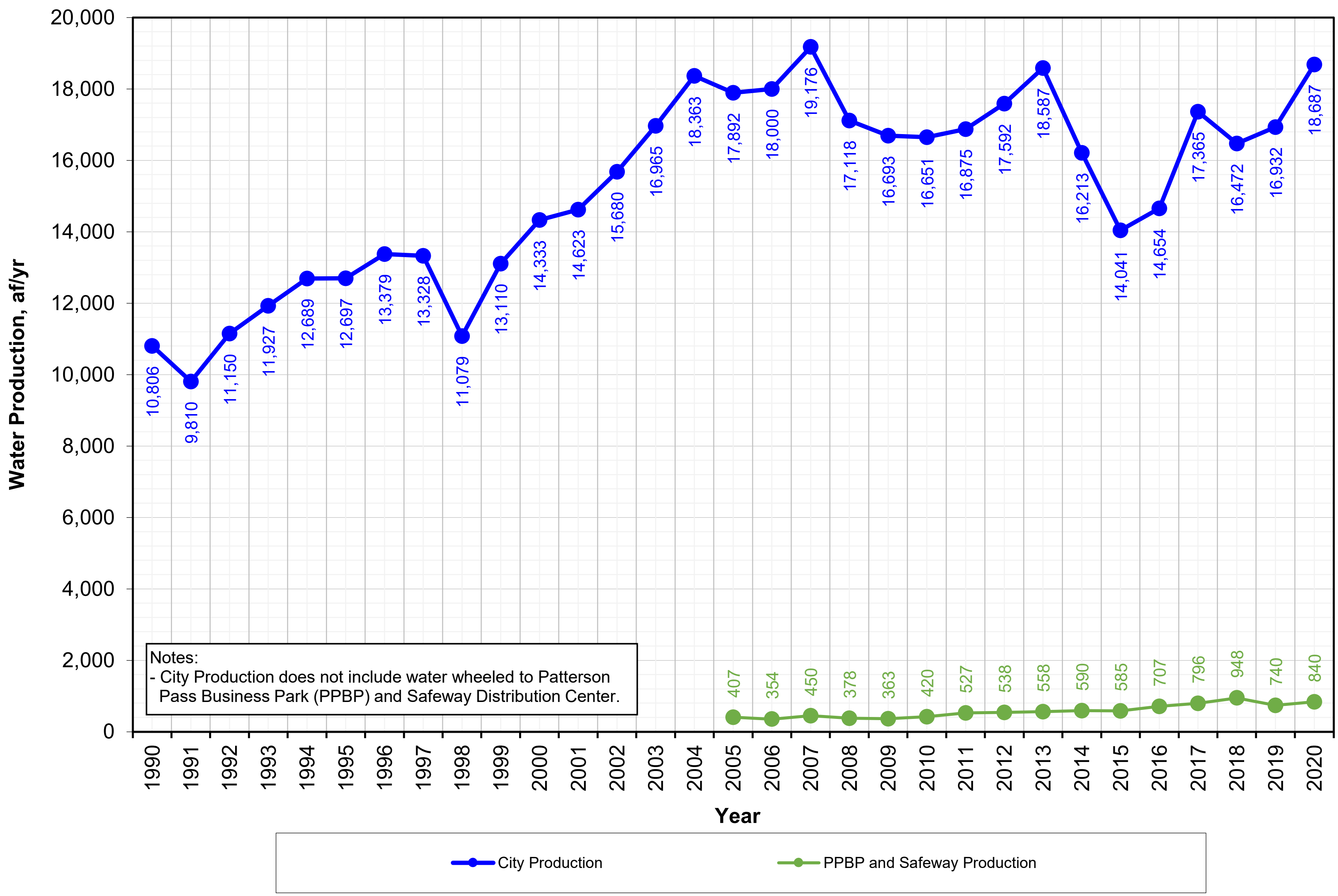


Table 4-3. Historical Annual Potable Water Production including Wheeled Water for Patterson Pass Business Park

Year	City Production, af/yr[(a)]	Wheeled USBR Water for the PPBP, af/yr[(b)]	Total Production	
			af/yr	MG
2005	17,892	407	18,299	5,963
2006	18,000	354	18,354	5,981
2007	19,176	450	19,626	6,395
2008	17,118	378	17,496	5,701
2009	16,693	363	17,056	5,558
2010	16,651	420	17,071	5,563
2011	16,875	527	17,402	5,670
2012	17,592	538	18,130	5,908
2013	18,587	558	19,145	6,239
2014	16,213	590	16,803	5,475
2015	14,041	585	14,626	4,766
2016	14,654	707	15,361	5,005
2017	17,365	796	18,161	5,918
2018	16,472	948	17,420	5,676
2019	16,932	740	17,672	5,758
2020	18,687	840	19,527	6,363

(a) Source: Annual Production Totals.xls spreadsheets received from the City.
(b) The City wheels USBR water for the Patterson Pass Business Park and the Safeway Distribution Center. This water is not part of the City's annual water rights allocations and is therefore tracked separately from the City Production.

4.4.2 Historical Potable Water Consumption

Potable water consumed by customer class between 2015 and 2017 is summarized in Table 4-4. This data indicates that, on average, residential use (including single family and multi-family land use types) represents approximately 67 percent of the total metered water consumption in the City. Commercial and Industrial customers represent an average of approximately 15 and 5 percent, respectively, of the total metered water consumption. Irrigation accounts for the remaining 13 percent of the total metered water consumption.

Projected future water consumption by customer class is discussed below under *Section 4.8.6 Projected Buildout Water Demands*.

Table 4-5 provides a summary of the top 15 potable water users in 2017 by customer classification. These top users accounted for approximately 11 percent of the total metered water consumption in 2017. The top user is an industrial food processing user, and their overall water use represents more than 4 percent of the City's 2017 water consumption. The remaining large Commercial, Multi-Family Residential, and Irrigation water users account for about 7 percent of the City's total water consumption in 2017.

Table 4-4. Potable Water Consumption

Year	Residential Single-Family		Residential Multi-Family		Commercial		Industrial		Irrigation		Total, af/yr[(b)]
	Percent[(a)]	af/yr	Percent[(a)]	af/yr	Percent[(a)]	af/yr	Percent[(a)]	af/yr	Percent[(a)]	af/yr	
2015	61.3%	8,582	7.0%	984	15.2%	2,129	5.2%	725	11.3%	1,579	13,999
2016	60.1%	8,400	7.0%	977	15.0%	2,102	4.9%	685	13.0%	1,811	13,976
2017	58.8%	9,737	6.0%	999	15.8%	2,619	4.7%	784	14.6%	2,413	16,552
Average	60.1%	8,907	6.7%	987	15.4%	2,283	4.9%	731	12.9%	1,935	14,842

(a) Based on meter data received from the City on October 15, 2019.

(b) Source: City of Tracy AWWA Water Audit Spreadsheets, received from the City on November 1, 2018.

Table 4-5. Summary of Top 15 Potable Water Users in 2017

No.	Customer Class	Total Annual Consumption, ccf	Total Annual Consumption, MG	Percentage of Total Annual Consumption, %
1	Industrial	295,480	221	4.10
2	Commercial	123,785	93	1.72
3	Commercial	47,990	36	0.67
4	Irrigation	42,985	32	0.60
5[(a)]	Irrigation	29,466	22	0.41
6	Multi-Family Residential	29,210	22	0.41
7	Irrigation	28,857	22	0.40
8	Commercial	28,070	21	0.39
9	Multi-Family Residential	26,308	20	0.36
10	Commercial	25,167	19	0.35
11	Commercial	23,962	18	0.33
12	Commercial	23,198	17	0.32
13	Commercial	22,344	17	0.31
14	Irrigation	20,720	15	0.29
15	Commercial	20,050	15	0.28
	Total	**787,592**	**589**	**10.9**

Source: 2015. May 2018 Reads.csv received from the City on May 30, 2018.

(a) Large user appears to be due to a leak and has been resolved.

4.4.3 Potable Unaccounted-for Water/Non-Revenue Water

Unaccounted-for water (UAFW) within the City is the difference between the recorded water production and metered water consumption. UAFW includes a combination of various water uses that are not metered, such as water used for hydrant testing, firefighting, and system flushing or water that is lost from system leaks and water main breaks. As noted above, unaccounted-for water is also referred to as non-revenue water (NRW).

Potable UAFW between 2015 and 2017[8] is summarized in Table 4-6. Table 4-6 indicates that the potable UAFW within the City averaged approximately 8.9 percent between 2016 and 2017 (data from 2015 appeared suspect and was not included in the average). This UAFW percentage is lower than the UAFW percentage used in the 2015 UWMP (9.6 percent), but is above the UAFW percentage (7.5 percent) used in the 2012 WSMP. For planning purposes in this Citywide Water System Master Plan, a UAFW percentage of 9.6 percent (consistent with the 2015 UWMP) was used to project the City's total future water production requirements.

[8] The City's 2018-2020 consumption data was not available at the time of this evaluation. Based on data provided in the City's 2020 UWMP, UAFW in 2018 and 2019 dropped to about 6.8 percent and 5.8 percent, respectively, but then increased significantly in 2020 to over 18 percent, although the 2020 data had not yet been validated.

Table 4-6. Potable Unaccounted-for Water

Year	Total Production, af/yr[a]	Consumption, af/yr[b]	Difference, af/yr	Percentage, UAFW, %
2015	14,626	13,999	627	4.3
2016	15,361	13,976	1,385	9.0
2017	18,161	16,552	1,609	8.9
			Average (2016 and 2017)[c]	**8.9**

(a) Source: Refer to Table 4-3. Includes water wheeled to Patterson Pass Business Park and Safeway Distribution Center by the City.
(b) Source: City of Tracy AWWA Water Audit Spreadsheets, received from the City on November 1, 2018.
(c) Average does not include 2015 because data appears to be suspect.

The City Utilities Department, in conjunction with the Public Works and Construction Management Departments, is implementing several new programs to address water loss. A new process was developed for the coordination of installation of new meters in new development areas with the City's billing and accounting systems to ensure that new accounts are metered and billed appropriately. The City has also implemented a new construction meter program, whereby the Public Works Department is now installing the meter on the hydrant and providing clamps so that the meter cannot be moved or stolen. These programs were started in Fall 2021 and water loss numbers were reduced immediately. The City will be conducting ongoing investigations to evaluate water loss and make improvements as needed to meet the State's new water loss standards.

4.4.4 Per Capita Potable Water Demand

Historical per capita potable water demands were calculated by dividing the annual potable water production previously presented in Table 4-2 by the respective annual population previously presented in Table 4-1. Table 4-7 summarizes the per capita potable water demands for the City between 2009 and 2020. As shown in Table 4-7, the per capita water demand has averaged approximately 168 gpcd over the past 10 years. The per capita demand decreased significantly in 2015 and 2016 to 144 gpcd and 147 gpcd, respectively. As discussed previously, this sharp decrease in 2015 and 2016 is most likely due to the extreme dry hydrologic (drought) conditions resulting in voluntary and mandatory water conservation. The per capita demand has increased in recent years (2017-2020) as water use restrictions have been lifted and customers have resumed more typical water use behavior.

Figure 4-4 compares the per capita water demand, water production, and population for the period from 2011 to 2020. As shown on Figure 4-4, the population has increased at a relatively constant rate from 2011 to 2020. Therefore, the majority of the variation observed in the per capita water demand is due to variations in the City's total water production, which appears to vary based on economic and hydrologic conditions.

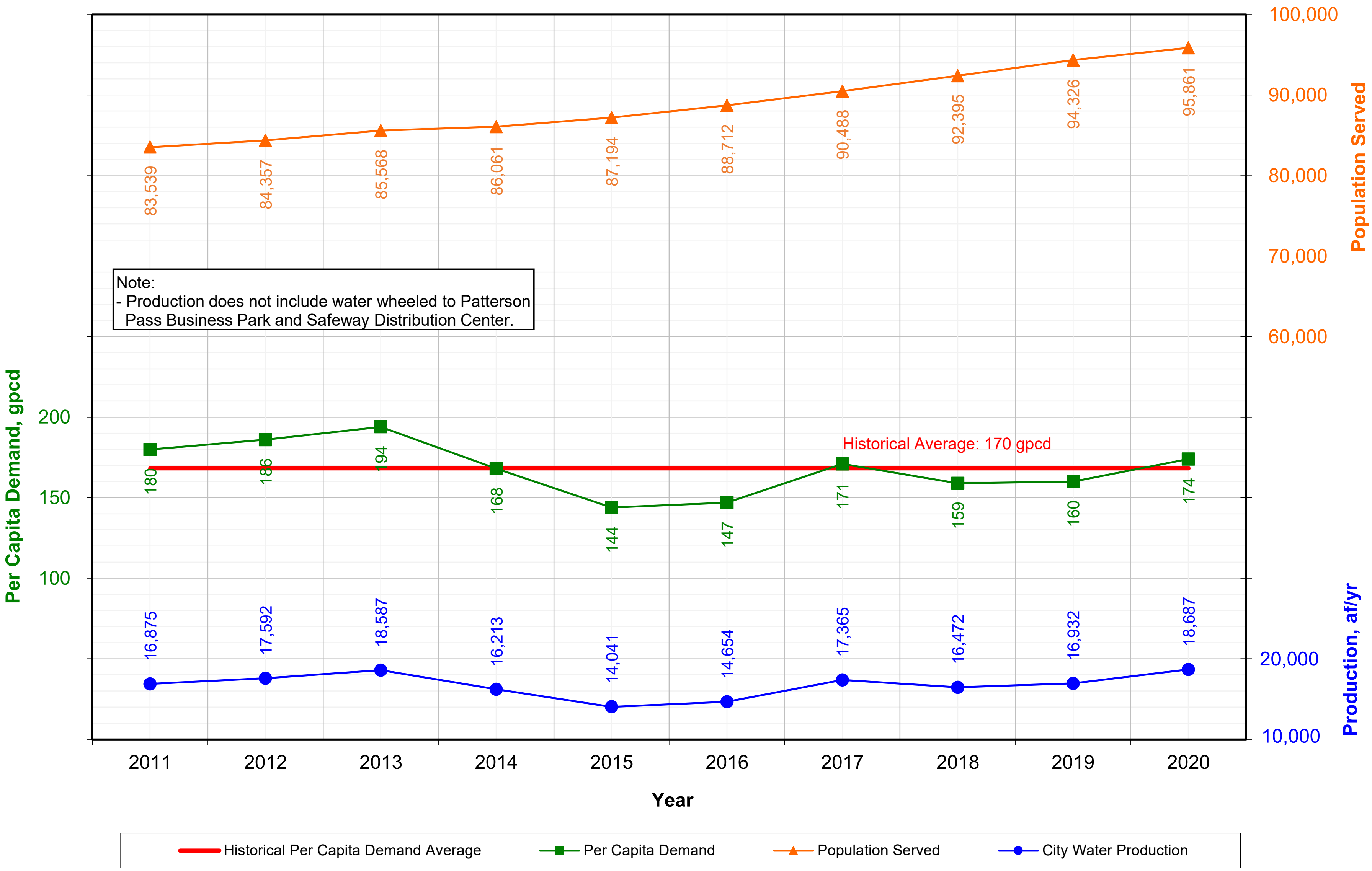
A comparison of per capita water demands with the goals set by SB X7-7 legislation is discussed below in *Section 4.6 Water Conservation and Water Use Efficiency* and *Section 4.9 Future Per Capita Water Use Projections*.

Table 4-7. Historical Per Capita Potable Water Demand					
Year	Population Served[(a)]	City Potable Water Production, af/yr[(b)]	Per Capita Potable Water Demand, gpcd	5-yr Average Per Capita Potable Water Demand, gpcd	10-yr Average Per Capita Potable Water Demand, gpcd
2009	82,040	16,693	182		
2010	82,922	16,651	179		
2011	83,539	16,875	180		
2012	84,357	17,592	186		
2013	85,568	18,587	194		
2014	86,061	16,213	168		
2015	87,194	14,041	144		168
2016	88,712	14,654	147		
2017	90,488	17,365	171		
2018	92,395	16,472	159	162	
2019	94,326	16,932	160		
2020	95,861	18,687	174		

(a) Source: Refer to Table 4-1.

(b) Source: Refer to Table 4-2. Includes UAFW. Does not include water wheeled to Patterson Pass Business Park and Safeway Distribution Center, as these are located outside of the City limits.

Figure 4-4. Comparison of Historical Per Capita Water Demand, Production and Population



4.5 EXISTING RECYCLED WATER PRODUCTION AND CONSUMPTION

The City anticipates using recycled water for landscape irrigation to offset potable water demands. The City's Wastewater Treatment Plant can currently produce up to approximately 9 mgd of tertiary-treated wastewater meeting Title 22 requirements, which can be used for landscape irrigation and other non-potable uses. Initially, the City intends to irrigate using recycled water at the Legacy Fields sports complex.

4.6 WATER CONSERVATION AND WATER USE EFFICIENCY

As discussed in Chapter 2, the City has developed a list of principles for sustainable infrastructure to ensure a reliable water supply for future generations. A key principle that relates to the Citywide Water System Master Plan Update is water conservation and water use efficiency. Water conservation and water use efficiency will be necessary to meet requirements set by the State (e.g., the Water Conservation Act of 2009 and Making Water Conservation a California Way of Life legislation) to reduce the City's per capita water use. Discussions regarding existing and future water conservation and water use efficiency in the City are presented below.

4.6.1 Existing Water Conservation

The City is committed to preserving California's water resources through water conservation and efficient use of water, and currently has an ongoing Water Conservation Plan that implements the Best Management Practices (BMPs) which were developed by the California Urban Water Conservation Council (CUWCC)[9]. These BMPs include residential surveys, public and school education programs, rebates for water efficient appliances and other specific programs. These programs have been successful in reducing the City's water use, especially in the recent dry years.

4.6.2 Compliance with the Water Conservation Act of 2009 (SB X7-7)

In February 2008, Governor Arnold Schwarzenegger called for a statewide 20 percent reduction in per capita water use by 2020 and asked State and local agencies to develop a more aggressive plan of water conservation to achieve the goal. A team of State and federal agencies (the 20x2020 Agency Team) consisting of the DWR, SWRCB, California Energy Commission, Public Utilities Commission, Department of Public Health, California Air Resources Board, CALFED Program, the USBR, and the CUWCC was formed to develop a statewide implementation plan for achieving this goal.

Then, on November 10, 2009, Governor Arnold Schwarzenegger signed Senate Bill X7-7 (SB X7-7), one of several bills passed as part of a comprehensive set of Delta and water policy legislation. SB X7-7, known as the Water Conservation Act of 2009, requires a 20 percent reduction in urban water usage by 2020 and establishes various methodologies for urban water suppliers to establish their interim (2015) and final (2020) per capita water use targets.

[9] It should be noted that the CUWCC was replaced by a new organization, the California Water Efficiency Partnership (CalWEP), in March of 2018.

As documented in the City's 2015 UWMP, the City's adopted per capita water use targets were 204 gpcd (2015 interim target) and 181 gpcd (2020 final target). As documented in the City's 2015 UWMP, the City's per capita water use in 2015 was 146 gpcd, which was well below the 2015 interim target[10]. In recent years there has been some rebound in per capita water use from the historic low in 2015 (see Table 4-7 and Figure 4-4). As documented in the City's 2020 UWMP, the City's per capita water use in 2020 was 181 gpcd, equal to its 2020 final target[11].

4.6.3 Making Water Conservation a California Way of Life

In May 2016, Governor Jerry Brown signed Executive Order B-37-16, instructing State agencies to help Californians adopt permanent changes to use water more wisely. The Executive Order laid out a framework for moving the State from temporary, emergency water conservation measures to a more lasting approach customized to the unique conditions of each local water agency.

In May 2018, the California State Legislature (Legislature) enacted two policy bills (SB 606 and AB 1668) to establish a new foundation for long-term improvements in water conservation and drought planning to adapt to climate change and the resulting longer and more intense droughts in California. These two bills amended existing law to expand authorities and requirements to enable permanent changes and actions for those purposes to improve the State's water future for generations to come. SB 606 and AB 1668 are direct outcomes of Governor Brown's Executive Order B-37-16.

The recommendations in the April 2017 report entitled "Making Water Conservation a California Way of Life, Implementing Executive Order B-37-16" and subsequent extensive legislative outreach efforts informed the development of SB 606 and AB 1668. The new laws focus on establishing water use objectives and long-term water efficiency standards that apply to urban retail water suppliers, including:

- **Indoor Residential Water Use:** Although not all standards have been developed, the indoor residential water use efficiency standard has been set by the Legislature. Until January 1, 2025, the standard is set at 55 gpcd, then it drops to the greater of 52.5 gpcd or a standard developed by the DWR between January 2, 2025 and January 1, 2030; and then the greater of 50 gpcd or a standard developed by DWR after January 1, 2030.

[10] It should be noted that the 2015 per capita water use calculated in the City's 2015 UWMP (146 gpcd) is slightly higher than the 2015 per capita water use shown in Table 4-7 and Figure 4-4. The difference is due to a slightly different service area population in the 2015 UWMP per capita water use population.

[11] It should be noted that the 2020 per capita water use calculated in the City's 2020 UWMP (181 gpcd) is slightly higher than the 2020 per capita water use shown in Table 4-7 and Figure 4-4. The difference is due to the inclusion of the Larch Clover CSD in the service area population and the inclusion of the water production wheeled to the PPBP in the 2020 UWMP per capita water use calculation.

- **Outdoor Residential Water Use and Commercial, Industrial and Institutional (CII) Irrigation with Dedicated Meters:** Per SB 606 and AB 1668, the SWRCB is required to adopt long-term standards for outdoor irrigation of landscape areas by June 30, 2022. The standards to be set shall incorporate the principles of the State's MWELO[12], which considers evapotranspiration adjustment factors, landscape areas, maximum applied water allowance, reference evapotranspiration, and special landscape area.
- **Water Loss (due to leaks in water system pipes):** With regard to water loss standards, SB 555, passed in October 2015, requires the SWRCB to develop water loss performance standards for urban retail water suppliers. The SWRCB is required to evaluate the life-cycle cost of achieving these standards. The standards will incorporate local and operational conditions to determine economically achievable water loss reduction for each urban retail water supplier.

The recently passed water efficiency legislation only provides a "provisional standard" for indoor residential water use and does not currently provide specific information on what the water efficiency standards will be for outdoor residential water use and non-residential water uses. These standards will be developed in the coming years and should be further evaluated in subsequent planning studies. Also, there are no guarantees that urban retail water suppliers will meet the water efficiency standards to be set, so West Yost recommends that the City continue to consider more conservative water demand projections based on recent water use for their future water supply and system planning.

4.7 ADOPTED PEAKING FACTORS

Peaking factors are used to calculate water demands expected under high demand conditions (i.e., maximum day and peak hour). The resulting water demands calculated for maximum day and peak hour conditions are then used to evaluate and size transmission/distribution pipelines and storage facilities, and to define water supply needs and capacity requirements. This section describes the methodology used to develop peaking factors for the maximum day and peak hour demand conditions within the City's potable and recycled water systems.

4.7.1 Potable Water System Peaking Factors

Table 4-8 summarizes the average and maximum day production and the corresponding peaking factors between 2010 and 2018. As shown in Table 4-8, the maximum day peaking factor for the City ranged from a low of 1.5 in 2015 and 2017 to a high of 1.8 in 2018. The average maximum day peaking factor from 2010 to 2018 is equal to 1.6 times the average day demand.

The City currently has an adopted maximum day peaking factor of 2.0 times the average day demand, which is higher than what has been observed in recent years. Based on the data from more recent maximum day trends, this higher peaking factor provides a very conservative estimate of the required water supply and distribution facilities to support projected water demands.

[12] California Code of Regulations Title 23 Chapter 2.7 Model Water Efficient Landscape Ordinance.

Consequently, for planning purposes in this Citywide Water System Master Plan Update, a maximum day peaking factor of 1.7 was adopted. This factor provides a slightly more conservative estimate of maximum day demands when compared with the 2010 to 2018 average maximum day peaking factor of 1.6, but will not excessively overestimate maximum day demands as compared with the City's current adopted maximum day peaking factor of 2.0.

Table 4-8. Historical Maximum Day Demand Peaking Factors

Year	Date[a]	Maximum Day Production, mgd[a]	Average Day Production, mgd[b]	Maximum Day to Average Day Factor
2010	July 17	25.8	15.2	1.7
2011	July 28	25.5	15.5	1.6
2012	July 13	27.8	16.2	1.7
2013	June 8	27.0	17.1	1.6
2014	June 9	24.9	15.0	1.7
2015	June 20	19.8	13.1	1.5
2016	August 8	22.0	13.7	1.6
2017	August 1	25.0	16.2	1.5
2018[c]	August 17	27.2	15.3	1.8
			Average	**1.6**

(a) Source: Max Day Data 201810221430.pdf received from the City on October 22, 2018.
(b) Source: Refer to Table 4-3. Includes water wheeled to Patterson Pass Business Park and Safeway Distribution Center.
(c) Maximum day production data for 2018 is from compiled SCADA data received from the City on May 3, 2019.

The City currently has an adopted peak hour demand factor of 3.4 times the average day demand, equivalent to a factor of 1.7 times the maximum day demand. SCADA data from 2018 was used to confirm the peak hour factor, which was found to be 1.6 times the maximum day demand. This confirms that the currently adopted peak hour factor of 1.7 times the maximum day demand is still accurate; this factor will continue to be used for planning purposes in this Citywide Water System Master Plan Update. However, because the adopted maximum day demand factor has been decreased from 2.0 times the average day demand to 1.7 times the average day demand, the new adopted peak hour demand factor used for planning purposes in this Citywide Water System Master Plan Update will be 2.9 times the average day demand.

4.7.2 Recycled Water System Peaking Factors

Peaking factors for recycled water systems are somewhat different from potable water systems, in that irrigation periods are generally limited to shorter time periods, typically during the late evenings and very early mornings (e.g., 10 p.m. to 6 a.m.). For purposes of this Citywide Water System Master Plan Update, an irrigation period of eight (8) hours per day has been assumed. In addition, recycled water demand is anticipated to be at its maximum during the summer and fall months when temperatures and landscape irrigation water demands are at their highest.

To estimate future monthly recycled water use, the City's existing monthly potable water use for its dedicated landscape irrigation accounts was evaluated. Based on 2017 data, monthly irrigation water use reaches a maximum in September with irrigation water use equal to 17.6 percent of the total annual irrigation water use. This percentage of irrigation water use during the maximum month can be converted to an average day to maximum day peaking factor equal to 6.4 times the average day irrigation demand (0.176/30 days x 365 days x [24 hours/8-hour irrigation period]). This factor is higher than the currently adopted factor of 5.8 times the average day irrigation demand. To be conservative, for planning purposes in this Citywide Water System Master Plan Update, the new (higher) maximum day irrigation peaking factor of 6.4 was adopted.

The peak hour recycled water demand was assumed to be approximately 10 percent above the maximum day irrigation demand, which equates to a peak hour peaking factor of 7.0 (1.1 x 6.4).

Table 4-9 summarizes the maximum day and peak hour peaking factors adopted for this Citywide Water System Master Plan Update.

Table 4-9. Adopted Peaking Factors

Demand Condition	Potable Water System	Recycled Water System
Average Day	Annual Use divided by 365 days per year	Annual Use divided by 365 days per year
Maximum Day	1.7 times the Average Day Demand	6.4 times the Average Day Demand (assuming an 8-hour irrigation period)
Peak Hour	2.9 times the Average Day Demand	7.0 times the Average Day Demand (10% above Maximum Day Demand)

4.8 FUTURE WATER DEMAND PROJECTIONS

Future water demands projections consist of two components: (1) existing (baseline) water demands, and (2) projected water demands from new developments calculated using unit water demand factors and the land use assumptions discussed previously in Chapter 3 and presented in Appendix A.

Using the land use assumptions presented in Appendix A, future water demands were calculated using a unit water demand methodology based on the proposed land use acreage or residential dwelling units projected for each project or development area. Subsequent sections describe the current unit water demand factors adopted in the 2012 WSMP and the development of the updated unit water demand factors used to calculate future water demands for this Citywide Water System Master Plan Update, followed by a discussion of total projected water demands for the 2025, 2040, and buildout time frames.

4.8.1 Existing Unit Water Demand Factors and Land Use Assumptions

In the 2012 WSMP, unit water demand factors were generally developed by correlating land use data with existing metered water use. The City's existing unit water demand factors are summarized in Table 4-10. These factors are typically multiplied by dwelling units or land use area data to calculate a projected water demand estimate.

Table 4-10. 2012 WSMP Adopted Unit Water Demand Factors			
Land Use Designation	Unit Water Demand Factor		
	gpcd	gpd/du	af/ac/yr
Residential – Very Low Density[(a)]	130	429	--
Residential – Low Density[(a)]	130	429	--
Residential – Medium Density[(b)]	115	310	--
Residential – High Density[(b)]	100	220	--
Residential – Very High Density	100	150	--
Commercial[(c)]	--	--	2.0
Office[(c)]	--	--	1.5
Industrial[(c,d)]	--	--	1.5
Institutional[(c)]	--	--	1.5
Parks[(e)]	--	--	4.0

(a) Assumes exterior water use will be with potable water, except for parks.
(b) Assumes exterior water use will be with recycled water (i.e., 15 percent of the total gross acres will be landscaped and irrigated with recycled water).
(c) Unit water demand factor to be applied to 85 percent of the total gross acres only, assuming that 15 percent of the total gross acres will be landscaped and irrigated with recycled water.
(d) Assumes that high water use industries will not be developed.
(e) Unit water demand factor to be applied to 15 percent of the total gross acres and/or any gross acreage that will require exterior water use.

In addition to these adopted unit water demand factors, the City has also used the following specific assumptions regarding dwelling units per acre for each residential land use type and floor to area ratios (FAR) for Commercial and Industrial land uses. These assumptions help to further refine water demand estimates from various proposed development projects that do not have a specific dwelling unit count or floor area estimate available. Table 4-11 summarizes the adopted dwelling unit and FAR assumptions that the City has recommended for estimating future water demands.

Table 4-11. Adopted Dwelling Unit Densities and Floor to Area Ratios[(a)]		
Land Use Designation	Range	Recommended Density or Ratio
Residential – Very Low Density	0.1 to 2.0 du/acre	1.5 du/acre
Residential – Low Density	2.1 to 5.8 du/acre	4.35 du/acre
Residential – Medium Density	5.9 to 12.0 du/acre	9 du/acre
Residential – High Density	12.1 to 25 du/acre	18.75 du/acre
Residential – Very High Density	Up to 40 du/acre[(b)]	--
Commercial	Maximum FAR 1.0	FAR 0.3
Office	Maximum FAR 1.0	FAR 0.3
Industrial	Maximum FAR 0.5	FAR 0.4

(a) Source: General Plan, DC&E (February 1, 2011).
(b) Source: Water Supply Assessment for the Downtown Specific Plan, West Yost Associates (April 2009).

4.8.2 Verification of Unit Water Demand Factors

Due to possible changes in water use patterns over time, the existing unit water demand factors presented in Table 4-10 were verified to confirm if they are still representative of the City's more recent water use patterns. Unit water demand factors that are refined using more recent water use data help to project more accurate water demands. The following sections discuss the methodologies used to "spot check" and verify existing residential and non-residential unit water demand factors.

4.8.2.1 General Methodology

Unit water demand factors were verified using existing land use and parcel information in Geographic Information System (GIS) format, which were correlated to existing (2017) metered water use data. Meter data from 2017 was used to verify the unit water demand factors because it was (1) the most recent data available at the time of the evaluation, and (2) more representative of normal water use than 2015 or 2016 data when there were mandatory water use restrictions in place. To calculate unit water demand factors by land use designation, the City's existing land use data was first added to the parcel data using GIS analysis tools. Metered water use data was then automatically linked to the land use/parcel data by service addresses first or manually by location if needed. The unit water demand factor for each land use designation was then calculated by dividing the total metered water use by the total parcel area for which it was linked.

The parcel area used in this initial calculation did not include streets and therefore represented net area. Accordingly, the unit water demand factors calculated were "net" factors. Subsequently, the "net" unit water demand factors were adjusted to account for acreage from streets so they could be applied to the gross acreage information provided by City staff for future development[13]. The following sections describe the updated unit water demand factors first for residential land uses and then for non-residential land uses.

Typically, metered water use data used to determine unit water demand factors would be normalized to represent average water use across multiple years. Although it is expected that some increase or "rebound" in water demand from 2017 could potentially occur in the future, a portion of the observed reduction in water use will likely be permanent. This is supported by the City's 2018 water production, which was less than 2017 water production. Therefore, due to these permanent changes in water use, the 2017 metered water use data was not normalized based on historical water use.

[13] The gross acreage within the existing City limits is 16,616 acres, and the net acreage within the City limits assigned an existing or planned land use is 13,607 acres. Therefore, a factor of 1.22 was used to convert from net acreage to gross acreage.

4.8.2.2 Residential Unit Water Demand Factors

Single family residential unit water demand factors (Residential-Very Low Density and Residential-Low Density land uses) were refined by automatically linking metered water use to parcels by service address. Single family residences are typically served by a single meter, and there is typically only one single family residence on a given parcel. Because of this one-to-one relationship between meters and parcels, the unit water demand factors for single family residences could be accurately calculated using this method. In summary, 87 percent of the existing single family residential parcels were linked with a water meter by service address. Figure 4-5 illustrates the methodology used to calculate the refined unit water demand factors for single family residential land use types.

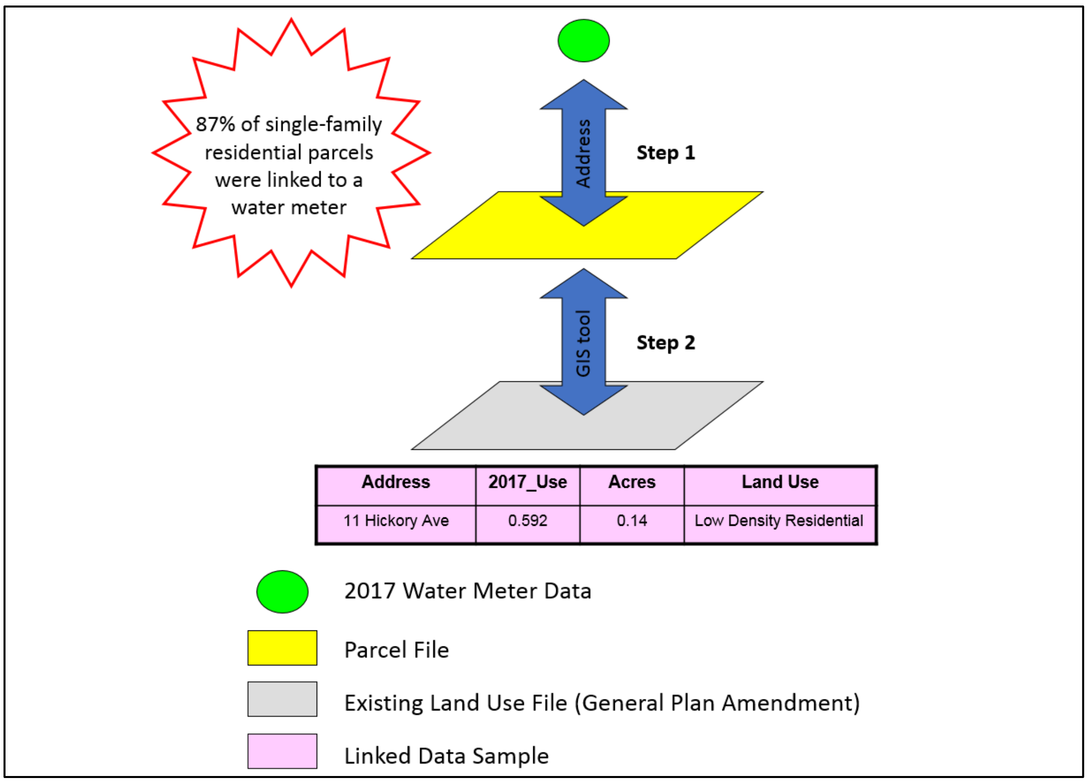


Figure 4-5. Residential Unit Water Demand Factor Methodology

Table 4-12 presents the unit water demand factors calculated using the methodology described above. The calculated Residential-Very Low Density factor is 8 percent higher than the factor adopted in the 2012 WSMP. Because this factor is based on a small sample size of 83 parcels, it is recommended that no adjustment be made to the Residential-Very Low Density unit water demand factor. The calculated Residential-Low Density factor is 14 percent lower than the factor adopted in the 2012 WSMP. Although some rebound in water use from 2017 is expected in existing residences, it is also projected that a combination of future State-mandated conservation measures and the installation of water efficient appliances and landscaping in new homes will lower residential water use even further in the future. Therefore, it is recommended that the Low Density Residential unit water use factor be adjusted 15 percent lower than the adopted 2012 WSMP factor to reflect more recent water use trends.

Table 4-12. Refined Single-Family Residential Unit Water Demand Factors

Land Use Designation	2017 Metered Water Use Linked, af/yr	Number of Occupied Parcels/Dwelling Units Linked(a)	Calculated Unit Water Demand Factor, gpd/du(b)	2012 WSMP Unit Water Demand Factor, gpd/du	Calculated Change in Unit Water Demand Factor, %	Recommended Change in Unit Water Demand Factor, %
Residential – Very Low Density	43	83	464	429	8%	0%
Residential – Low Density	6,238	15,139	368	429	-14%	-15%

(a) Does not include vacant parcels (parcels with no water use in 2017).
(b) Assumes one dwelling unit per parcel.

Residential-Medium, Residential-High Density, and Residential-Very High Density land uses generally have multiple meters and multiple addresses associated with a single parcel. Because of this, the methodology described above to calculate unit water demand factors often underestimates the unit water demand factors for these land use categories because not all the meters which supply a given parcel can be automatically linked with a single parcel address. Therefore, the unit water demand factors for Residential-Medium, Residential-High Density, and Residential-Very High Density land uses are recommended to be reduced by 15 percent, consistent with the adjustment for the Residential-Low Density factor.

4.8.2.3 Non-Residential Unit Water Demand Factors

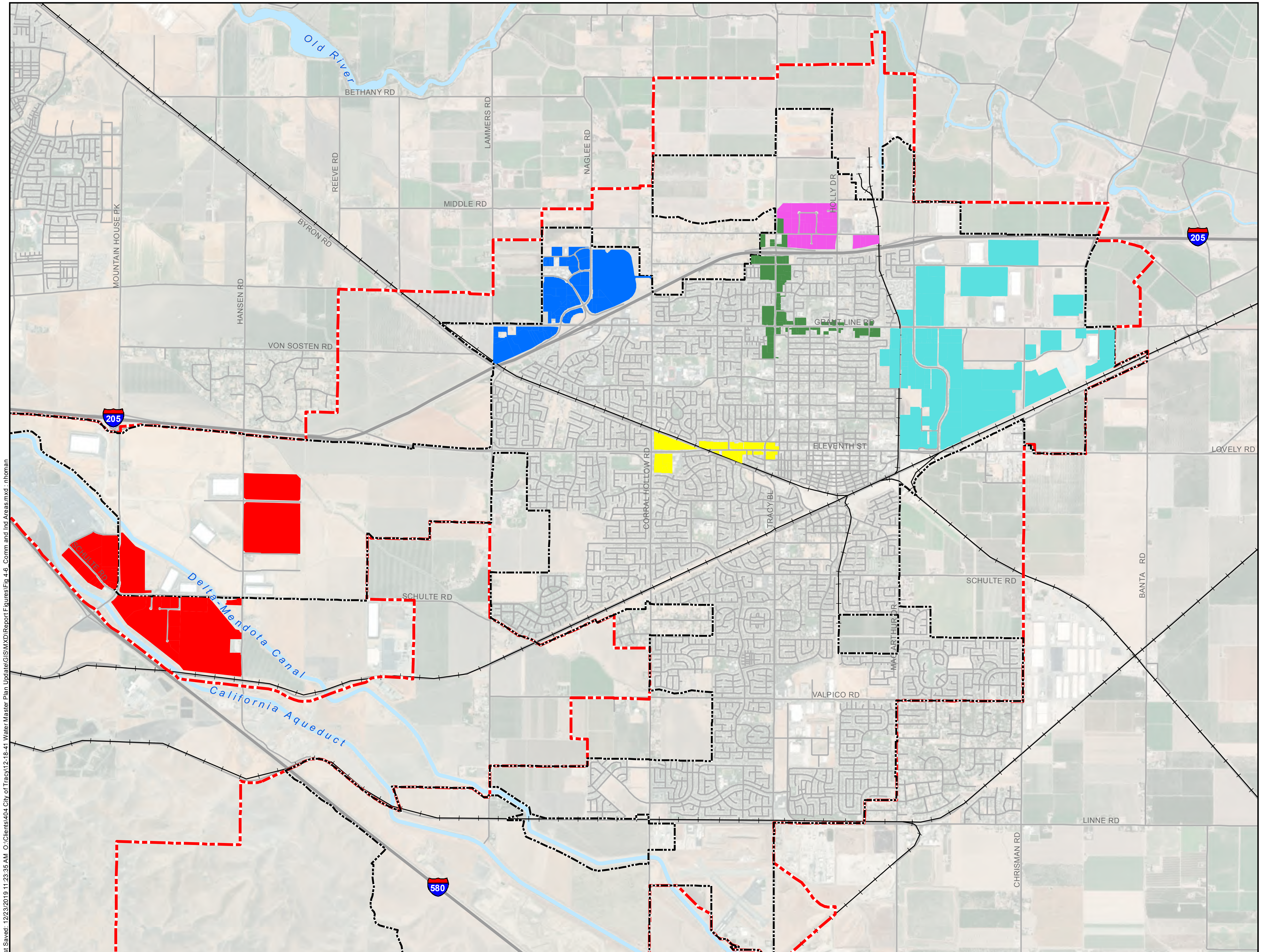
Non-residential land uses generally have multiple water service meters (e.g., domestic and irrigation meters) and multiple addresses associated with a single parcel. Because of this, automatically linking metered water use from multiple meters to a single parcel by address is difficult and would generally underestimate the unit water demand factors for non-residential land use categories because not all the meters which supply a single parcel can be automatically linked with that parcel. Therefore, a different methodology was used to "spot check" and refine the unit water demand factors for non-residential land use categories.

Representative areas of the City with high concentrations of Commercial and Industrial land uses were first selected as shown on Figure 4-6, and the metered water use from water meters in these areas were manually associated with parcels based on each meter's spatial location. From the metered water use and parcel acreage that were linked through this process, unit water demand factors were then calculated for each of these representative areas, which are summarized in Table 4-13.

Unit water demand factors for Commercial land use in the representative areas varied from 1.4 to 2.0 acre-feet per acre per year (af/ac/yr). The much lower factor for the Naglee Mall and West Grant Line Road Shopping Center is likely due to the inclusion of large parking lots which serve the Mall and Shopping Center in the gross acreage linked. The average unit water demand factor for the representative Commercial areas is 1.7 af/ac/yr. To be conservative, it is recommended that a Commercial unit water demand factor of 1.8 af/ac/yr, which is slightly above the average, be adopted. This represents approximately a 10 percent reduction from the 2012 WSMP factor of 2.0 af/ac/yr.

Unit water demand factors for Industrial land use in the representative areas varied from 0.8 to 1.3 af/ac/yr. The Northeast Industrial area likely has a higher factor due to the presence of high water use industries such as food processing plants. The IPC and Patterson Pass Business Park areas have a much lower factor because most of the existing buildings are warehouses with low water use. To be conservative, it is recommended that a unit water demand factor of 1.3 af/ac/yr be adopted as the new Industrial unit water demand factor to accommodate the wide range of possible Industrial water uses for planning purposes. This represents approximately a 13 percent reduction from the 2012 WSMP factor of 1.5 af/ac/yr.

The unit water demand factor for Office land use was also calculated using this procedure. However, since there are no highly concentrated areas of Office land use in the City, and the amount of Office land use is relatively small, the metered water use from water meters for all Office parcels was manually linked with each Office parcel to calculate an Office unit water demand factor. The unit water demand factor calculated in this manner was found to have slightly increased from the 2012 WSMP factor of 1.5 af/ac/yr. However, it is recommended that no adjustment be made to the Office unit water demand factor.



N

0 2,000 4,000

Scale in Feet

Symbology

- City Limits
- Sphere of Influence

Representative Commercial Areas

- Naglee Mall and Grant Line Road Shopping Center
- Tracy Boulevard and East Grant Line Road
- Eleventh Street

Representative Industrial Areas

- Northeast Industrial Area
- Northern Industrial Area
- IPC/Patterson Pass Business Park

TRACY

WEST YOST ASSOCIATES

Figure 4-6

Representative Commercial and Industrial Areas

City of Tracy
Water System Master Plan Update

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Table 4-13. Unit Water Demand Factors for Commercial, Industrial, and Office Land Uses			
Representative Area	2017 Water Use Linked, af/yr	Gross Acreage Linked(a)	Unit Water Demand Factor, af/ac/yr
Commercial Land Use			
Naglee Mall and West Grant Line Road Shopping Center	426	313	1.4
Tracy Boulevard and East Grant Line Road	253	126	2.0
Eleventh Street	135	81	1.7
		Average	**1.7**
Industrial Land Use			
Northeast Industrial Area	1,134	900	1.3
Northern Industrial Area	109	130	0.8
IPC/Patterson Pass Business Park	623	730	0.9
		Average	**1.0**
Office Land Use			
All Existing Parcels	87	56	1.6
(a) A factor of 1.22 was used to convert from net acreage to gross acreage.			

For Institutional land use, the water meter data which could be linked was insufficient to justify adjusting the Institutional unit water demand factor.

Similarly, the water meter data which could be linked with Parks land use parcels was also insufficient to justify adjusting the Parks unit water demand factor. However, the Parks factor was compared with the maximum allowable water use for parks per MWELO[14] to verify that it did not exceed the maximum allowable usage. As shown in Table 4-14, the maximum allowable water use for parks, which qualify as special landscape areas, is 4.3 af/ac/yr based on MWELO guidelines. Since this is greater than the current Parks unit water demand factor of 4.0 af/ac/yr, it is recommended that no adjustment be made to the Parks unit water demand factor. This factor will also be used for all recycled water irrigation areas within the City.

In the 2012 WSMP, the Parks unit water demand factor was used to calculate water use for irrigated areas for residential and non-residential land uses. However, under current MWELO guidelines, the maximum allowable water use for potable water irrigation in residential and non-residential land use areas is restricted to approximately 2.4 and 1.9 af/ac/yr, respectively, as shown in Table 4-14. Therefore, these factors will be adopted for planning purposes in this Citywide Water System Master Plan Update to comply with MWELO and the City's Water Efficient Landscape Ordinance.

[14] The State's MWELO was adopted by the City of Tracy as part of its Water Efficient Landscape Ordinance (City of Tracy Municipal Code, Chapter 11.28 Water Management, Article 8 Water Efficient Landscape Ordinance).

Table 4-14. City of Tracy Maximum Allowable Water Use Factors for Irrigation[a]		
Land Use	Maximum ETAF[b]	Water Use Factor, af/ac/yr
Special Landscape Areas[c]	1.00	4.3
Residential	0.55	2.4
Non-Residential	0.45	1.9

(a) Based on the California Code of Regulations, Title 23 Waters, Division 2 DWR, Chapter 2.7 Model Water Efficient Landscape Ordinance (MWELO), updated 2015 and included in the City of Tracy Municipal Code Chapter 11.28 Water Management, Article 8 Water Efficient Landscape Ordinance.
(b) ETAF = Evapotranspiration Adjustment Factor = (Plant Factor based on Hydrozone Area)/(Irrigation Efficiency).
(c) Special Landscape Areas are areas dedicated solely to edible plants, recreational areas, areas irrigated with recycled water, or water features using recycled water.

4.8.3 Adopted Unit Water Demand Factors

As discussed above, most of the unit water demand factors were verified and refined (if needed) by linking metered water use data to existing land use data either automatically by service address or manually by location. Table 4-15 summarizes the unit water demand factors adopted for this Citywide Water System Master Plan Update. Based on work completed to "spot check" and refine these adopted factors, they are appropriate for use in projecting future water demands as discussed in the following sections.

Table 4-15. Adopted Unit Water Demand Factors			
Land Use Designation	gpd/du	af/ac/yr	Percent Change from 2012 WSMP, %
Residential – Very Low Density[a]	429	--	0
Residential – Low Density[a]	365	--	-15
Residential – Medium Density[b]	264	--	-15
Residential – High Density[b]	187	--	-15
Residential – Very High Density[b]	128	--	-15
Commercial[c]	--	1.8	-10
Office[c]	--	1.5	0
Industrial[c]	--	1.3	-13
Institutional[c,d]	--	1.5	0
Parks and Areas Irrigated with Recycled Water[d,e]	--	4.0	0
Other Irrigated Area - Residential[f,g]	--	2.4	NA
Other Irrigated Area - Non-Residential[f,h]	--	1.9	NA

(a) Includes exterior water use.
(b) Does not include exterior water use. Assumes that 15 percent of the total gross acres will be landscaped and irrigated.
(c) Does not include exterior water use. Water demand factor to be applied to 85 percent of the total gross acres only, assuming that 15 percent of the total gross acres will be landscaped and irrigated.
(d) Insufficient data available to adjust factor using water meter data; therefore, no adjustment was made.
(e) Factor to be used for turf, recreational areas, edible plants, and areas irrigated with recycled water.
(f) Based on the Maximum Allowable Water Use per MWELO and the City's Water Efficient Landscape Ordinance.
(g) Unit water demand factor to be applied to gross acreage in residential areas that will require potable water for exterior water use.
(h) Unit water demand factor to be applied to gross acreage in non-residential areas that will require potable water for exterior water use.

4.8.4 Existing (Baseline) Water Demands

For this Citywide Water System Master Plan Update, the total "existing" water demand component used for future water demand projections was calculated as the sum of the water delivered to the PPBP and IPC in 2017 plus the City's average water production from 2005 to 2013 for a total of approximately 18,400 af/yr. Because the PPBP and IPC have been growing rapidly, recent water production data was considered the most representative of existing water use for these areas. However, due to the recent drought and associated conservation measures, water production data from 2014 through 2016 were considered less representative of future water use in other areas of the City. It should be noted that the estimated existing baseline water demand of 18,400 af/yr is very similar to the average total water production for 2019 and 2020 (18,600 af/yr), thus validating the estimated existing baseline demand.

Because the water delivered to PPBP is wheeled water, only approximately 17,800 af/yr of the existing water demands must be met by the City's water supply agreements and contracts. The City is responsible for delivering the remaining 600 af/yr to PPBP, and must have adequate water treatment capacity, pumping capacity, and transmission capacity to serve a total of 18,400 af/yr, in addition to projected future water demands.

4.8.5 Recycled Water Use Assumptions

Recycled water will be used as a source of water supply for landscape irrigation and other non-potable uses to offset potable water demands on a project-by-project basis where feasible. The City has constructed a recycled water transmission line which extends south along Lammers Road to the intersection with Schulte Road, and further expansions to the recycled water system are planned in the future.

For this Citywide Water System Master Plan Update, the following assumptions were made regarding the recycled water system:

- The transmission main in Lammers Road will be extended south to the Delta Mendota Canal by 2025. Most large development projects located on the west side of the City will be served by the recycled water system by 2025, except for Cordes Ranch, West Side Industrial, and Tracy Hills Specific Plans
- Recycled water service will be extended to Cordes Ranch, West Side Industrial, and Tracy Hills Specific Plans by 2040
- Future recycled water service areas on the east side of the City (East Side Industrial, Chrisman Road, UR 1, and Rocha), will be served by a separate recycled water transmission main which will not be constructed until after 2040
- Recycled water service will not be extended to developments in the following areas due to the isolated locations and relatively small individual potential recycled water demands within them:
  - I-205 Corridor Specific Plan
  - Industrial Areas Specific Plan
  - Northeast Industrial Specific Plan

- — Berg Road Subdivision
- — Berg/Byron Remainder
- — Other small approved projects (refer to Table 3-1, footnote (f) for the full list)
- — Miscellaneous Infill

- Only a small number of existing parks and irrigated areas located close to the recycled water transmission main alignments will be converted to recycled water service
- Within new developments served by recycled water, 15 percent of gross acreage for Residential – Medium Density, Residential – High Density, Residential – Very High Density, Commercial, Office, Industrial, and Institutional land uses will be irrigated with recycled water. This represents irrigation use for common landscaped areas and roadway medians
- Within new developments served by recycled water, 11.2 percent[15] of gross acreage for Residential – Very Low Density, Residential – Low Density, and Residential – Medium Density land uses will develop as neighborhood and community parks which will be irrigated with recycled water
- Front yards of single-family residences in the Residential – Very Low Density and Residential – Low Density will be irrigated with potable water, even in developments served by recycled water
- UAFW for the recycled water system will be 5 percent (consistent with the 2015 UWMP)

Potable water demand offsets from recycled water use will be accounted for in the projected water demands. Demands from irrigated acreage in development projects with recycled water supply available will be calculated using the recycled water demand factor of 4.0 af/ac/yr.

4.8.6 Projected Buildout Water Demands

Projected water demands for the 2025, 2040, and buildout time frames were calculated by multiplying the adopted unit water demand factors (refer to Table 4-15) by the additional future dwelling units or gross acreage projected to occur. As discussed in Chapter 3, data regarding the additional future dwelling units and gross acreage to be developed was provided by the City's Planning Division or referenced from available planning documents.

The resulting future water demand projections from the projected future developments were adjusted to account for UAFW and then added to the existing water demands to provide a projection of the total water production required for each of the evaluated time frames. Refer to Appendix A for detailed land use assumptions and water demand calculations.

[15] Consistent with assumption in Appendix D of the 2012 WSMP. A comparison of the future parks area calculated using this assumption and the projection of required park area from the City's 2013 Parks Master Plan showed them to be within 1 percent of each other.

Table 4-16 summarizes the projected potable and recycled water production for the City at the 2025, 2040, and buildout time frames. As shown in Table 4-16, even with the use of recycled water, the City's potable water production is projected to almost double at buildout (from 17,800 af/yr to 33,500 af/yr). Most of the increase in water demand is associated with new development within the City's specific plans and future service areas. Approximately 70 percent of the increase in potable water demands and 65 percent of the increase in recycled water demands are projected to occur by 2040.

The estimated buildout potable water production is approximately 8 percent lower than the previous estimate of 36,300 af/yr, as presented in the City's 2012 WSMP. Although many of the unit water demand factors have been decreased by 10 to 15 percent compared to those used in the 2012 WSMP, the projected buildout potable water production did not decrease substantially because:

- The current buildout land use projections include approximately 5,600 more dwelling units than what was assumed in the 2012 WSMP. Although the projected buildout acreage for non-residential land uses (primarily Commercial and Industrial) has decreased since the 2012 WSMP, residential developments typically use more water than non-residential developments; and
- The potable water UAFW factor was increased from the 7.5 percent factor used in the 2012 WSMP to 9.6 percent.

The estimated buildout recycled water production is approximately 16 percent lower than the previous estimate of 7,500 af/yr as presented in the City's 2012 WSMP. This is because:

- The 2012 WSMP included the Gateway Exchange Program, in which recycled water service would be extended to most of the existing parks and large irrigated areas in the City to offset the potable water demands from the Gateway development (now called Westside). The Gateway Exchange Program is no longer being considered, and it is projected that only a few existing parks and irrigated areas will receive recycled water supply;
- The Tracy Hills Specific Plan previously included a large golf course which was to be irrigated with recycled water. The golf course area is now projected to remain un-irrigated open space instead; and
- The recycled water UAFW factor was decreased from the 7.5 percent factor used in the 2012 WSMP to 5.0 percent.

Table 4-16. Summary of Future Projected Water Production[a,b,c]

Demand Category	2025 (Near Term)		2040		Buildout	
	Potable Water, af/yr	Recycled Water, af/yr	Potable Water, af/yr	Recycled Water, af/yr	Potable Water, af/yr	Recycled Water, af/yr
Future	3,000	900	10,900	4,100	15,700	6,200
Existing - City[d]	17,800	100	17,800	100	17,800	100
Total to be Met by City Water Supply Contracts and Rights	**20,800**	**1,000**	**28,700**	**4,200**	**33,500**	**6,300**
Existing - PPBP Wheeled Water[e]	600	0	600	0	600	0
Total to be Delivered by City Distribution System	**21,400**	**1,000**	**29,300**	**4,200**	**34,100**	**6,300**

(a) Refer to Appendix A for detailed water demand calculations.
(b) Includes UAFW.
(c) Totals rounded to the nearest hundred.
(d) Includes water delivered to existing buildings in the IPC.
(e) Does not include water delivered to existing buildings in IPC.

It should be noted that the potable water demand projections presented in the City's 2020 UWMP are slightly different than those presented in Table 4-16 above. The difference is due to the 2020 UWMP using water demand projections from a previous draft of this Citywide Water System Master Plan Update, which have since been revised due to revisions in the 2040 and Buildout land use assumptions, as well as the 2020 UWMP, which included an estimate of passive conservation due to water savings which resulted primarily from: (1) the natural replacement of existing plumbing fixtures with water-efficient models required under current plumbing code standards, and (2) the installation of water-efficient fixtures and equipment in new buildings and retrofits as required under CALGreen Building Code Standards. Overall, these differences are minor, with the 2020 UWMP projecting a 2025 potable water demand of 20,509 af/yr, a 2040 potable water demand of 28,403 af/yr, and a 2045 (Buildout) potable water demand of 33,079 af/yr.

As the City continues to develop, potable water consumption between customer classes is expected to shift due to changes in the City's projected land use composition. Table 4-17 compares the historical average and projected potable water consumption by customer class. As shown in Table 4-17, the residential customer classes are expected to decrease their overall potable water consumption proportion as water use shifts towards non-residential customer classes. Although, as discussed above, the ratio of projected non-residential to residential development has decreased since the 2012 WSMP, the planned development within the City's SOI will still shift towards more non-residential land use. This trend is primarily due to large industrial developments such as Cordes Ranch, West Side Industrial, East Side Industrial, UR 3, and Tracy Hills Phase 5, among others.

Irrigation water use is projected to be a much smaller proportion of the City's potable water use at buildout because (1) many new development areas will be served by the recycled water system at buildout, and (2) some of the City's existing irrigated areas will be converted to recycled water use.

Customer Class	Historical Average Annual Consumption(a), %	Projected Annual Consumption in 2025(b), %	Projected Annual Consumption in 2040(b), %	Projected Annual Consumption at Buildout(b), %
Single-Family Residential(c)	60.1	58.0	54.0	53.3
Multi-Family Residential(d)	6.7	7.6	6.9	8.5
Residential Subtotal	66.8	65.6	60.9	61.7
Commercial(e)	15.4	13.5	14.2	14.2
Industrial	4.9	9.3	16.4	17.6
Irrigation(f)	12.9	11.6	8.4	6.5
Total	**100**	**100**	100	100

Table 4-17. Historical and Projected Potable Water Consumption by Customer Class

(a) Refer to Table 4-4.
(b) Includes existing and projected future potable demands.
(c) Includes projected future residential demands (excluding irrigation) for Residential - Very Low Density, Residential - Low Density, and Residential - Medium Density land use types.
(d) Includes projected future residential demands (excluding irrigation) for Residential - High Density and Residential - Very High Density land use types.
(e) Includes projected future demands (excluding irrigation) for Commercial, Office, and Institutional land use types.
(f) Includes projected future irrigation demands to be served by potable water. Accounts for planned conversions of irrigation services to recycled water use.

4.9 FUTURE PER CAPITA WATER USE PROJECTIONS

The projected potable water demands shown in Table 4-16 were used in combination with population projections to evaluate the City's projected future per capita water use.

Table 4-18 shows the population projections and projected per capita potable water use for the 2025, 2040, and buildout time frames. Population projections for 2025 and 2040 were taken from the Tracy Municipal Services Review (June 2019). For buildout, the population was estimated using the dwelling unit data detailed in Appendix A and people per dwelling unit assumptions consistent with those used in the 2012 WSMP[16]:

- Residential – Very Low Density: 3.3 people/du
- Residential – Low Density: 3.3 people/du
- Residential – Medium Density: 2.7 people/du
- Residential – High Density: 2.2 people/du
- Residential – Very High Density: 1.5 people/du

[16] Data for all but Residential - Very High Density assumption provided in an e-mail from City on November 18, 2009. The Residential – Very High Density assumption is from the Water Supply Assessment for the Downtown Specific Plan, West Yost Associates, April 2009.

Based on these assumptions, the City is projected to have a total future population of approximately 160,600 at buildout.

Table 4-18. Projected Population and Per Capita Potable Water Use

Time Frame	Projected Potable Water Demand, af/yr[a,b]	Projected Population[a]	Per Capita Potable Water Use, gpcd
2025[c]	20,800	109,900	169
2040[c]	28,700	141,300	181
Buildout[d]	33,500	160,600	186

(a) Totals rounded to the nearest hundred.
(b) From Table 4-16.
(c) Population projection from the Tracy Municipal Services Review, June 2019.
(d) Future population for buildout was calculated based on residential dwelling unit data presented in Appendix A and on the following people per dwelling unit assumptions:
Residential - Very Low Density = 3.3 people/du
Residential - Low Density = 3.3 people/du
Residential - Medium Density = 2.7 people/du
Residential - High Density = 2.2 people/du
Residential - Very High Density = 1.5 people/du

As shown in Table 4-18, the City's per capita water use is projected to increase somewhat through buildout. This increase in per capita water use results from the projected shift in water demands from primarily residential to more non-residential (e.g., industrial) water use in the future. This proposed growth trend increases the City's water demand disproportionately to the City's increase in population and therefore results in an increase to the City's per capita water use.

It is likely that recent water conservation legislation (SB 606 and AB 1668) will introduce new conservation targets lower than those established by SB X7-7. However, West Yost recommends that the City continue to use more conservative water demand projections for their future water supply and system planning because: (1) the recently passed water efficiency legislation has not yet specifically defined the reductions needed from outdoor irrigation of landscape areas; and (2) there are no guarantees that urban retail water suppliers will meet the water efficiency standards to be set.

CHAPTER 5
Existing and Future Water Supplies

5.1 OVERVIEW

The purpose of this chapter is to provide an updated evaluation of the availability and reliability of the City's existing and additional planned future water supply sources to meet the projected buildout water demands for the City as described in Chapter 4. This chapter includes the following sections:

- Changes to the City's Water Supplies Since the Completion of the 2012 Citywide Water System Master Plan and the 2015 UWMP
- Existing Potable Water Supplies
- Future Potable Water Supplies
- Existing Non-Potable Water Supplies
- Reliability of the City's Water Supplies
- Sufficiency of the City's Water Supplies
- Summary of Water Supply Recommendations

5.2 CHANGES TO THE CITY'S WATER SUPPLIES SINCE THE COMPLETION OF THE 2012 CITYWIDE WATER SYSTEM MASTER PLAN AND THE 2015 URBAN WATER MANAGEMENT PLAN

The 2012 WSMP evaluated the sufficiency of the City's water supplies to meet the then-projected buildout water demands. The City's 2015 UWMP, adopted by the City in July 2016, evaluated the City's existing and future water supplies, together with the City's water conservation programs, and their ability to meet projected future water demands and comply with SB X7-7. Since those documents were completed, significant new residential and commercial development has occurred in the City and planning for future developments has been refined (as described in Chapter 3).

During this same time, the availability and reliability of the City's water supplies have been impacted by drought conditions and associated unprecedented cutbacks in surface water supply deliveries. The City's 2020 UWMP, adopted in June 2021, addresses these changes in water supply availability and reliability. In addition, new legislation has been passed which will further impact future water use and future water supply availability and reliability, including the following:

- Comprehensive groundwater legislation contained in SBs 1168 and 1319, and AB 1739, which are collectively referred to as the Sustainable Groundwater Management Act (SGMA), was approved in September 2014 and became effective on January 1, 2015. The legislative intent of SGMA is to provide sustainable management of groundwater basins, enhance local management of groundwater, establish minimum standards for sustainable groundwater management, and provide local groundwater agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater.

- SB 606 and AB 1668 were passed in May 2018 and established new statewide water use efficiency standards for indoor residential water use, outdoor residential water use, commercial, industrial and institutional irrigation of landscaped areas and water loss. A primer entitled "Making Water Conservation a California Way of Life" was developed to be a reference document for the implementation of the complex 2018 legislation.
- In 2018, the SWRCB adopted amendments to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) which restrict the use of flows from the Lower San Joaquin River and its tributaries (the Stanislaus, Tuolumne and Merced Rivers) to improve conditions for fish and wildlife. Specifically, the Bay-Delta Plan Amendment restricts the use of flows until 40 percent of unimpaired flows are rededicated for water quality and instream fisheries. This restriction could potentially significantly impact the availability of the City's water supplies from the SSJID. However, due to the uncertainty surrounding the implementation of the Bay-Delta Plan Amendment, SSJID's 2020 UWMP assumed that the Bay-Delta Plan Amendment would not be implemented. In its 2020 UWMP, the City also presents the SSJID reliability assuming that the Bay-Delta Plan Amendment is not implemented, but the City's 2020 UWMP also provided a parallel analysis of reliability assuming that the Bay-Delta Plan Amendment is implemented.

5.3 EXISTING POTABLE WATER SUPPLIES

The City currently receives water supplies from the following sources:

- Untreated surface water from the DMC (CVP) (treated at the City's JJWTP)
- Untreated surface water from BBID pre-1914 rights (treated at the City's JJWTP)
- Treated surface water from the Stanislaus River via the South County Water Supply Project (SCWSP) (treated and delivered to the City by the SSJID)
- Groundwater pumped from eight groundwater wells located within the City

Table 5-1 provides a summary of the City's existing water supply agreements and contracts. A discussion of each of these water supplies and their anticipated availability and reliability is provided below.

Table 5-1. Existing Water Supplies

Supply Source	Existing Water Agreements/Contracts (Supply Quantity, af/yr)
Potable Water Supplies	
Surface Water Supplies	
USBR CVP Contract with M&I Reliability (treated at City's JJWTP)	10,000[(a)]
USBR CVP Contract with Ag Reliability (treated at City's JJWTP)	10,000[(b)]
BBID Pre-1914 rights for use in Tracy Hills (treated at City's JJWTP)	3,330[(c)]
SSJID South County Water Supply Project	11,120[(d)]
Groundwater	Up to 9,000[(e)]
Semitropic Water Storage Bank	Up to 3,500[(f)]
ASR	Up to 1,000[(g)]
Non-Potable Water Supplies[(h)]	
Recycled Water Exchange	7,500
Recycled Water (for non-potable uses)	6,300

(a) M&I-reliability CVP water. Assumes the terms of the long-term renewal contract with the USBR are consistent with those of the interim renewal contract entered into between the City and USBR in February 2016.
(b) Assignments from Banta-Carbona Irrigation District (BCID) and West Side Irrigation District (WSID).
(c) Up to 4,500 af/yr, but no more than the potable water demand for Tracy Hills (3,330 af/yr). This water is only available for use in the portion of Tracy Hills that lies within BBID Raw Water Service Area 2 the CVP Consolidated Place of Use, so the quantity of supply is limited to potable water demand in this area. Therefore, the maximum BBID supply delivered to this area is reduced to 3,330 af/yr.
(d) Includes the 10,000 af/yr allocation and the additional 1,120 af/yr obtained through the 2013 Lathrop-Tracy Purchase, Sale, and Amendment Agreement. Does not include the interim purchase from Escalon.
(e) The City is able to withdraw up to 9,000 af/yr of groundwater from the Tracy Subbasin. However, due to the aging infrastructure and water quality issues in the City's groundwater supplies, the City is projecting to be able to withdraw up to 2,500 af/yr in normal years. During dry years, the City anticipates increasing its groundwater production on a short-term basis from the normal year production of 2,500 af/yr to 4,500 af/yr.
(f) The City has purchased 10,500 af of water storage in the Stored Water Recovery Unit, which allows the City to withdraw up to 3,500 af/yr for three consecutive years.
(g) Supplies from ASR are assumed to be dry year supplies. During normal years, the City will not withdraw ASR water. In single dry years and multiple dry years, this water supply is considered to be 100 percent reliable. The City estimates that up to 1,000 af/yr of groundwater can be extracted from buffer storage in the Lower Tulare Formation aquifer associated with the City's current ASR Program.
(h) While the City's Wastewater Treatment Plant is currently capable of providing recycled water supply, additional infrastructure will be required to provide for its beneficial use (see additional information in this chapter and in Chapter 9).

Each of these existing supplies is described below. A summary table listing the City's existing and future water supplies under various hydrologic conditions is provided following the discussion of the City's future water supplies.

The City's historical use of these water supplies is shown on Figure 5-1. As shown, the City's highest annual water use occurred in 2007 and totaled 19,176 af/yr. Since then, water use has decreased with downturns resulting from the 2008 Great Recession which slowed development growth for several years and the 2011 to 2017 California drought which prompted mandatory statewide water conservation in 2015 and 2016. Since the end of the drought, water use has rebounded (increased) somewhat but is still below the highest historical use in 2007. Also shown on Figure 5-1 is the City's population since 1980. As shown, while the City's population has more than quadrupled since 1980, water use has only a little more than doubled. The relatively low increase in water demand as compared to population growth results from the reduction of overall per capita water use from over 300 gpcd in the early 1980s to less than 180 gpcd in recent years as described in Chapter 4.

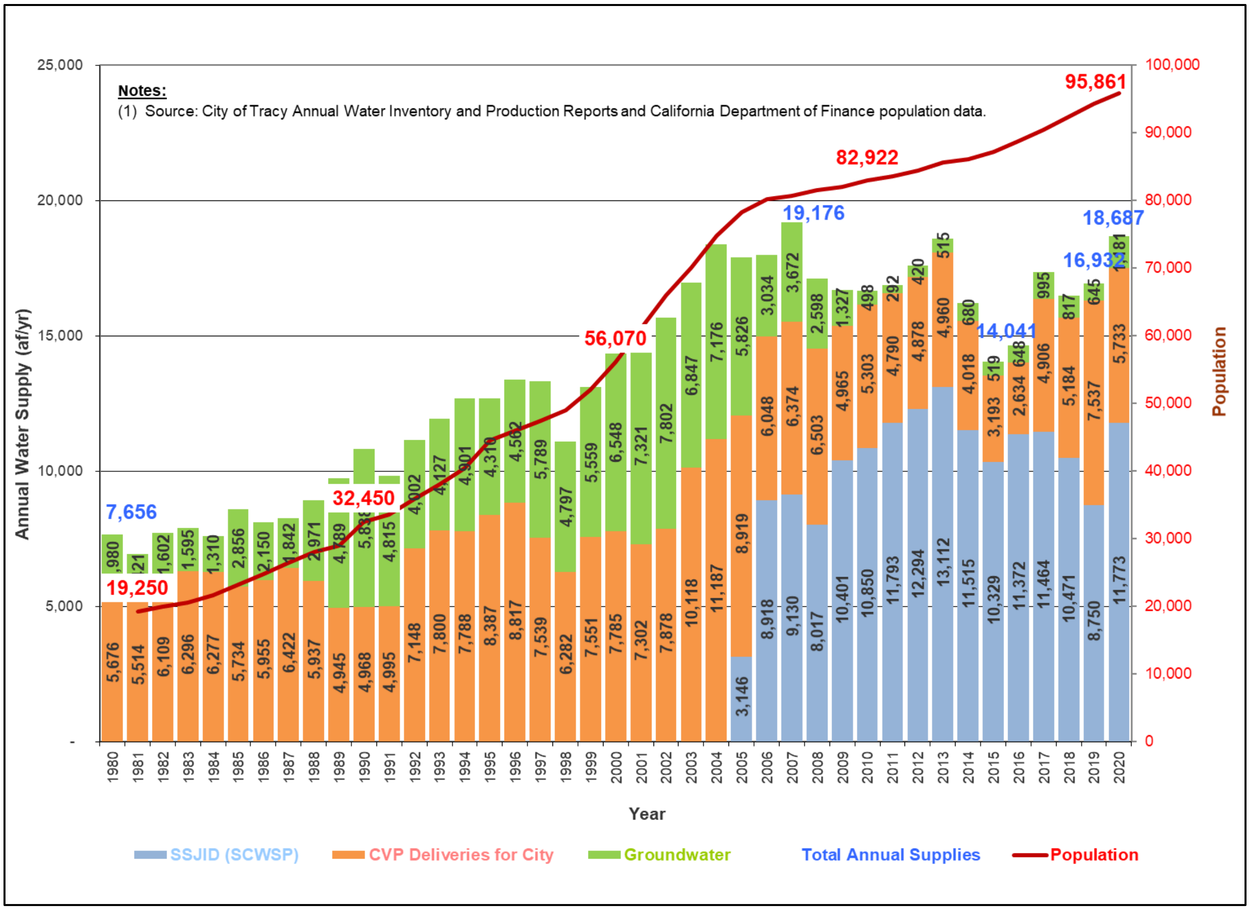


Figure 5-1. Historical Water Supplies

5.3.1 Central Valley Project Water via the Delta-Mendota Canal

5.3.1.1 M&I-Reliability Supplies from the CVP

In 1974, the City entered into a 40-year contract with the USBR for an annual entitlement of 10,000 af/yr of surface water from the CVP via the DMC. The original contract expired in 2014; however, since December 2013, the City and USBR have entered into a series of two-year interim renewal contracts to provide water service to the City while the terms of the long-term contract renewal are negotiated and the associated environmental documentation is prepared. The most recent interim renewal contract term begins March 1, 2020 and ends February 28, 2022. The City anticipates on-going contract renewals for this source.

Allocations for the Municipal and Industrial (M&I)-reliability CVP water since 2010 are summarized in Table 5-2.

Table 5-2. Historical Annual CVP M&I Allocations (South of Delta)

Year	Annual CVP M&I Allocation (percent of contractual amount unless otherwise noted)
2010	75 percent
2011	100 percent
2012	75 percent
2013	70 percent
2014	50 percent
2015	Public health and safety needs or at least 25 percent of historical use, whichever is greater
2016	55 percent of historical use
2017	100 percent of contract amount
2018	Public health and safety needs or at least 75 percent of historical use, whichever is greater
2019	100 percent of historical use
2020	Public health and safety needs or at least 70 percent of historical use, whichever is greater

In February 2017, new guidelines and procedures went into effect associated with the updated CVP M&I Water Shortage Policy. In general, the policy provides for the following:

- When M&I contractor allocations are at 100 percent, the allocation of M&I water will be based on Contract Total
- When M&I contractor allocations are below 100 percent, the allocation of M&I water will be based on a contractor's historical use of CVP M&I water
- An M&I contractor's historical use will be determined by calculating the average quantity of CVP water put to beneficial use within the service area during the last three years of water deliveries that were unconstrained by the availability of CVP water

It should be noted that before allocation of M&I water to a contractor will be reduced, allocation of irrigation water will be reduced below 75 percent of Contract Total. When allocation of irrigation water has been reduced below 75 percent and still further water supply reductions are necessary, both the M&I and irrigation allocations will be reduced by the same percentage increment. The M&I allocation will be reduced until it reaches 75 percent of historical use, and the irrigation allocation will be reduced until it reaches 50 percent of irrigation Contract Total. The M&I allocation will not be further reduced until the irrigation allocation is reduced to below 25 percent of Contract Total. When allocation of irrigation water is reduced below 25 percent of Contract Total, USBR will reassess both the availability of CVP water supply and CVP water demand.

According to the policy, USBR will strive to deliver CVP water to M&I water service contractors at not less than the amount needed to meet public health and safety needs, taking into consideration contractors' CVP allocations and available non-CVP supplies, provided CVP water is available.

For this Citywide Water System Master Plan Update, consistent with the City's 2020 UWMP, the following assumptions have been made with regards to delivery of M&I-reliability supplies from the CVP under the various hydrologic conditions:

- Normal Years: 75 percent of historical use
- Single Dry Years: 25 percent of historical use
- Multiple Dry Years: 40 percent of historical use

5.3.1.2 Ag-Reliability Supplies from the CVP

In 2004, the USBR approved the assignment of 5,000 af/yr of Ag-reliability CVP contract entitlement to the City from the BCID. Also in 2004, the USBR approved the assignment of an additional 2,500 af/yr of Ag-reliability CVP contract entitlement water to the City from the WSID with the option to purchase an additional 2,500 af/yr of CVP contract entitlement from the WSID. The purchase of the additional 2,500 af/yr was approved in December 2013, increasing the City's assignment of WSID water to 5,000 af/yr.

Deliveries of Ag-reliability water can vary significantly, and during severe water shortages supply may be reduced as much as 100 percent, as they were in 2014 and 2015. Allocations for the Ag-reliability CVP water since 2010 are summarized in Table 5-3.

Table 5-3. Historical Annual CVP Ag Allocations (South of Delta)

Year	Annual CVP Ag Allocation, percent of contractual amount
2010	45
2011	80
2012	40
2013	20
2014	0
2015	0
2016	5
2017	100
2018	50
2019	75
2020	20

For this Citywide Water System Master Plan Update, consistent with the City's 2020 UWMP, the following assumptions have been made with regards to delivery of Ag-reliability supplies from the CVP:

- Normal Years: 50 percent of annual entitlement
- Single Dry Years: 0 percent of annual entitlement (based on actual allocation in 2015)
- Multiple Dry Years: 0 percent of annual entitlement (based on the average allocations for 2014, 2015 and 2016; 1.67 percent rounded down to 0 percent)

5.3.1.3 Treatment and Use of CVP Surface Water Supplies

The City's CVP surface water supplies received via the DMC are treated at the City's JJWTP, which was originally constructed in 1979, expanded in 1988, and then expanded again in 2008. The JJWTP is located adjacent to the Delta-Mendota Canal in the southern portion of the City. The current treatment capacity of the JJWTP is 30 mgd.

The City's annual combined M&I and Ag CVP surface water supplies used by the City since 2010 are shown in Table 5-4.

Table 5-4. Historical Annual CVP Surface Water Supplies

Year	Annual CVP Surface Water Supplies, af[a]
2010	5,303
2011	4,790
2012	4,878
2013	4,960
2014	4,018
2015	3,193
2016	2,634
2017	4,906
2018	5,184
2019	7,537
2020	5,733

(a) Does not include CVP supplies which are treated and wheeled for the Patterson Pass Business Park (see Table 5-5 below).

The City also treats and serves relatively small quantities of CVP/DMC water purchased by others through a "treatment and wheeling agreement" for use at the Patterson Pass Business Park only. The Patterson Pass Business Park is now built out. The City's deliveries through the Patterson Pass Business Park Booster Pump Station since 2010 are shown in Table 5-5. A comparable quantity of BBID CVP/DMC water is anticipated to be available for annual delivery to the Patterson Pass Business Park in the future.

Table 5-5. Historical Annual Deliveries to Patterson Pass Business Park

Year	Deliveries to Patterson Pass Business Park, af
2010	420
2011	527
2012	538
2013	558
2014	590
2015	585
2016	707[(a)]
2017	796[(a)]
2018	948[(a)]
2019	740[(a)]
2020	840[(a)]

(a) Deliveries shown for 2016 to 2019 may include demands in the International Park of Commerce (Cordes Ranch) due to the metering configuration in place during those years.

5.3.2 Surface Water from BBID Pre-1914 Water Rights

Part of the proposed Tracy Hills Specific Plan area was annexed into the BBID and is entitled to water service from BBID, using BBID's pre-1914 appropriative water rights. This water is delivered to the City via the DMC and is treated at the City's JJWTP before delivery to the Tracy Hills Project. The City anticipates that up to 4,500 af/yr of pre-1914 water rights water could be provided by BBID on a year-round basis to serve the Tracy Hills Project in the BBID service area. However, the volume of water available to the City through this agreement is limited to the demand in the BBID service area portion of the Tracy Hills Project. The projected potable water demand in this area is estimated to be 3,330 af/yr at buildout. Because the water supply is based on pre-1914 appropriative rights, the supply has historically been considered to be firm and well-established.[17]

[17] It should be noted that in August 2021, following the June 2021 adoption of the City's 2020 UWMP, the SWRCB issued an initial order imposing water right curtailment and reporting requirements in the Sacramento-San Joaquin Delta watershed that included the curtailment of pre-1914 appropriative water right claims in the San Joaquin River watershed. Based on this August 2021 order, the reliability of BBID's pre-1914 appropriative water rights may be uncertain.

5.3.3 Stanislaus River Water

The City, in partnership with the cities of Manteca, Lathrop and Escalon, and the SSJID, have constructed a surface water treatment plant near Woodward Reservoir in Stanislaus County and a transmission pipeline to deliver treated surface water to each city. The project is called the South County Water Supply Project (SCWSP). This water supply is based on SSJID's senior pre-1914 appropriative water rights to the Stanislaus River, coupled with an agreement with the USBR to store water in New Melones Reservoir.

As part of the SCWSP, the City was initially allocated up to 10,000 af/yr of water. In 2006, the City entered into a temporary contract with Escalon to purchase Escalon's allocation of 2,015 af/yr of SCWSP supply until Escalon constructs the necessary infrastructure to convey the SCWSP water; this contract is anticipated to sunset in 2025. In August 2013, the City purchased an additional 1,120 af/yr of SCWSP entitlement from the City of Lathrop. Thus, the City's current contractual amount of SCWSP water is 13,135 af/yr in total. Once the agreement with Escalon sunsets (anticipated to occur in 2025), the City's contractual allocation will be reduced to 11,120 af/yr.

Treated water deliveries of SCWSP water commenced in July 2005, and deliveries have been essentially uninterrupted since then (see Figure 5-1). In some years, SCWSP deliveries were less than the City's full project allotment; however, during these years the City did not require its full SCWSP allotment, even though the full contract amount was available from SCWSP. However, since 2010, the City has actually received more than its allotment in some years. Historical deliveries from the SCWSP to the City since 2010 are shown in Table 5-6.

Table 5-6. Historical Deliveries from the SCWSP to the City of Tracy

Year	SCWSP Deliveries, af
2010	10,850
2011	11,793
2012	12,294
2013	13,112
2014	11,515
2015	10,329
2016	11,372
2017	11,464
2018	10,471
2019	8,750
2020	11,773

The SCWSP was expected to have high reliability as a result of its senior pre-1914 rights. SSJID's 2015 UWMP, adopted by SSJID in June 2016, indicated that it would meet 98.2 to 99.9 percent of urban demands in normal years (the percent of urban demand met increases in the future as agricultural demands decrease), 73.6 to 75.3 percent of urban demands in single dry years, and 85.1 to 87.1 percent of urban demand in multiple dry years. In the City's 2015 UWMP, supplies from the SCWSP were assumed to have high reliability with normal year allocations at 100 percent of the City's contractual entitlement, and single dry year and multiple dry year allocations at 85 percent of the City's contractual entitlement.

However, in December 2018, the SWRCB released amendments to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) with significant changes to the previous Bay-Delta Water Quality Control Plan. The Bay-Delta Plan Amendment requires releases of approximately 40 percent of what would naturally flow in watersheds tributary to the San Joaquin River (including the Stanislaus River) during the February to June period. This means that surface water users on those watersheds would be restricted from using and storing water until 40 percent of unimpaired flows are rededicated for water quality and instream fishery purposes. For the Stanislaus River, the resulting surface water cutbacks would be significant. However, there is much uncertainty surrounding the implementation of the Bay-Delta Plan Amendment.

In its 2020 UWMP, SSJID presented a water reliability analysis assuming that the Bay-Delta Plan Amendment will not be implemented given its uncertainties. As an SSJID retail agency customer, the City relies on SSJID for the reliability projections for the Stanislaus River water supply. Consistent with SSJID's approach, the City's 2020 UWMP assumes that the Bay-Delta Plan Amendment will not be implemented. However, to fully assess the potential impacts of the Bay-Delta Plan Amendment and better plan for the potential shortfalls, the City conducted a parallel set of reliability analyses assuming that the Bay-Delta Plan Amendment will be implemented and included it as Appendix G of its 2020 UWMP.

For purposes of this Citywide Water System Master Plan Update, the reliability of the SCWSP supply has been revised to be consistent with the City's 2020 UWMP. Allocations will be assumed to be as follows:

- Normal Years: Allocations will be assumed to be 100 percent of the City's contractual entitlement
- Single Dry Years: Allocations will be assumed to be 56 to 76 percent of the City's contractual entitlement
- Multiple Dry Years: Allocations will be assumed to be 56 to 100 percent of the City's contractual entitlement

5.3.4 Groundwater

5.3.4.1 City Wells

The City overlies a portion of the San Joaquin Valley Groundwater Basin-Tracy Subbasin (Tracy Subbasin). The City currently operates eight groundwater production wells and one ASR well. Four wells (Production Wells 1, 2, 3 and 4) are located near the City's JJWTP and pump directly into the JJWTP clearwells, where the groundwater is blended with treated surface water. Four other wells (Lincoln Well, Lewis Manor Well (Well 5), Park and Ride Well (Well 6), and Ball Park Well (Well 7) are located throughout the City and pump water directly into the distribution system after disinfection. The City's newest well, Well 8, located near the intersection of Tracy Boulevard and 6th Street, is an ASR Well, and is capable of injecting treated surface water into the aquifer for storage and extracting it for later use (see additional discussion in Section 5.3.5 below).

5.3.4.2 Groundwater Yield

A 1990 Kennedy/Jenks/Chilton (K/J/C) study estimated a perennial groundwater yield of 6,700 af/yr in the Tracy Subbasin within the Tracy Study Area. However, in 2001, to determine if additional groundwater resources were available in the Tracy Study Area, the City conducted an updated groundwater analysis. The Estimated Groundwater Yield Study, prepared by Bookman-Edmonston Engineering, provided an evaluation of potential groundwater yield and determined that a 2,300 af/yr increase of the average annual operational groundwater yield above the groundwater yield recommended in the 1990 K/J/C study could be provided within the estimated sustainable yield of the Tracy Subbasin in the Tracy Study Area, without adverse impact to groundwater resources or quality in the Tracy Study Area over a 50-year timeframe. This expansion of groundwater usage to 9,000 af/yr would be within the City's estimated share of the aquifer's sustainable yield of 22,000 af/yr of the 28,000 af/yr total (which includes groundwater usage within West Side Irrigation District, Naglee-Burk Irrigation District, Plain View Water District (now part of the BBID), and BCID). It was also estimated that this expansion of groundwater usage would result in a groundwater level drop of 10 feet but would stabilize at this level.

In 2015, the City hired GEI Consultants (GEI) to perform an assessment on what the effects would be if the City were to pump between 16,000 and 22,000 AFY for a single year to meet its demands during a drought emergency when no surface water supplies were available. The assessment considered potential impacts on groundwater levels, groundwater quality, and land subsidence. GEI's approach to this assessment was to estimate drawdown beneath the City, including drawdown caused by well interference, under scenarios wherein all of the City's wells were pumped for a single year at rates needed to meet the above stated demands. Drawdown estimates were made using analytical methods and aquifer hydraulic property data from pumping tests performed at two of the City's wells. Results showed that the City does have capacity to pump its wells to meet these single dry year demands, but that drawdown in the City wells and at locations proximate to the City would exceed that which has been historically observed. GEI (2015) estimated that groundwater levels would recover from their drawdown within approximately seven years.

5.3.4.3 Groundwater Quality

Groundwater quality in the Tracy Subbasin varies spatially and with depth. In general, the northern part of the Tracy Subbasin is characterized by a sodium water type, and the southern part of the Tracy Subbasin is characterized by calcium-sodium type water. The northern part of the Tracy Subbasin is also characterized by a wide range of anionic water types, including bicarbonate; chloride; and mixed bicarbonate-chloride. Major anions in the southern part of the Tracy Subbasin include sulfate-chloride and bicarbonate-chloride.

One water quality concern that the City actively manages is Total Dissolved Solids (TDS). The City's groundwater supply typically meets the primary maximum contaminant level (MCL) of 1,000 milligrams per liter (mg/L) but frequently exceeds the secondary MCL of 500 mg/L. In 2019, the City's groundwater supply ranged from 386 to 876 mg/L of TDS, with an average concentration of 752 mg/L. Because the TDS concentrations are significantly higher in the groundwater supply than in the City's other water supply sources, in order to meet the secondary MCL in its overall water supply, the City typically scales back its groundwater production from its estimated sustainable yield of 9,000 af/yr, particularly in normal rainfall years.

5.3.4.4 Groundwater Management

5.3.4.4.1 City Groundwater Management Policy and Mitigated Negative Declaration for City Groundwater Production of 9,000 af/yr

On a local level, in 2001, the City adopted a Groundwater Management Policy, and prepared a Groundwater Management Policy Mitigated Negative Declaration. The Groundwater Management Policy and the Groundwater Management Policy Mitigated Negative Declaration are described below.

Pursuant to the findings of the 2001 Bookman-Edmonston study (discussed above in Section 5.3.4.2), the Tracy City Council adopted a Groundwater Management Policy in 2001 that established the City's maximum annual groundwater extraction rate of 9,000 af/yr. To comply with CEQA and to evaluate the potential negative effects of increased groundwater extraction on water quality, water levels, and subsidence, the City also prepared a Groundwater Management Policy Mitigated Negative Declaration. The Groundwater Management Policy Mitigated Negative Declaration specifies the frequency and type of monitoring and reporting the City must conduct to evaluate the sustainability of the increased groundwater extraction rate.

Consistent with the Groundwater Management Policy Mitigated Negative Declaration, the City has maintained groundwater production rates well below the estimated sustainable yield of 9,000 af/yr.

5.3.4.4.2 Compliance with the 1992 Groundwater Management Act (AB 3030)

The 1992 Groundwater Management Act (AB 3030) established provisions by which local water agencies could develop and implement groundwater management plans (GMPs). GMPs are generally designed to prevent local and regional aquifer overdraft, which reduces available groundwater resources and which, under certain conditions, can lead to degradation of water quality and to land subsidence.

The City, BBID, BCID, and San Joaquin County formed a Groundwater Advisory Committee to facilitate the development of a regional groundwater management plan (GWMP) for the Tracy Subbasin. The planning area of the Tracy GWMP encompassed the portion of the Tracy Subbasin underlying San Joaquin County. The Tracy GWMP was adopted in 2007.

The key results of the Tracy GWMP included the following:

- Developed a general consensus among stakeholders regarding the characterization of the area's water problems, current and future demands, and groundwater conditions;
- Documented the region's groundwater management goals and establishing basin management objectives to help measure progress in attaining the goals;
- Developed specific solutions and common programs for the basin; and
- Provided an implementation plan to direct future groundwater management activities.

The Tracy GWMP concluded that the Tracy Subbasin is full, but experiences groundwater quality issues in portions of the basin associated with nitrate, boron, sulfate, chloride, and total dissolved solids (TDS). As such, many of the groundwater management options that were recommended focused on creating available storage and managing pumping in order to increase water quality within the Tracy Subbasin.

San Joaquin County is the designated Monitoring Entity under the California Statewide Groundwater Elevation Monitoring (CASGEM) program for the portion of the Tracy Subbasin underlying the county. However, upon submission of the Groundwater Sustainability Plan, the CASGEM program will be superseded by the SGMA monitoring efforts.

5.3.4.4.3 Tracy Regional Groundwater Management Plan

In addition to participating in the development of the Tracy Subbasin GMP, in 2005 the City was awarded a DWR grant for approximately $185,000 to prepare a Tracy Regional Groundwater Management Plan (Tracy Regional GMP) for the portion of the Tracy Subbasin that underlies the City of Tracy. The Tracy Regional GMP was completed in March 2007. A key objective of the Tracy Regional GMP was the development of Basin Management Objectives (BMOs) for groundwater levels, groundwater quality, and land subsidence in the region.

5.3.4.4.4 Compliance with the 2014 Sustainable Groundwater Management Act

On August 29, 2014, the California Legislature passed comprehensive groundwater legislation contained in SBs 1168 and 1319, and AB 1739, which are collectively referred to as SGMA. This legislation was signed by Governor Brown on September 16, 2014 and it became effective on January 1, 2015. The legislative intent of SGMA is to provide sustainable management of groundwater basins, enhance local management of groundwater, establish minimum standards for sustainable groundwater management, and provide local groundwater agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater.

The Tracy Subbasin is designated by DWR as a medium priority basin. As such, the Tracy Subbasin is subject to the requirements of SGMA, which include the formation of a one or more Groundwater Sustainability Agencies (GSAs) and the development and implementation of one or more Groundwater Sustainability Plans (GSPs) by January 31, 2022. If the statutory deadline is not met for GSP development and/or implementation, the State has the authority to intervene and manage groundwater within non-compliant subbasins. SGMA requires that adopted GSPs result in sustainable groundwater management which avoids undesirable results.

The Tracy Subbasin contained areas of San Joaquin, Contra Costa and Alameda Counties. The Banta-Carbona Irrigation District, Byron-Bethany Irrigation District, City of Tracy, City of Lathrop, Stewart Tract, West Side Irrigation District, and San Joaquin County are GSAs within the Tracy Subbasin. The GSAs recognize that developing and adopting a single GSP for the subbasin would be the most efficient way of achieving sustainability and preventing State intervention into local groundwater management.

Working with San Joaquin County and the Tracy Subbasin GSAs, a Memorandum of Agreement (MOA) has been developed for the development of the San Joaquin County GSP for the Tracy Subbasin. Under the terms of the MOA, San Joaquin County is designated as the lead entity to enter into an agreement with the City of Brentwood to coordinate the allocation of grant funds.

The City, BCID, BBID[18], City of Lathrop, San Joaquin County, and Stewart Tract are the six GSAs formed in the Tracy Subbasin and are working cooperatively to develop a single GSP. The Tracy Subbasin GSAs were awarded a DWR grant to develop the GSP. Pursuant to the Grant Agreement, each GSA designated an appointee to form the GSP Coordination Committee, and the San Joaquin County was appointed as the Grant Administrator. The Grant Administrator or any two appointees may call meetings of the GSP Coordination Committee as needed to in the GSP development process.

The GSP for the Tracy Subbasin has been adopted by the GSAs and was submitted to DWR by the statutory deadline of January 31, 2022. The Final GSP is available on the Tracy Subbasin website: https://tracysubbasin.org.

As one of the six GSAs that are managing the Tracy Subbasin., the City has been actively involved in GSP development activities and will continue to be involved throughout SGMA implementation. The City has one appointee (and an alternate) on the Tracy Subbasin GSP Coordination Committee, which meets quarterly, and the Technical Committee, which meets monthly.

[18] The West Side Irrigation District officially merged with Byron-Bethany Irrigation District in September 2020, which occurred later than the release of the draft GSP chapters.

5.3.4.5 Historical Groundwater Use

As discussed previously, the City currently operates eight groundwater extraction wells and one ASR well. The total production capacity of all of the wells combined is 28.2 mgd, which would equate to a total annual production capability of about 31,600 af/yr if the wells were pumped continuously; however, as described above, the City's maximum annual groundwater extraction rate has been established to be 9,000 af/yr. Key characteristics of the City's wells are listed in Table 5-7.

Table 5-7. Groundwater Well Characteristics

City Well Name/Number	Year Drilled	Total Well Depth (Casing Depth), feet	Casing Diameter, inches	Depth of Perforated Zone, feet[(a)]	Design Capacity, gpm	Production Capacity, mgd
Well 1	1986	1,010 (1,000)	16"	450-550 580-980	1,500	2.2
Well 2	1989	990 (870)	16"	420-850	2,000	2.9
Well 3	1989	1,020 (900)	16"	420-890	2,000	2.9
Well 4	1989	1,020 (950)	16"	380-940	2,000	2.9
Lincoln Well	1990	1,000 (1,000)	16"	490-980	2,500	3.6
Well 5[(b)] (Lewis Manor Well)	2000	1,015 (1,000)	18"	410-480 601-630 650-670 805-830 900-930 965-990	2,500	3.6
Well 6 (Park & Ride Well)	2001/02	1,250 (1,216)	18"	550-598 610-636 656-678 738-754 774-796 966-982 1,014-1,122 1,176-1,196	2,000	2.9
Well 7 (Ball Park Well)	2002	1,070 (894)	18"	550-598 570-732 850-874	2,500	3.6
Well 8[(c)]	2004	850 (850)	18"	370-460 510-640 680-820	2,500	3.6

(a) Source: GEI Consultants, Summary of Groundwater Conditions November 2007 through November 2008, dated January 23, 2009.
(b) Data shown is for the Lewis Manor Replacement Well constructed in 2000.
(c) Well 8 went into operation in September 2010, initially as an extraction well and then as a permitted ASR Well.

It should be noted that only Wells 1, 2, 3, 4 and 8 currently have provisions for ammonia addition. It is recommended that provisions for ammonia addition be added to the City's other wells to provide maximum flexibility in the operation of the wells in conjunction with the City's surface water supplies which are disinfected through chloramination.

The City's annual groundwater production since 2010 is shown in Table 5-8.

Table 5-8. Historical Groundwater Production by the City of Tracy

Year	Annual Groundwater Production, af
2010	498
2011	292
2012	420
2013	515
2014	680
2015	519
2016	648
2017	995
2018	817
2019	645
2020	1,181

5.3.4.6 Projected Future Groundwater Use

As discussed in Section 5.3.4.2, the City may sustainably pump up to 9,000 af/yr from the local groundwater basin. Since the hard, high TDS groundwater is of lower quality than the City's surface water sources, the City has scaled back its groundwater extraction in most years. However, the City will continue to rely on groundwater for peaking and drought and emergency water supply.

The City anticipates that total extraction during a normal year will be 2,500 af/yr. By reducing groundwater extraction on an average annual basis, the City will: (1) increase the overall quality of its drinking water, thus increasing customer satisfaction and reducing system maintenance and repair caused by the lower-quality groundwater; and (2) recharge the underlying aquifer, effectively increasing the availability of groundwater during a drought or emergency condition (i.e., effectively "banking" groundwater).

The projected use of groundwater during dry years is about 4,500 af/yr and is consistent with the City's Groundwater Management Policy. In the event that the City is unable to secure additional high-quality surface water supplies in the future, the City is able to expand groundwater production up to 9,000 af/yr. In the event of a severe water supply shortage or emergency, the City has the ability to increase production dramatically, up to 22,000 af/yr.

5.3.5 Aquifer Storage and Recovery

The City's ASR Program allows the City to optimize conjunctive use of its water supplies through injection of surplus treated (potable) drinking water into selected aquifer zones within the groundwater subbasin for storage when surplus supplies are available, and recovery of that potable water from the aquifer to optimize water quality and meet seasonal peak demands during drought periods, or when emergency or disaster scenarios preclude the use of imported water supplies.

In January 2004, the City constructed a new well (Well 8) that was designed to allow for both injection and extraction of water supplies in conjunction with the City's proposed ASR Program. In early 2009, the City contracted to construct the above-ground well facilities (including the pump house, pump, motor, SCADA, electrical, telemetry, chemical feed systems, *etc.*) to have Well 8 operational in September 2010, initially as an extraction well, and in the future as part of the City's proposed ASR Program. In addition, the City installed two monitoring wells for use in the demonstration project monitoring and testing for the proposed ASR Program.

The City obtained regulatory approval from the Central Valley Regional Water Quality Control Board (RWQCB) to conduct an ASR Demonstration Testing Program. The Phase 1 ASR Demonstration Testing was conducted between January 2011 and September 2011 and involved the injection of 233 acre-feet (76 million gallons) of treated SSJID potable water, storage in the confined aquifer, and subsequent extraction of 340 acre-feet (111 million gallons) of water[19]. The Phase 2 ASR Testing was initiated in late December 2011 and was completed in September 2012 with injection of 700 acre-feet. The Tracy City Council approved and adopted a CEQA Negative Declaration (SCH No. 2012102013) for the permanent ASR Program on December 4, 2012.

Injection of treated SSJID water into the ASR well occurs during the winter months (i.e., November through April), when City demands are low and when the City's JJWTP and groundwater wells can be shut down such that only treated SSJID water is injected per the City's ASR permit. Extraction occurs primarily in the summer months to meet increased demands associated with irrigation needs, and as needed during droughts and water shortage emergencies. It is estimated that between 685 and 915 af/yr of potable water could be injected into the aquifer, assuming a 5-month continuous injection rate of 1.5 to 2.0 mgd at Well 8. The City's current strategic plan for ASR operations involves injecting up to 1,000 af/yr over six months during the winter and extracting 75 percent of the injection volume during the following summer. These operations would result in net injection into the Lower Tulare Formation aquifer, which will gradually create a "buffer supply" that the City can utilize in dry years or during water shortage emergencies.

Net annual ASR injection and extraction amounts from Well 8 since 2013 are shown in Table 5-9.

[19] Interim (Final) Status Report for Well 8 ASR Demonstration Program, Memorandum prepared for City of Tracy by Pueblo Water Resources, dated December 7, 2011.

Table 5-9. Tracy ASR Well 8 Annual Injection and Extraction	
Year	Net Injection or Extraction, af
2013	415 (injection)
2014	221 (extraction)
2015	322 (injection)
2016	165 (injection)
2017	665 (injection)
2018	2 (injection)
2019	0
2020	190 (injection)

5.3.6 Out-of-Basin Water Banking

The Semitropic Groundwater Storage District Groundwater Storage Bank (Semitropic) is a water storage system that began operation in the early 1990s. Located in Kern County between the California Aqueduct and the DMC, Semitropic is one of eight California groundwater banking agencies. Semitropic works by having its banking partners deliver their surplus water to Semitropic for storage. Then, when requested by the banking partner, Semitropic returns the stored water to the California Aqueduct for use by its partners either by exchanging its entitlement or by reversing the intake facility (known as "pumpback"). Through "pumpback", Semitropic can deliver a maximum of 90,000 af/yr of water into the California Aqueduct. The State would then deliver the water to the banking partners.

The total storage capacity at Semitropic is 1.65 million acre-feet and, as listed below, there is still a significant amount of storage capacity which is uncommitted and available. The current Semitropic banking partners and their reserved/available storage capacities are listed in Table 5-10.

Table 5-10. Semitropic Water Storage District Banking Partners[(a)]	
Partner Agency	Storage Allocation, af
Metropolitan Water District of Southern California	350,000
Valley Water (formerly known as Santa Clara Valley Water District)	350,000
Alameda County Water District	150,000
Zone 7 Water Agency	65,000
Newhall Land & Farming Company	55,000
San Diego County Water Authority	45,000
Poso Creek Water Company	60,000
City of Tracy	**10,500**
Homer, LLC	15,000
Harris Farms, LLC	10,500
Available Capacity	474,750
Unallocated Storage	64,250
Total Storage Capacity	**1,650,000**
(a) Source: Semitropic Water Storage District website (www.semitropic.com) as of February 12, 2020.	

In June 2006, the City entered into a pilot agreement with Semitropic for 1,000 acre-feet of water storage at Semitropic, which allowed for an annual withdrawal of up to 333 af/yr (e.g., 1,000 acre-feet divided by 3). The pilot agreement was intended to establish the procedures for water deposits and withdrawals by the City of Tracy and was terminated when the Permanent Agreement with Semitropic was implemented (see below).

On June 5, 2012 the Tracy City Council approved a long-term agreement with Semitropic for 3,500 units of water storage. One unit of water storage allows for a withdrawal of up to 1 af/yr for three years; hence, the agreement would allow for withdrawal of 3,500 af/yr for three years (10,500 af total). To store water in Semitropic, the City would not withdraw its share of CVP water from the DMC, but instead allow this water to continue to move through the DMC and California Aqueduct systems for delivery to and use by Semitropic. This is called “in lieu storage.” Upon request by the City, in accordance with the contract, Semitropic would pump the stored water into the California Aqueduct and a like amount of water would be made available to the City directly from the DMC.

Though the City could utilize this supply in any year, it is most valuable during extended drought years when the City's surface water supplies are reduced. The City anticipates that banking water at Semitropic will increase the reliability of the City's water supply and help close the potential future gap between supply and demand during drought conditions or other water supply shortage emergencies. If the City uses water from the Semitropic water bank in any given year, it would manage its supplies during subsequent years such that it could refill the water bank for future use. The City plans to actively maintain storage in Semitropic as feasible.

As of December 2020, the City currently has 6,887 acre-feet of water in storage at Semitropic.

5.4 FUTURE POTABLE WATER SUPPLIES

The City is currently anticipating the following potential future potable water supplies:

- Additional ASR wells
- Additional CVP water supplies from USBR available through a recycled water exchange agreement
- Additional CVP water supplies from BBID
- Additional SCWSP water supplies

These potential future potable water supplies are described below.

5.4.1 Additional ASR Wells

As described above, the City currently has one ASR well (Well 8) which allows the City to inject excess SCWSP water supplies into the groundwater basin for later extraction when needed. The current injection and extraction capacity is 700 af/yr. The City is planning to expand the ASR program with the installation of additional ASR wells. The City’s ASR Program will be expanded to provide up to 1,000 af/yr of water supplies from the existing and new ASR wells by 2040. The ASR supply will be used to meet demands during dry years, thereby increasing the reliability of the City's water supply and helping to close the potential gap between supply and demand during drought conditions or water shortage emergencies.

One constraint with the City's ASR Program is that the permit only allows for SCWSP water to be injected. This means that the City has to shut down the JJWTP and the groundwater wells during the injection period so that only SCWSP supplies are being utilized. A potential alternative to avoid this operational restriction, if the City's ASR permit cannot be modified to allow for other water supplies to be injected, would be to construct a dedicated SCWSP water pipeline to the ASR well(s). Future expansion of the ASR program will need to fully evaluate these operational restrictions and potential alternatives.

5.4.2 Additional CVP Water Supplies from USBR Available Through a Recycled Water Exchange Program

The City is evaluating the potential for indirect reuse of its available recycled water through an exchange agreement with the USBR whereby a portion of the City's tertiary-treated wastewater (recycled water) would be discharged to the DMC and a like amount of water (i.e., a one-to-one exchange) could then be diverted from the DMC by the City for treatment at the City's JJWTP for potable use. Such supplies would be 100 percent reliable and would not be subject to drought cutbacks.

The benefits of such an exchange agreement include the following:

- Provides for the beneficial use of recycled water: Recycled water (tertiary treated wastewater) is currently discharged by the City into the Delta with minimal beneficial use
- Provides an additional potable water supply for the City: Through indirect reuse, it provides an additional potable water supply for City residents and enhances water supply reliability for the community
- Provides enhanced water supply reliability: Recycled water is a "drought proof" water supply
- Reduces the City's dependence on CVP water supply: CVP water has become increasingly unreliable due to drought, climate change and environmental impacts. Indirect reuse of recycled water would reduce the City's dependence on CVP water supplies
- Builds on existing infrastructure: Operations under the exchange agreement would utilize the existing wastewater treatment facilities and recently constructed recycled water pump station and pipelines
- Reduces salt loading in the Delta: Recycled water has a total dissolved solids content of approximately 660 milligrams per liter. Water of this quality is suitable for reuse but does not meet Delta salinity standards. This results in the USBR having to release additional water from New Melones Reservoir to attain Delta salinity standards.

The project would require development of a project description, NEPA/CEQA review, approval of an exchange agreement and then design and construction of a recycled water pipeline to discharge recycled water to the DMC downstream of the City's JJWTP intake. If such a project is approved and implemented, the City anticipates that it would initially provide up to 5,900 af/yr of additional potable water supplies to the City, with future expansion as needed to meet future demands.

5.4.3 Additional CVP Water Supplies from BBID

Additional BBID DMC/CVP water supplies may be available to the City as agricultural land is converted to M&I uses. The land area that could potentially provide this additional water supply includes the portion of BBID's service area that falls within the City's planning areas (excluding the BBID Raw Water Service Area 2). Eligible land area is estimated to be approximately 2,600 acres. While the exact quantity of water that would be available is unknown, a contractual entitlement equal to 3.4 af/yr/acre may be available, resulting in a total supply of up to 8,800 af/yr (2,600 acres x 3.4 af/yr/acre). However, it should be noted that the additional water supplies would have agricultural reliability similar to the City's Ag-reliability CVP supplies described in Section 5.3.1.2 above and therefore would be subject to significant cutbacks in dry years. Agreements between Tracy and BBID, as well as environmental review, would need to occur before such a transaction could take place.

However, because of the uncertainty associated with the availability and reliability of this supply source, especially in dry years, for purposes of this Citywide Water System Master Plan Update, it is assumed that this future water supply will not be available to the City in the future.

5.4.4 Additional SCWSP Water Supplies

The City previously anticipated that an additional 1,880 af/yr of treated water supplies may be available from the SCWSP in the future through a Conserved Water Amendment Agreement. This additional supply would have the same reliability as the supply that the City is currently receiving from the SCWSP, including that recently purchased from the City of Lathrop. Delivery of these additional supplies to the City would be through the same, existing facilities currently delivering the City's existing SCWSP supplies. Delivery of these additional supplies would be subject to approval and environmental review.

However, because of the current uncertainty associated with the availability and reliability of this supply source, especially in dry years as a result of the Bay-Delta Plan Amendment, for purposes of this Citywide Water System Master Plan Update, it is assumed that this future water supply will not be available to the City in the future.

5.5 EXISTING NON-POTABLE WATER SUPPLIES

5.5.1 Recycled Water

In 2002, the City adopted a Recycled and Non-Potable Water Ordinance requiring all new subdivisions, to the extent practicable, to install the required infrastructure (such as dual-distribution pipelines) to provide recycled water to meet non-potable water demands at parks, golf courses, athletic fields, schools, median island landscapes, and industrial sites. The ordinance was codified into the Tracy Municipal Code as Chapter 11.30 “Recycled and Non-Potable Water”.

In March 2013, the City adopted Ordinance 1183 amending Chapter 11.30 of the Tracy Municipal Code to update the City’s recycled water requirements to be consistent with State, regional and local standards, including the California SB X7-7, 2010 California Green Building Standards Code, California Model Water Efficient Landscape Ordinance, and the City of Tracy Sustainability Action Plan. Approvals and permits for the production, distribution and use of recycled water will be required from the RWQCB and the SWRCB Division of Drinking Water.

Both the 2012 WSMP and Tracy Wastewater Master Plan included recommended capital improvement projects for the development of the City’s recycled water system, including pump station and pipeline facilities to deliver recycled water within the City’s service area for use for landscape irrigation and other non-potable uses. To date, the City has spent approximately $85 million on improvements to the City’s WWTP to allow for the production of tertiary-treated wastewater meeting Title 22 requirements for recycled water use for landscape irrigation and other non-potable uses. In December 2013, the City adopted Development Impact Fees to fund recycled water infrastructure improvements. In 2015, the City received a $18 million Proposition 84 grant from DWR to fund construction of pump stations and pipelines to distribute recycled water. In March 2019, the City received an amended order from the SWRCB approving the change in place of use of its treated wastewater. The order allows for the City to change the point of discharge and place of use of treated wastewater by a reduction in discharge to Old River of up to 8.1 mgd, with a maximum annual limit of 5,900 af/yr and use the treated wastewater for industrial and irrigation purposes within the service areas of the City’s Sphere of Influence, BBID within the City’s Sphere of Influence and WSID.

The City recently completed construction of a recycled water pump station at the City’s WWTP and a recycled water pipeline from the WWTP west to Lammers Road and south to Kimball High School. A second phase of construction will include a second pump station and additional recycled water pipeline to further extend the distribution of recycled water supplies within the City.

As described in Chapter 4, at buildout of the City’s General Plan, it is estimated that the recycled water demand for landscape irrigation will be approximately 6,300 af/yr.

5.5.2 Shallow Non-Potable Groundwater

As discussed above, the Tracy Subbasin underlying the City has two aquifers: semi-confined and confined. The uppermost semi-confined aquifer is primarily comprised of alluvial and flood basin formations. The underlying confined aquifer is primarily comprised of the Tulare Formation and it is overlain by the Corcoran Clay, which separates the upper semi-confined aquifer from the underlying confined aquifer. The City’s production wells draw from the confined aquifer only and the average annual operational groundwater yield of 9,000 af/yr described in previous sections applies only to the confined aquifer. The City does not currently pump any groundwater from the semi-confined aquifer.

The shallow semi-confined groundwater is considered to be suitable for agricultural irrigation purposes. However, due to the poor water quality associated with the shallow groundwater supply, the use of this supply to meet the non-potable demands within the City's SOI is not recommended and is not discussed further in this Citywide Water System Master Plan Update.

5.6 RELIABILITY OF THE CITY'S WATER SUPPLIES

5.6.1 Potable Water Supply Reliability

The projected reliability for each of the City's supply sources under normal, single dry and multiple dry year conditions are described below.

5.6.1.1 Normal Years

Normal or wet water years are those that match or exceed median rainfall and runoff levels. The reliability of each of Tracy's existing and future water supplies and their projected availability during normal and wet years is described below:

- The City's contract with the USBR for 10,000 af/yr of DMC/CVP water is subject to M&I reliability. Based on the historical record, the City's long-term average allocation of DMC/CVP water pursuant to this contract is anticipated to be at least 85 percent of the total entitlement. However, due to recent environmental concerns in the Delta and potential future impacts due to climate change, the normal year supply of DMC/CVP M&I water is assumed to be 75 percent of the City's historical use. Based on a historical use of 5,930 af/yr (i.e., the average quantity of CVP water put to beneficial use by the City during the last three years of water deliveries that were unconstrained by the availability of CVP water), the projected normal year supply is 4,448 af/yr.
- The City has received acquired assignments from Banta-Carbona Irrigation District (BCID; 5,000 af/yr) and West Side Irrigation District (WSID; 5,000 af/yr) for a total entitlement of 10,000 af/yr of DMC/CVP water. These supplies are subject to Ag-reliability. The City is conservatively estimating that it will receive 50 percent of its Ag-reliability contractual entitlement, or 5,000 af/yr, in normal years.
- The City has acquired up to 4,500 af/yr of pre-1914 appropriative water rights water from BBID. These supplies are restricted in their place of use, and therefore the supply is anticipated to be equal to the projected demand within that place of use (i.e., the Tracy Hills area) ranging from 800 af/yr in 2025 to 3,300 af/yr in 2045. The City anticipates being able to receive 100 percent of this supply in normal years.

- The City has a total contractual entitlement of 13,135 af/yr of Stanislaus River water provided through the SCWSP, including 10,000 af/yr from its original contract with SSJID, 1,120 af/yr purchased from Lathrop, and 2,015 af/yr purchased on an interim basis from Escalon. The agreement between Tracy and Escalon is assumed to terminate after 2025. Based on information provided by SSJID, the City expects to receive 100 percent of its SCWSP water supply allocation during a normal water year. As such, the City anticipates being able to receive 13,135 af/yr of SCWSP supply in 2025 and 11,120 af/yr afterwards, assuming normal year conditions.
- The City is able to withdraw up to 9,000 af/yr of groundwater from the Tracy Subbasin. However, due to the aging infrastructure and water quality issues in the City's groundwater supplies, the City is projecting to be able to withdraw up to 2,500 af/yr in normal years. This groundwater supply is considered to be 100 percent reliable.
- The City does not anticipate using its Semitropic water or ASR water in normal years.
- The City anticipates that a Recycled Water Distribution Network and Exchange agreement will be executed with the USBR by 2030 to provide additional CVP supplies to the City in exchange for the City discharging a like amount of tertiary-treated recycled water to the DMC. The City assumes that the Recycled Water Distribution Network and Exchange will be implemented as needed to meet future demand conditions and is currently projected to supply an amount ranging from 1,925 af/yr in 2030 to 7,500 af/yr in 2045. This water supply is considered to be 100 percent reliable.
- The City's recycled water supply is expected to be 100 percent reliable. Based on the projected non-potable demands and assuming that the City makes investments in infrastructure and permitting, the City estimates that they will have access to 1,000 af/yr of recycled water supply in 2025, increasing to 6,300 af/yr in 2045.

The reliability of each of the City's existing and additional planned future water supplies and their projected availability during normal years at buildout is shown in Table 5-11.

Table 5-11. Projected Existing and Additional Planned Future Water Supplies Available in Normal Years at Buildout

Supply	Percent Allocation/ Entitlement	Projected Available Supplies, af/yr
Existing Water Supplies		
USBR CVP - Tracy Contract[(a)]	75	4,448
USBR CVP - BCID Contract	50	2,500
USBR CVP - WSID Contract	50	2,500
	Total CVP Supplies	**9,448**
BBID (pre-1914 to meet Tracy Hills demand)	100	3,300
SCWSP (SSJID) (pre-1914)	100	11,120
Groundwater	100	2,500
Semitropic Water Storage Bank[(b)]	0	0
Total Existing Potable Supplies		**26,368**
Additional Planned Future Water Supplies[(a)]		
Additional USBR CVP (BBID contract)	0	0
Aquifer Storage and Recovery[(b)]	0	0
Recycled Water Exchange	100	7,500
Recycled Water (non-potable)	100	6,300
Total Additional Planned Future Potable Supplies		**7,500**
Total Potable Supplies		**33,868**
Total Additional Planned Future Non-Potable Supplies		**6,300**
TOTAL WATER SUPPLY		**40,168**

Source: City of Tracy 2020 UWMP, Table 7-2, June 2021.

(a) Percent of historical use
(b) Not used in normal years.

5.6.1.2 Single Dry Years

During a single dry year, all of the City's existing surface water allotments are subject to some level of reduction. Assumed reductions are based on actual reductions in CVP deliveries experienced in the recent drought and the new USBR M&I Reliability Policy adopted in 2017. The actual reductions will vary with the severity of the regional water supply shortage and climatic conditions, and the consideration of contract agreements.

The following describes the availability and reliability of the City's existing and additional planned future water supplies under single dry year conditions:

- The City's contract with the USBR for 10,000 af/yr of DMC/CVP water is subject to M&I reliability. During a single dry year, the City estimates to receive 25 percent of the City's historical use. Based on the historical use of 5,930 af/yr, the projected supply is 1,483 af/yr.

- The City has a total entitlement of 10,000 af/yr of DMC/CVP Ag-reliability water. The City anticipates receiving 0 percent of its DMC/CVP Ag-reliability water in a single dry year.
- The City has acquired up to 4,500 af/yr of pre-1914 appropriative water rights water from BBID. This supply is restricted with regard to the place of use (Tracy Hills). The City anticipates being able to receive 85 percent of its contractual entitlement in a single dry year (3,825 af/yr). As the projected demand is 3,300 af/yr in 2045 and is lower than the 3,825 af/yr of available supply, the reduction in reliability does not result in a reduction to actual amount of water used. Therefore, the supply in a single dry year is anticipated to be equal to the projected demand within the Tracy Hills area, ranging from 800 af/yr in 2025 to 3,300 af/yr in 2045.
- The City has a total contractual entitlement of 13,135 af/yr of Stanislaus River water provided through the SCWSP. Based on information provided by SSJID, the City expects to receive 76 percent of its SCWSP water supply allocation during 2025, 2030, and 2035 and 56 percent during 2040 and 2045. In addition, the SCWSP water transferred from Escalon is assumed to be unavailable after 2025. As such, the City estimates 9,974 af/yr of SCWSP supply in 2025, 8,444 af/yr in 2030 and 2035, and 6,177 af/yr afterwards.
- During a single dry year, the City anticipates increasing its groundwater production on a short-term basis from the normal year production of 2,500 af/yr to 4,500 af/yr. The groundwater supply is considered to be 100 percent reliable.
- The City anticipates that 700 af/yr of water will be available for use in a single dry year through operation of its ASR well. An additional 300 af/yr is estimated to be available by 2040 for a total of 1,000 af/yr. This water supply is considered to be 100 percent reliable assuming that the City is consistently able to refill the ASR storage during non-drought years to maintain at least 1,000 af in storage at the beginning of a single dry year.
- The City has acquired 10,500 af/yr of storage in Semitropic, which allows the City to withdraw up to 3,500 af/yr for three consecutive years. Due to the difficulties experienced by the City in accessing stored water via the DMC on a short timeframe, the City has conservatively assumed that the Semitropic water will not be available in a single dry year.
- The City anticipates that a Recycled Water Distribution Network and Exchange agreement will be executed with the USBR by 2030 to provide additional CVP supplies to the City in exchange for the City discharging a like amount of tertiary-treated recycled water to the DMC. The City assumes that the Recycled Water Distribution Network and Exchange will be implemented as needed to meet future demand conditions and is currently projected to supply an amount ranging from 1,925 af/yr in 2030 to 7,500 af/yr in 2045. This water supply is considered to be 100 percent reliable.
- The City’s recycled water supply is expected to be 100 percent reliable. Based on the projected non-potable demands and assuming that the City makes investments in infrastructure and permitting, the City estimates that they will have access to 1,000 af/yr of recycled water supply in 2025, increasing to 6,300 af/yr in 2045.

The reliability of each of the City's existing and additional planned future water supplies and their projected availability during a single dry year at buildout is shown in Table 5-12.

Table 5-12. Projected Existing and Additional Planned Future Water Supplies Available in Single Dry Years at Buildout

Supply	Percent Allocation/ Entitlement	Projected Available Supplies, af/yr
Existing Water Supplies		
USBR CVP - Tracy Contract[a]	25	1,483
USBR CVP - BCID Contract	0	0
USBR CVP - WSID Contract	0	0
	Total CVP Supplies	**1,483**
BBID (pre-1914 to meet Tracy Hills demand)	100	3,300
SCWSP (SSJID) (pre-1914)[b]	56	6,177
Groundwater[c]	100	4,500
Semitropic Water Storage Bank	0	0
Total Existing Potable Supplies		**15,460**
Additional Planned Future Water Supplies		
Additional USBR CVP (BBID contract)	0	0
Aquifer Storage and Recovery[c] [d]	100	1,000
Recycled Water Exchange[c]	100	7,500
Recycled Water (non-potable)[c]	100	6,300
Total Additional Planned Future Potable Supplies		**8,500**
Total Potable Supplies		**23,960**
Total Additional Planned Future Non-Potable Supplies		**6,300**
TOTAL WATER SUPPLY		**30,260**

Source: City of Tracy 2020 UWMP, Table 7-3, June 2021.

(a) Percent of historical use.
(b) Percentage of contract entitlement is based on information from SSJID for 2040 and later.
(c) Groundwater and recycled water volumes assume the City invests in infrastructure and/or permitting.
(d) ASR volumes assume surplus supplies are available in wet years to inject and store, as well as additional investment in ASR construction and operation.

5.6.1.3 Multiple Dry Years

During multiple dry years, the City's surface water supplies (from both the CVP and SCWSP) may be significantly reduced. Thus, in the event of drought, the City will have to depend more heavily on conservation efforts, groundwater, and the proposed future supply projects.

The following describes the availability and reliability of the City's existing and additional planned future water supplies under multiple dry year conditions:

- The City's contract with the USBR for 10,000 af/yr of DMC/CVP water is subject to M&I reliability. During multiple dry years, the City estimates that it will receive 40 percent of the City's historical use. Based on the historical use of 5,930 af/yr, the projected supply is 2,372 af/yr.

- The City has a total entitlement of 10,000 af/yr of DMC/CVP Ag-reliability water. The City anticipates receiving 0 percent of its DMC/CVP Ag-reliability water in multiple dry years.
- The City has acquired up to 4,500 af/yr of pre-1914 appropriative water rights water from BBID. This supply is restricted with regard to the place of use (Tracy Hills). The City anticipates being able to receive 85 percent of its contractual entitlement in multiple dry years (3,825 af/yr). As the projected demand is 3,300 af/yr in 2045 and is lower than the 3,825 af/yr of available supply, the reduction in reliability does not result in a reduction to actual amount of water used. Therefore, the supply in multiple dry years is anticipated to be equal to the projected demand within the Tracy Hills area, ranging from 800 af/yr in 2025 to 3,300 af/yr in 2045.
- The City has a total contractual entitlement of 13,135 af/yr of Stanislaus River water provided through the SCWSP. Based on information provided by SSJID, the City's SCWSP water supply reliability during multiple dry years range from 56 to 100 percent. In addition, the SCWSP water transferred from Escalon is assumed to be unavailable after 2025.
- During multiple dry years, the City anticipates increasing its groundwater production on a short-term basis from the normal year production of 2,500 af/yr to 4,500 af/yr. The groundwater supply is considered to be 100 percent reliable.
- The City anticipates that 700 af of water will be available for use in multiple dry years through operation of its ASR well. An additional 300 af is estimated to be available by 2040 for a total of 1,000 af. The City is assumed to be unable to refill the ASR storage during multiple dry years. Therefore, the annual ASR supply available is assumed to equal one fifth of the total stored volume (i.e., 140 af/yr between 2025 and 2035 and 200 af/yr between 2040 and 2045). This water supply is considered to be 100 percent reliable assuming that the City is consistently able to refill the ASR storage in non-drought years to maintain at least 1,000 af in storage at the beginning of a multiple dry year sequence.
- The City has acquired 10,500 af/yr of storage in Semitropic, which allows the City to withdraw up to 3,500 af/yr for three consecutive years. Due to the difficulties experienced by the City in accessing stored water via the DMC on a short timeframe, the City has conservatively estimated that the 0 percent of the City's storage will be available in the first year of a five-consecutive-year drought, and 100 percent will be available over the following four years. Based on the City's current storage at Semitropic of 6,887 af, the amount available in the second to fifth year of a five-consecutive-year drought is assumed to be 1,722 af/yr (6,887 af divided by four). A similar reliability estimate is provided for all dry-year sequences under the assumption that the City is consistently able to re-fill the water bank in non-drought years to maintain at least 7,000 af/yr in storage at the beginning of a multiple dry year sequence.

- The City anticipates that a Recycled Water Distribution Network and Exchange agreement will be executed with the USBR by 2030 to provide additional CVP supplies to the City in exchange for the City discharging a like amount of tertiary-treated recycled water to the DMC. The City assumes that the Recycled Water Distribution Network and Exchange will be implemented as needed to meet future demand conditions and is currently projected to supply an amount ranging from 1,925 af/yr in 2030 to 7,500 af/yr in 2045. This water supply is considered to be 100 percent reliable.
- The City's recycled water supply is expected to be 100 percent reliable. Based on the projected non-potable demands and assuming that the City makes investments in infrastructure and permitting, the City estimates that they will have access to 1,000 af/yr of recycled water supply in 2025, increasing to 6,300 af/yr in 2045.

The reliability of each of the City's existing and additional planned future water supplies and their projected availability during a five-consecutive-dry year (multiple dry year) period at buildout is shown in Table 5-13.

Table 5-13. Projected Existing and Additional Planned Future Water Supplies Available Five-Consecutive-Dry Years at Buildout

Supply	Percent Allocation/ Entitlement	Projected Available Supplies, af/yr				
		Year 1	Year 2	Year 3	Year 4	Year 5
Existing Water Supplies						
USBR CVP - Tracy Contract[(a)]	40	2,372	2,372	2,372	2,372	2,372
USBR CVP - BCID Contract	0	0	0	0	0	0
USBR CVP - WSID Contract	0	0	0	0	0	0
Total CVP Supplies		**2,372**	**2,372**	**2,372**	**2,372**	**2,372**
BBID (pre-1914 to meet Tracy Hills demand)	100	3,300	3,300	3,300	3,300	3,300
SCWSP (SSJID) (pre-1914)	*See Note (b)*	11,120	11,120	6,177	6,177	11,120
Groundwater[(c)]	100	4,500	4,500	4,500	4,500	4,500
Semitropic Water Storage Bank	100	0	1,722	1,722	1,722	1,722
Total Existing Potable Supplies		**21,292**	**23,014**	**18,071**	**18,071**	**23,014**
Additional Planned Future Water Supplies						
Additional USBR CVP (BBID contract)	0	0	0	0	0	0
Aquifer Storage and Recovery[(c)(d)]	100	200	200	200	200	200
Recycled Water Exchange[(c)]	100	7,500	7,500	7,500	7,500	7,500
Recycled Water (non-potable)[(c)]	100	6,300	6,300	6,300	6,300	6,300
Total Additional Planned Future Potable Supplies		**7,700**	**7,700**	**7,700**	**7,700**	**7,700**
Total Potable Supplies		**28,992**	**30,714**	**25,771**	**25,771**	**30,714**
Total Additional Planned Future Non-Potable Supplies		**6,300**	**6,300**	**6,300**	**6,300**	**6,300**
TOTAL WATER SUPPLY		**35,292**	**37,014**	**32,071**	**32,071**	**37,014**

Source: City of Tracy 2020 UWMP, Tables 7-4 and 7-5, June 2021.

(a) Percent of historical use.
(b) Information provided by SSJID. SSJID's reliability estimates for a five consecutive year drought were based on the historical supplies available for the SCWSP during the 2012 to 2016 drought period. During 2012, 2013, and 2016 (the first, second, and fifth years), SSJID was able to provide the full allocation to SCWSP participants, whereas during 2014 and 2015 (the third and fourth years), SSJID was only able to provide 75 percent of the full allocation to SCWSP participants.
(c) Groundwater and recycled water volumes assume the City invests in infrastructure and/or permitting.
(d) ASR volumes assume surplus supplies are available in wet years to inject and store, as well as additional investment in ASR construction and operation.

5.6.2 Emergency Water Supply Conditions

During the recent drought conditions in California, water supply deliveries from the SWP and CVP (and other surface water supply sources throughout California) were severely reduced and even the availability of pre-1914 water rights was challenged. Many water supply agencies, including the City, implemented their Water Shortage Contingency Plans, including mandatory water conservation measures, to reduce water use. Even with 0 percent deliveries from the City's USBR CVP agricultural supplies in 2014, the diversity of the City's water supply portfolio together with water conservation efforts by the City's customers allowed the City to meet all water demands. If the recent drought were to re-occur, and deliveries of surface water supplies are reduced further, the City's Water Shortage Contingency Plan would be enacted as needed.

The City's Water Shortage Contingency Plan includes shortage response actions for six water shortage levels up to greater than 50 percent shortage due to foreseeable or unforeseeable events. The City's Water Shortage Contingency Plan is included in Appendix H of the 2020 UWMP. The City may implement demand reduction actions, supply augmentation, mandatory restrictions, and other actions as appropriate for the shortage level to reduce the gap between supply and demand.

Further, the City has prepared a Water System Emergency Response Plan which provides a framework for emergency response by the City's Utilities Department by describing the department's emergency management organization, roles, and responsibilities and emergency policies and procedures. The Water System Emergency Response Plan provides action plans to be implemented to address the emergency.

5.6.3 Non-Potable Water Supply Reliability

Recycled water supplies are generally regarded as being highly reliable water supplies, even during drought conditions. This is because wastewater flows are primarily generated from interior water uses which generally remain about the same throughout the year and during drought conditions (reductions in water use during drought conditions are primarily the result of reduced exterior water uses which generally do not become wastewater flows). For this reason, it is assumed that recycled water supplies will be 100 percent reliable under all hydrologic conditions.

5.7 SUFFICIENCY OF THE CITY'S WATER SUPPLIES

5.7.1 Potable Water Supply Availability

Table 5-14 summarizes the projected availability of the City's existing and planned future potable water supplies compared with projected water demands in normal, single dry and multiple dry years at buildout.

To be conservative, water demands were assumed to be at normal levels. With future planned projects implemented, the results of the assessment show that water supply is sufficient during normal years. However, during a single dry year or a multiple dry year period, the City must depend more heavily on conservation efforts, groundwater, and the proposed future supply projects to overcome the gap between supply and demand. As described in the City's 2020 UWMP, these findings are primarily due to projected reduced reliability of the City's CVP supplies and SSJID supplies in dry years.

Table 5-14. Summary of Buildout Total Water Supply Versus Demand During Hydrologic Normal, Single Dry, and Multiple Dry Years[a]

Hydrologic Condition		Supply and Demand Comparison, af/yr
Normal Year[b]		
Available Total Water Supply		40,168
Total Water Demand		39,800
	Potential Surplus (Deficit)	368
	Percent Shortfall of Demand	-
Single Dry Year[c]		
Available Total Water Supply		30,259
Total Water Demand		39,800
	Potential Surplus (Deficit)	(9,541)
	Percent Shortfall of Demand	24%
Multiple Dry Years[d]		
Year 1	Available Total Water Supply[e]	35,292
	Total Water Demand	39,800
	Potential Surplus (Deficit)	(4,508)
	Percent Shortfall of Demand	11.3%
Year 2	Available Total Water Supply	37,014
	Total Water Demand	39,800
	Potential Surplus (Deficit)	(2,786)
	Percent Shortfall of Demand	7.0%
Year 3	Available Total Water Supply	32,071
	Total Water Demand	39,800
	Potential Surplus (Deficit)	(7,729)
	Percent Shortfall of Demand	19.4%
Year 4	Available Total Water Supply	32,071
	Total Water Demand	39,800
	Potential Surplus (Deficit)	(7,729)
	Percent Shortfall of Demand	19.4%
Year 5	Available Total Water Supply	37,014
	Total Water Demand	39,800
	Potential Surplus (Deficit)	(2,786)
	Percent Shortfall of Demand	7.0%

(a) Water demands are from Table 4-16.
(b) Normal Year supplies are from Table 5-11
(c) Single Dry Year supplies are from Table 5-12.
(d) Multiple Dry Year supplies are from Table 5-13
(e) Assumes 0 percent of the City's storage in Semitropic is available for the first year.

To close the gap between supply and demand during dry years, the City will need to implement its Water Shortage Contingency Plan to reduce water demands and implement future water supply projects. This includes full implementation of the proposed Recycled Water Distribution Network and Exchange Program and expansion of the ASR Program. Delays in implementing these projects could result in greater water supply shortages and the need for additional water conservation to meet demands. Investments in wet year water supplies will also be needed to refill storage in Semitropic and expand the City's ASR program.

The dry year shortfalls presented in Table 5-14 include water supply and demand projections with numerous uncertainties and the situation is dynamic and discussed in Section 7 of the 2020 UWMP. The City continues to work on strategies and actions to address the projected water supply shortfall. Uncertainties are itemized below:

- The Bay-Delta Plan Amendment implementation is under negotiation. The SSJID and others are continuing negotiations with the SWRCB on implementation of the Bay-Delta Plan Amendment for water supply cutbacks, particularly during droughts. This is a dynamic situation and the projected drought cutback allocations may need to be revised before the next (i.e., 2025) UWMP depending on the outcome of ongoing negotiations. The City has considered a conservative estimate of the potential impacts of the Bay-Delta Plan Amendment on the SCWSP (and therefore the City), which is provided in Appendix G of its 2020 UWMP.
- The supply yield of the City's development of additional ASR and recycled water supplies are accounted for in current supply projections. However, implementation of these projects will require significant investment by the City. Similarly, investments in wet years supplies will be needed to refill storage in Semitropic and expand the City's ASR program.
- The City continues to work closely with the USBR and SSJID on their rationing policies to ensure that M&I needs can be met. Rationing policies may potentially be revised.
- The City's projected water demands are subject to change in the future based on water conservation policies and regulations for current and future development, and the pace and extent of development.
- Frequency and duration of cutbacks and, therefore, the shortfalls are also uncertain. In addition to the supply volumes, the above listed uncertainties would also impact the projected frequency and duration of shortfalls.

5.7.2 Recycled Water Supply Availability

Recycled water will be treated to a tertiary level in accordance with Title 22 requirements at the City's WWTP and will be distributed to recycled water use areas within the City's SOI for use for landscape irrigation and other non-potable uses and will be used as part of the Recycled Water Distribution Network and Exchange Program. It is anticipated that with expansion of the City's WWTP adequate recycled water supplies will be available on an annual basis to meet the projected recycled water demands at buildout of the City's General Plan.

The projected future use of recycled water supplies to meet non-potable water demands such as landscape irrigation within the City's service areas is critical to reduce potable water demands and reserve the City's available potable water supplies for their most important uses and to ensure that the City has adequate water supplies to meet future water demands. Without this future recycled water use within the City's service areas, and without the Recycled Water Distribution Network and Exchange Program, the City would have inadequate potable water supplies to meet anticipated future water demands.

5.8 WATER MANAGEMENT STRATEGIES AND OPTIONS

The City has developed strategies and actions to address the projected supply shortfalls. These are discussed in the City's 2020 UWMP and summarized below.

5.8.1 Recycled Water for Non-Potable Use

The City continues to develop recycled water supplies as discussed in Section 5.5.1. Recycled water is planned to augment non-potable demands that would otherwise be supplied with potable water. Buildout potable water demands could be less than the current projections and therefore the resultant supply shortage will likely to be smaller.

5.8.2 Future Water Supply Projects

The City continues to evaluate the expansion of its existing supply and to obtain new supply sources, including the ASR Program and Recycled Water Distribution Network and Exchange Program. Other potential supply options, such as direct potable reuse of recycled water, are also being considered.

The City has also recently entered discussions with the Contra Costa Water District (CCWD) and the San Luis & Delta-Mendota Water Authority to explore the City's potential participation in the Phase 2 Los Vaqueros Reservoir Expansion Project. Los Vaqueros Reservoir is an offstream storage facility located in the coastal foothills west of the Sacramento-San Joaquin Delta. CCWD completed construction of the Los Vaqueros Project in 1997 with an original storage capacity of 100,000 acre-feet. CCWD stores water in Los Vaqueros Reservoir that is diverted from the Delta when water quality is favorable for later release and blending when Delta water quality is degraded. An initial expansion, Phase 1, to 160,000 acre-feet was completed in 2012 to address seasonal water quality degradation and drought needs. The reservoir also provides important emergency water supply storage, recreation, and flood management. The proposed Phase 2 expansion project builds upon the successful Phase 1 expansion completed in 2012. The proposed project will include a regional intertie (the Transfer-Bethany Pipeline), improved pump stations and pipelines and could increase the reservoir's capacity up to 275,000 acre-feet. The Transfer-Bethany Pipeline is currently anticipated to be completed in 2025/2026, with the reservoir expansion to be completed by 2030. The City's participation in the project would increase the City's water supply reliability by providing storage of supplies for use in dry years. The estimated cost for 5,000 acre-feet of storage for the City will be approximately $10 million plus an additional $1.5 million for implementation. In October 2021, the Tracy City Council authorized staff to initiate the process to participate in the project and authorized the City Manager to execute the project activity agreement.

5.8.3 Implementation of Demand Management Measures

The City has an active water conservation program and continues to implement the demand management measures described in Section 9 of the City's 2020 UWMP. Further, in response to the anticipated future shortfalls, the City has developed a robust Water Shortage Contingency Plan that systematically identifies ways in which the City can reduce water demands. The Water Shortage Contingency Plan is included in Section 8 of the City's 2020 UWMP.

5.8.4 Policy-Based Water Efficiency Tools

The City is currently exploring other policy-based water efficiency tools that other supply-constrained agencies across California have implemented. These policy-based tools are often bundled together and referred to as Water Demand Offset (WDO) or Water Neutrality policies. Through these policies, project developers are generally required to offset the new demand anticipated by the development through some combination of demand mitigation options, such as:

- **On-site retrofits.** Project developer with existing property reduces total projected water demand by retrofitting existing property with efficient water fixtures. If projected water demand is reduced below baseline for existing property, no off-site WDOs are required. If not, offsite WDOs are required.
- **Off-site retrofits.** Project developer coordinates and pays for installation of water efficient fixtures at other properties or converts existing irrigation systems to recycled water for other off- site properties, typically those owned by other entities.
- **On-site reuse.** Larger scale developments are required to implement on-site reuse of water, including rainwater, greywater, stormwater, and blackwater, as has recently been implemented by the Cities of San Francisco and Menlo Park.
- **Supply augmentation.** Project developer secures its own water supply to serve the development, either through direct provision of water to the development or through an agreement to transfer rights to the water supplier.
- **WDO fees.** Project developer pays fees to implementing entity based on the amount of water offset, and the agency uses the fees to fund water conservation programs. Such conservation programs could include system water loss mitigation projects (e.g., capital improvement, Advanced Metering Infrastructure [AMI] meters, etc.), purchase of water efficient equipment (e.g., NO-DES hydrant flushing machine to recycle water used to flush mains), and recycled water system infrastructure, as well as fixture rebate or retrofit and education-based conservation programs.

Such policies could be designed as a "net neutral" policy wherein the new development is required to offset all new demands associated with the development project and minimize the overall supply reliability impacts for the existing customers.

5.9 SUMMARY OF WATER SUPPLY RECOMMENDATIONS

The following summarizes recommendations related to the City's water supplies:

- Provisions for ammonia addition should be added to the City's existing Lincoln Well, Lewis Manor Well, Park & Ride Well and Ball Park Well, and any future wells, to provide maximum flexibility for the City's use of groundwater in conjunction with the City's surface water supplies which are disinfected through chloramination.
- The City's ASR Program should be expanded in the future to provide up to 1,000 af/yr of supply. An evaluation of potential ASR options and operational scenarios should be conducted as additional ASR wells are planned to determine if dedicated SSJID supply pipelines to the ASR wells will be required if the City's ASR permit cannot be modified to allow for other supplies to be injected. See Chapter 8 for additional discussion about the City's future ASR wells.
- The City should continue discussions with the Contra Costa Water District for the City's participation in the Phase 2 Los Vaqueros Reservoir Expansion Project. The City's participation in the project would increase the City's water supply reliability by providing storage of supplies for use in dry years.
- The proposed Recycled Water Distribution Network and Exchange Program should be developed as soon as possible to provide for the exchange of recycled water supplies for surface water supplies which can be treated and used to meet the City's potable water demands. The City's 2020 UWMP assumes an exchange quantity of 7,500 af/yr; however, if this amount could be increased, projected water shortages may be reduced. Subsequent revisions to the projected potable water demand and/or the water supply availability and reliability assumptions may change the required quantities and timing of the proposed Recycled Water Distribution Network and Exchange Program.
- Development the Recycled Water Distribution Network and Exchange Program will require an expansion of the City's WWTP to be able to produce the recycled water required for the exchange and the design and construction of a recycled water pipeline to discharge recycled water to the DMC downstream of the City's JJWTP intake. Additional discussion of the pipeline required for the Recycled Water Distribution Network and Exchange Program is provided in Chapter 9.
- The City's recycled water system should continue to be developed to the maximum extent possible to allow for irrigation demands to be met with recycled water supplies to offset the demand for potable water supplies. The quantity required is estimated to be 6,300 af/yr by buildout based on the recycled water use assumptions described in Chapter 4.

As described in this Citywide Water System Master Plan Update, and in the City's 2020 UWMP, water supply conditions continue to change in California, and the availability and reliability of the City's water supplies may continue to change in the coming years. City staff are continuously monitoring water supply conditions and making adjustments to water system operations as needed. Additional ASR wells and/or other infrastructure improvements may be needed to serve developments which rely on water supplies with agricultural rights under various agreements with the City. The water supply recommendations described above, and their associated costs, may need to be refined in the future as water supply conditions change.

CHAPTER 6
System Performance and Operational Criteria

6.1 OVERVIEW

The purpose of this chapter is to define the recommended performance and operational criteria for the City's potable and recycled water distribution systems. For the potable water system, these criteria include recommendations for the required fire flow and flow duration, definitions of "emergency events", and recommendations for surface water treatment capacity, system storage capacity (operational, fire flow, and emergency components), system pumping capacity, minimum and maximum system pressures, and maximum pipeline velocity and head loss. The recycled water system performance and operational criteria includes recommendations for recycled water treatment capacity, system storage capacity (seasonal and operational components), system pumping capacity, minimum and maximum system pressures, and maximum pipeline velocity and head loss.

The City currently uses the City Design Standards (dated February 2020) and City Standard Plans and Specifications (dated February 2020) for the planning and design of its potable and recycled water distribution systems. The City Design Standards and City Standard Plans and Specifications should be referenced for specific design information for water system facilities as applicable.

Key water system design criteria and operational standards from the City Design Standards and City Standard Plans and Specifications documents are incorporated into this chapter; however, additional explanation and discussion have been added to further describe various system recommendations. The following sections of this chapter present the recommended performance and operational criteria for the City's potable and recycled water systems:

Potable Water System

- General Potable Water System Reliability and Recommendations
- Fire Flow Requirements
- Potable Water System Capacity During High Demand Periods
- Water Treatment Capacity
- Potable Water Storage Capacity
- Potable Water Pumping Facility Capacity
- Potable Water Critical Supply Facilities
- Potable Water Transmission and Distribution Pipeline Sizing and Recommended System Pressures

Recycled Water System

- Recycled Water Demand Condition Evaluation
- Recycled Water Treatment Capacity
- Recycled Water Storage Capacity
- Recycled Water Pumping Facility Capacity
- Recycled Water Transmission Pipeline Sizing and Recommended System Pressures

6.2 POTABLE WATER SYSTEM

Components of the recommended performance and operational criteria for the City's potable water system are discussed below.

6.2.1 General Potable Water System Reliability and Recommendations

Attention to enhancing the reliability of the system under all conditions is an important part of maintaining high quality water service. Water system reliability is achieved through a number of system features including: (1) appropriately sized storage facilities, (2) redundant or "firm" pumping, transmission, and treatment facilities where required, and (3) alternate power supplies. Reliability and water quality are also improved by designing looped water distribution pipelines and avoiding dead-end distribution mains whenever possible. Looping pipeline configurations reduces the potential for stagnant water and the associated problems of poor taste and low chlorine residuals. In addition, proper valve placement is also necessary to maintain reliable and flexible system operation under normal and abnormal operating conditions.

6.2.1.1 Water Quality Standards

Water quality standards largely pertain to protecting public health and consistently delivering a satisfactory product to the customer. The U.S. Environmental Protection Agency (EPA) and the State Water Resources Control Board Division of Drinking Water (DDW) are the agencies responsible for establishing water quality standards. The EPA and DDW prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. The City, as water purveyor, is responsible for ensuring that the applicable water quality standards and regulations are met at all times.

6.2.1.2 Recommendations for New Developments

Various policies to reduce water use and comply with water efficiency standards were recommended in Chapter 2 for future service areas and new developments within the City. These policies were recommended to assist the City with achieving its water conservation goals and maintaining the long-term sustainability of its water resources. As new developments are integrated into the City's existing water system, the recommended policies discussed in Chapter 2 should be reviewed for compliance. In addition, proposed water system facilities located in the future service areas and new developments within the City should also meet the recommended system performance criteria (e.g., minimum and maximum system pressures) discussed in the following sections and more specifically under *Section 6.2.8 Potable Water Transmission and Distribution Pipeline Sizing and Recommended System Pressures.*

6.2.2 Fire Flow Requirements

The City's Public Works Department operates and maintains the water distribution system within the City, but the City's Fire Department (Fire Department) is concerned with the availability of adequate water supply for firefighting purposes. Consequently, the Fire Department establishes minimum water flows and residual system pressures during a fire fighting event that the City is responsible for providing from the potable water system.

The Fire Department uses the California Fire Code (CFC) Table B150.1 *Minimum Required Fire Flow and Flow Duration for Buildings,* to assist them in establishing minimum fire flows and durations for individual structures. The recommended fire flow requirements for the City based on various land use designations are presented in Table 6-1. These fire flow requirements were developed based on discussions with the Fire Department's Fire Marshal and will be used for the evaluation of the existing and future water system.

For planning purposes, the minimum fire flows identified in Table 6-1 are to be met concurrently with maximum day demand conditions while maintaining a minimum residual system pressure of 20 pounds per square inch (psi) throughout the water system. This criterion has been decreased from the 2012 WSMP, which used 30 psi as the minimum residual system pressure during a single fire flow event. For this Citywide Water System Master Plan, the criterion has been adjusted for consistency with the Fire Department's requirements and typical industry standards.

For large pressure zones, the City's water system should also have the capability to meet a system demand condition equal to the occurrence of a maximum day demand with two simultaneous fire flow events within that pressure zone while maintaining a minimum residual system pressure of 20 psi throughout the water system[20]. This conservative assumption of two simultaneous fire flow demands will help stress the City's water system and determine if the water system can provide reliable service during high demand conditions. Additionally, as discussed in subsequent sections of this chapter, fire flows presented in Table 6-1 and their expected duration will also be used to establish the City's storage capacity requirements.

[20] It is assumed that these two fire flow events will consist of one smaller single family residential fire flow combined with another larger industrial fire flow.

Table 6-1. Recommended Fire Flow Requirements[(a,b)]

Land Use Designation	Non-Sprinklered[(c)]			Sprinklered[(c,d)]		
	Fire Flow, gpm	Duration, hours	Recommended Storage, MG	Fire Flow, gpm	Duration, hours	Recommended Storage, MG[(j)]
Single Family Residential[(e)]	1,500	2	0.18	1,500	2	0.18
Multi Family Residential[(f)]	2,500	2	0.30	2,500	2	0.30
Commercial/Office[(g)]	6,000	4	1.44	3,500 [(i)]	4	0.72
Industrial	8,000	4	1.92	4,500 [(i)]	4	0.96
Institutional[(h)]	8,000	4	1.92	4,500 [(i)]	4	0.96

(a) Construction type and fire flow calculation area are not generally known during the development of a master plan; consequently, fire flow requirements set forth in this table are based on previous estimates for these land use types and similar communities.

(b) Unique projects or projects with alternate materials may require higher fire flows and should be reviewed by the Fire Marshal on a case-by-case basis (e.g., proposed commercial/industrial areas and schools).

(c) Specific fire flows were determined from Table B105.1 of the 2016 CFC, and depend on construction type and fire flow calculation area. Refer to Section 903 of the 2016 CFC and Section 9.06.060 of the City of Tracy Municipal Code for automatic sprinkler system requirements.

(d) As stated in the City of Tracy Design Standards (February 2020), the Fire Marshal normally allows up to a 50 percent reduction in fire flow if a building is provided with an automatic sprinkler system. However, the CFC also requires that no fire flow be less than 1,000 gpm for single family residential or 1,500 gpm for all other building types. For a more conservative fire flow estimate, requirements for sprinklered Single Family and Multiple Family Residential buildings were not reduced for this Citywide Water Master Plan.

(e) Single Family Residential includes Very Low and Low Density Residential land uses.

(f) Multi Family Residential includes Medium, High, and Very High Density Residential land uses.

(g) Commercial/Office includes Commercial, Office, Motel/Hotel and Mixed Use land uses.

(h) Institutional includes Medical, Public Facilities, School, Airport, Church, and Cemetery land uses.

(i) Fire flow includes a 500 gpm demand for on-site sprinkler flow.

(j) Recommended storage volumes do not include volume associated with 500 gpm sprinkler flow.

6.2.3 Potable Water System Capacity During High Demand Periods

Maximum day demand plus fire flow and peak hour demand conditions will be used to assess the adequacy of the City's potable water system during high demand periods. Adopted peaking factors for maximum day and peak hour demands are discussed in Chapter 4. The following sections discuss the assumptions and recommended criteria for each demand condition.

6.2.3.1 Maximum Day Demand plus Fire Flow

In accordance with typical industry standards, the City's water system should have the capability to meet a system demand condition equal to the occurrence of a maximum day demand concurrent with either one or two simultaneous fire flow event(s) while meeting the recommended system performance criteria (e.g., minimum and maximum system pressures) discussed under *Section 6.2.8 Potable Water Transmission and Distribution Pipeline Sizing and Recommended System Pressures.*

Maximum day demand plus fire flow should be met from a combination of supply sources (i.e., treated surface water from the JJWTP and SSJID supplies plus groundwater) and treated water storage reservoirs. The analysis of specific fire flow evaluations will be conducted assuming the largest booster pump at each pump station is offline (i.e., firm booster pumping capacity). In addition, the City's groundwater well system (well pumps) will be assumed to pump at firm capacity (i.e., firm groundwater pumping capacity) during a specific fire flow evaluation. Firm groundwater pumping capacity assumes that 20 percent of the City's groundwater wells will be out of service at any given time due to maintenance or operational issues.

These conservative assumptions ensure the reliability and flexibility of the system to provide sufficient flow during emergency fire flow conditions. It is also assumed that the pump stations with only one booster pump or without back-up power capability (either an on-site generator or adaptor for a plug-in generator) will not be available during an emergency fire flow analysis.

6.2.3.2 Peak Hour Demand

Peak hour demand should be met from a combination of supply sources (i.e., treated surface water from the JJWTP and SSJID supplies plus groundwater) and treated water storage reservoirs. Assumptions regarding firm pumping capacity will also apply during a peak hour demand condition. During a peak hour demand condition, the City's water system should be able to meet the recommended system performance criteria (e.g., minimum and maximum system pressures) discussed under *Section 6.2.8 Potable Water Transmission and Distribution Pipeline Sizing and Recommended System Pressures.*

6.2.4 Water Treatment Capacity

Sufficient water treatment capacity from a combination of the existing and/or expanded JJWTP, the City's treated surface water supplies from SSJID, and groundwater wells should be available to meet the City's maximum day demand condition. In addition, the City's goal is to meet maximum day demands without relying on groundwater. Sufficient treated water pumping capacity should also be available to assist in meeting a maximum day demand condition.

6.2.5 Potable Water Storage Capacity

The total potable water storage capacity required will be based on the following three components within each pressure zone:

- Operational Storage
- Fire Storage
- Emergency Storage

A discussion of these three storage components, along with a discussion of "credits" for groundwater supply and treated surface water supply, follows.

6.2.5.1 Operational Storage

Over any 24-hour period, water demands will vary. Typically, higher water demands will occur during the early morning hours when people are irrigating landscape and getting ready to go to work or school. Water demands will then decline to some nominal baseline level (depending on the proximity to water use patterns of adjacent commercial/industrial areas), and will then begin to increase again depending on outside water needs (and corresponding temperature), until it reaches a higher water demand in the early evening hours as people return home from work or school. Throughout the year, the peaks of this cycle will vary according to customer needs; thereby, creating maximum day and peak hour demands.

Typically, water treatment plants, supply turnouts, and/or wells are operated at a constant rate over a 24-hour period (baseline) and augmented by additional flow from storage tanks, and/or wells during high demand periods, as needed. Storage tanks are normally refilled when demands drop below the baseline water production flow rate. The storage volume used to meet these peak demand periods is called operational storage.

The operational storage requirements should be calculated based on the diurnal demand in a particular pressure zone or service area. If sufficient data is not available to develop a diurnal demand, then the recommended volume of water to be held in reserve for operational storage should be at least equal to 30 percent of the total volume of water used on a maximum day demand condition.

6.2.5.2 Fire Storage

As discussed above, fire flow requirements are identified in the CFC. These requirements are based on flow (in gpm), size of building (in square feet), and type of construction (wood frame, metal, masonry, installation of sprinklers, etc.). After a fire flow requirement is established, it is multiplied by the required fire flow duration to produce an estimate of the total volume of fire flow storage required. Table 6-1 presents the recommended fire flow criteria and associated required fire flow storage.

Sufficient fire flow storage should be available for the following simultaneous fire flow events in larger pressure zones (i.e., Zones 1 and 2):

- A Single Family Residential fire flow of 1,500 gpm for a duration of two hours. The resulting volume required for fire flow storage is 0.18 MG
- An Industrial fire flow of 4,000 gpm for a duration of four hours (if sprinklered). The resulting volume required for fire flow storage is 0.96 MG[21]

If unavailable by gravity storage, the fire flow must be supplied with a National Fire Protection Association (NFPA) rated fire pump. If an NFPA rated fire pump is not used, then a pump(s) and motor(s) combination with a backup power source of sufficient capacity to meet the required maximum fire flow and minimum residual pressure requirements, as determined by the Fire Marshal, will be required.

6.2.5.3 Emergency Storage

A reserve of stored water is also required to meet demands during an emergency. An emergency is defined as an unforeseen or unplanned event that may degrade the quality or quantity of potable water supplies available to serve customers. There are three types of emergency events that a water utility typically prepares for:

- Minor emergency. A fairly routine, normal, or localized event that affects a few customers, such as a pipeline break, malfunctioning valve, hydrant break, or a brief power loss. Utilities plan for minor emergencies and typically have staff and materials available to correct them quickly.
- Major emergency. A disaster that affects an entire, and/or large, portion of a water system, lowers the quantity and quality of the water, or places the health and safety of the community at risk. Examples include water treatment plant failures, raw water contamination or major power grid outages. Water utilities infrequently experience major emergencies.
- Natural disaster. A disaster caused by natural forces or events that create water utility emergencies. Examples include earthquakes, forest or brush fires, hurricanes, tornados or high winds, floods, and other severe weather conditions such as freezing or drought that damage or cause water system facilities to not be able to operate.

Determination of the required volume of emergency storage is a policy decision based on the assessment of the risk of failures and the desired degree of system reliability. The amount of required emergency storage is a function of several factors including the diversity of the supply sources, redundancy and reliability of the production facilities, and the anticipated length of the emergency outage. In developing an emergency storage requirement for the City, typical industry standards were used.

[21] Recommended storage does not include volume associated with 500 gpm sprinkler flow (refer to Table 6-1). Assumes a 50 percent reduction in the required fire flow due to the installation of fire sprinklers.

The American Water Works Association (AWWA) states that no formula exists for determining the amount of emergency storage required, and that the decision will be made by the utility based on a judgment about the perceived vulnerability of the system. For this Citywide Water System Master Plan, it has been assumed that the emergency storage requirement will be based on minor emergencies and *specific* major emergency criteria. The 2012 WSMP used an emergency storage volume requirement of two (2) times the average day demand. After reviewing emergency storage criteria for other similar water systems within the region, and taking into account the City's redundant sources of supply (JJWTP, SSJID, and groundwater), it is recommended that the City reduce the minimum quantity of emergency storage volume required to 1.5 times the average day demand for this Citywide Water System Master Plan Update.

6.2.5.4 Groundwater Credit

Based on the City's available groundwater wells, groundwater storage can account for a portion of the recommended emergency storage. The following must be true to use the groundwater supply to offset the need to provide surface storage:

- Groundwater supply is of potable water quality and can be reliably accessed (i.e., wells are equipped with on-site emergency generators)
- Groundwater supply is not already being relied upon to meet the City's average day demand requirements
- Sufficient water distribution facilities are available to distribute this water to demand areas

It will be assumed that only the firm groundwater supply will be available for a groundwater credit to offset the City's emergency storage requirement (i.e., 20 percent of wells could be out of service at any given time).

6.2.5.5 Treated Surface Water Supply Credit

Because the City currently has two independent sources of treated surface water supply (JJWTP and SSJID supplies), some quantity of treated surface water supply capacity can account for a portion of the City's recommended emergency storage. For this Citywide Water System Master Plan, it will be assumed that the smaller of the treated surface water supply sources (SSJID) will be available to offset a portion of the emergency storage requirement. However, the following must be true to use treated surface water supply to offset the need to provide surface storage:

- Treated surface water supply can be reliably accessed (i.e., treated surface water supply facility is equipped with on-site emergency generator)
- Sufficient treated surface water booster pumping facilities are available to distribute this water to demand areas

6.2.5.6 Total Storage Capacity Recommended

The City's recommended potable water storage capacity should be the sum of the following components:

- Operational: Volume of water necessary to meet diurnal peaks observed throughout the day, assumed to be equivalent to at least 30 percent of the maximum day demand
- Fire Flow: Volume of water necessary to supply two simultaneous fire flow events in larger pressure zones (i.e., Zones 1 and 2)
- Emergency: Volume of water necessary to provide 1.5 times an average day demand
- Groundwater Credit: Equal to the firm groundwater supply that can be reliably accessed (facilities equipped with auxiliary power)
- Treated Surface Water Supply Credit: Equal to the smaller of the available treated surface water supply sources (SSJID)

It should be noted that the sum of groundwater and treated surface water supply credits cannot be greater than the recommended emergency storage volume. The amount of total system storage and system peaking capacity required to meet these criteria will change over time as the City continues to grow and potable water demands increase.

6.2.6 Potable Water Pumping Facility Capacity

Sufficient firm water system pumping capacity should be provided to meet the greater of the following two demand conditions within each pressure zone and any additional pressure zone(s), which are provided service from this particular pressure zone.

1. A maximum day demand with two simultaneous fire flow events in larger pressure zones (i.e., Zones 1 and 2 should assume one smaller single family residential fire flow combined with another larger industrial fire flow) with booster pumps and well pumps assumed to operate at firm pumping capacity.
2. A peak hour demand with booster pumps and well pumps assumed to operate at firm pumping capacity.

The highest demand requirement between these two demand conditions sets the water system pumping capacity requirement. However, sufficient pumping capacity should also be provided so that the maximum day demand within each pressure zone can be supplied using firm pumping capacity with no assistance from storage reservoirs.

6.2.7 Potable Water Critical Supply Facilities

Critical pumping facilities are defined as those facilities that provide service to pressure zone(s) and/or service area(s) which do not have sufficient emergency storage available (see *Section 6.2.5.3 Emergency Storage*) and that meet the following criteria:

- The largest pumping facility that provides water to a particular pressure zone and/or service area
- A facility that provides the sole source of water to single or multiple pressure zones and/or service areas
- A pumping facility that provides water from a supply turnout
- A pumping facility that provides water from key groundwater supply wells (depends on capacity, quality and location)

All critical pumping facilities should be equipped with an on-site, back-up power generator. At less critical facilities, a plug-in adapter will be used to allow interconnection to a portable generator, which will be brought to the site by City staff during a prolonged power outage. In addition, portable generator booster connections will be configured at all tank/booster pump locations.

The City should also consider the following policies to make operations of the City's pumping facilities more efficient:

- Install solar power systems, or alternative power sources, at existing and new pump stations and other water system facilities, as feasible, to reduce electrical power consumption.
- Increase the frequency of routine O&M activities for existing pump stations and wells to maintain pump efficiencies and reduce power demands.

6.2.8 Potable Water Transmission and Distribution Pipeline Sizing and Recommended System Pressures

The following criteria will be used as guidelines for sizing new transmission and distribution pipelines. However, the City's existing system will be evaluated on a case–by-case basis. For example, if an existing pipeline experiences head loss in excess of the criteria described below during a maximum day plus fire flow event, this condition, by itself, does not necessarily indicate a deficiency as long as the minimum system pressure criterion is satisfied.

Consequently, the City's existing system will be evaluated using pressure as the primary criterion; and secondary criteria, such as pipeline velocity, head loss, age, and material type, will be used as indicators to locate where water system improvements may be needed.

New transmission and distribution pipelines to serve the City's future service areas should be located within designated utility corridors wherever possible. These designated utility corridors should be within public rights-of-way to minimize or eliminate the need for utility easements within private property.

6.2.8.1 Potable Water Transmission System

Transmission pipelines are generally 18-inches in diameter or larger and should be designed based on the criteria described below for average day, maximum day, and peak hour demand conditions. The criteria reflect industry standards and West Yost's experience working with the City's existing water system.

- Average Day Demand
  - Pressures should be maintained between a maximum of 100 psi[22] and a minimum of 40 psi
  - Maximum velocity within transmission pipelines should be 3 fps
  - Head losses within the transmission system pipelines should be limited to 3 feet per thousand feet (ft/kft) of pipeline
- Maximum Day Demand
  - Pressures should be maintained between a maximum of 100 psi[23] and a minimum of 40 psi
  - The maximum velocity within the transmission system pipelines should be 6 fps
  - Head losses within the transmission system pipelines should be limited to 3 ft/kft of pipeline
- Peak Hour Demand
  - Pressures should be maintained between a maximum of 100 psi[4] and a minimum of 40 psi
  - The maximum velocity within the transmission system pipelines should be 6 fps
  - Head losses within the transmission system pipelines should be limited to 3 ft/kft of pipeline

6.2.8.2 Potable Water Distribution System

Distribution pipelines are generally less than 18-inches in diameter and should be sized based on the criteria described below for average day, maximum day plus fire flow, and peak hour demand conditions. The criteria reflect industry standards and West Yost's experience working with the City's existing water system.

- Average Day Demand
  - Service pressures should be maintained between a maximum of 80 psi[4] and a minimum of 40 psi
  - The maximum velocity within the distribution system pipelines should be 6 fps

[22] A pressure reducing valve will be required on all water services with a static pressure greater than 80 psi.

[23] A pressure reducing valve will be required on all water services with a static pressure greater than 80 psi.

  - Head losses within the distribution system pipelines should be limited to 7 ft/kft of pipeline
- Maximum Day Demand plus Fire Flow
  - The minimum allowable residual pressure should be 20 psi at the flowing fire hydrant during the occurrence of a single fire flow event for smaller pressure zones
  - The minimum allowable residual pressure should be 20 psi at the flowing fire hydrants during the occurrence of two simultaneous fire flow events for larger pressure zones
  - The maximum velocity within the distribution system pipelines should be 12 fps, or the head losses within the distribution system pipelines should be limited to 10 ft/kft of pipeline, whichever criteria is more conservative given the specific hydraulic/system condition
- Peak Hour Demand
  - Service pressures should be maintained between a maximum of 80 psi[24] and a minimum of 40 psi
  - The maximum velocity within the distribution system pipelines should be 8 fps, or the head losses within the distribution system pipelines should be limited to 7 ft/kft of pipeline, whichever criteria is more conservative given the specific hydraulic/system condition

A summary of the recommended potable water system performance and operational criteria is presented in Table 6-2 and reflect typical water system industry standards including the California Safe Drinking Water Act and related laws, and AWWA standards.

[24] A pressure reducing valve will be required on all water services with a static pressure greater than 80 psi.

Table 6-2. Summary of Recommended Potable Water System Performance and Operational Criteria

Component	Criteria	Remarks / Issues
Fire Flow Requirements (flow [gpm] @ duration [hours])		
Single Family Residential	1,500 gpm @ 2 hrs	Existing development will be evaluated on case-by-case basis because of the historical varying standard.
Multi Family Residential	2,500 gpm @ 2 hrs	
Commercial/Office	3,500 gpm @ 4 hrs (with approved automatic sprinkler system)	
Industrial	4,500 gpm @ 4 hrs (with approved automatic sprinkler system)	
Institutional	4,500 gpm @ 4 hrs (with approved automatic sprinkler system)	
Water System Capacity		
Maximum Day Demand plus Fire Flow	Provide firm capacity equal to maximum day demand plus fire flow	Assume two simultaneous fire flow events in larger pressure zones (i.e., Zones 1 and 2).
Peak Hour Demand	Provide firm capacity equal to peak hour demand	
Water Treatment Capacity		
Treated Water Supply Capacity	Provide capacity equal to maximum day demand	--
Treated Surface Water Supply Capacity	Provide capacity equal to maximum month demand	--
Treated Water Pumping Capacity	Provide capacity equal to maximum day demand	--
Water Storage Capacity		
Operational	30 percent of maximum day demand	
Fire	Assume one Single Family Residential fire flow concurrent with a larger Industrial fire flow in larger pressure zones (i.e., Zones 1 and 2)	1,500 gpm @ 2 hrs = 0.18 MG 2,500 gpm @ 2 hrs = 0.30 MG 3,000 gpm @ 4 hrs = 0.72 MG 4,000 gpm @ 4 hrs = 0.96 MG
Emergency	1.5 x average day demand	--
Groundwater Credit (GWC)	Equal to the firm groundwater supply that can be reliably accessed (facilities equipped with auxiliary power)	The maximum combined emergency storage credit is equal to the recommended emergency storage capacity.
Treated Surface Water Credit (TSWC)	Equal to the smaller of the available treated surface water supply sources	
Total Water Storage Capacity	Operational + Fire + Emergency - GWC - TSWC	If possible, total storage should be evaluated by pressure zone.
Pumping Facility Capacity		
Pumping Capacity	Provide the greater of maximum day with two concurrent fire flows in larger pressure zones (i.e., Zones 1 and 2) or peak hour demand within each pressure zone	Assume firm pumping capacity. Sufficient pumping capacity should also be provided so that the maximum day demand can be supplied using firm pumping capacity with no assistance from storage reservoirs.
Backup Power	Equal to the firm capacity of the pumping facility	On-site generator for critical stations.[(a)] Plug-in portable generator for less critical stations.
Water Transmission Line Sizing		
Diameter	18-inches in diameter or larger	Locate new transmission pipelines within designated utility corridors wherever possible.
Average Day Demand Condition	--	Criteria based on requirements for new development, existing transmission mains will be evaluated on case-by-case basis. Evaluation will include review of age, material type, velocity, head loss, and/or pressure.
Minimum Pressure [psi]	40 psi	
Maximum Pressure [psi]	100 psi	
Maximum Head loss [ft/kft]	3 ft/kft	
Maximum Velocity [fps]	3 fps	
Maximum Day Demand Condition	--	
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/kft]	3 ft/kft	
Maximum Velocity [fps]	6 fps	
Peak Hour Demand Condition	--	
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/kft]	3 ft/kft	
Maximum Velocity [fps]	6 fps	
Hazen Williams "C" Factor	130	For consistency in hydraulic modeling.
Pipeline Material	Ductile Iron	
Water Distribution Line Sizing		
Diameter	Less than 18-inches in diameter	Must verify pipeline size with maximum day plus fire flow analysis. Locate new distribution pipelines within designated utility corridors wherever possible.
Average Day Demand Condition	--	Criteria based on requirements for new development, existing distribution mains will be evaluated on case-by-case basis. Evaluation will include review of age, material type, velocity, head loss, and/or pressure.
Minimum Pressure [psi]	40 psi	
Maximum Pressure [psi]	80 psi	
Maximum Head loss [ft/kft]	7 ft/kft	
Maximum Velocity [fps]	6 fps	
Maximum Day w/ Fire Flow Demand Condition	--	
Minimum Pressure [psi]	20 psi for a single fire flow event in smaller pressure zones; 20 psi for two simultaneous fire flow events in larger pressure zones	
Maximum Head loss [ft/kft]	10 ft/kft	
Maximum Velocity [fps]	12 fps	
Peak Hour Demand Condition	--	
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/kft]	7 ft/kft	
Maximum Velocity [fps]	8 fps	
Minimum Pipeline Diameter	--	--
General	8-inches	--
Industrial	12-inches	--
Distribution to cul-de-sac / dead-end street	6-inches	Permanent dead end runs shall be no longer that 250 feet unless in a cul-de-sac.
Distribution to fire hydrants	8-inches	--
Hazen Williams "C" Factor	130	For consistency in hydraulic modeling.
Pipeline Material	Ductile Iron	
Maximum Water Service Pressure	80 psi	Install PRV if service pressure is greater than 80 psi.

(a) A pumping facility is defined as critical if it provides service to pressure zone(s) and/or service area(s) which do not have sufficient emergency storage, and that meet the following criteria:

- The largest facility that provides water to a particular pressure zone and/or service area;
- A facility that provides the sole source of water to single or multiple pressure zones and/or service areas;
- A facility that provides water from a supply turnout; or
- A facility that provides water from key groundwater supply wells (depends on capacity, quality and location).

6.3 RECYCLED WATER SYSTEM

Components of the recommended performance and operational criteria for the City's backbone recycled water system are discussed below.

6.3.1 Recycled Water Demand Condition Evaluation

A peak hour demand condition during an 8-hour irrigation period will be used to assess the adequacy of the City's recycled water system.

6.3.2 Recycled Water Treatment Capacity

Sufficient recycled water treatment capacity should be available to meet the City's maximum day recycled water demand condition.

6.3.3 Recycled Water Storage Capacity

The total recycled water storage capacity required will be based on the following components:

- Seasonal Storage
- Operational Storage

A discussion of these two storage components follows.

6.3.3.1 Seasonal Storage

As described in Chapter 4, landscape irrigation demands are highest during the summer months (when plant evapotranspiration rates are high) and very low during the winter months. Demand for recycled water supplies to meet these seasonally varying demands will also vary month to month, depending on the specific climatic conditions that are occurring. Therefore, some seasonal storage may have to be provided to store recycled wastewater generated during low irrigation demand periods for use during the high summer demand periods. The actual quantity of seasonal storage required, if any, will be determined using an annual water balance between total recycled water supply available and the total seasonal recycled water demand.

6.3.3.2 Operational Storage

Sufficient operational storage should be provided to supply the demands of an eight-hour irrigation period during a maximum summer month demand condition, with a 10 percent demand increase occurring for one hour (i.e., peak hour) during the irrigation period. Due to concerns about water quality, it is recommended that this operational storage be entirely stored within an enclosed reservoir or tank system to limit exposure to potential contaminant sources after treatment, but before distribution and direct use.

6.3.3.3 Total Storage Capacity

The City's recommended recycled water storage capacity should be the sum of the following components:

- Seasonal: Volume of recycled water necessary to balance the required annual recycled water demands with the annual recycled water supply available
- Operational: Volume of recycled water necessary to supply the demands of an eight-hour irrigation period during a maximum summer month demand condition, with a 10 percent demand increase occurring for one hour

The amount of total system storage and system peaking capacity required to meet these criteria will change over time as the City continues to grow and recycled water demands increase.

6.3.4 Recycled Water Pumping Facility Capacity

Sufficient pumping capacity should be provided to meet the City's peak hour recycled water demand condition within each pressure zone and any additional pressure zone(s), which are provided service from this particular pressure zone.

6.3.5 Recycled Water Transmission Pipeline Sizing and Recommended System Pressures

Backbone recycled water system transmission pipelines are generally 16-inches in diameter or larger and should be designed based on the criteria described below for a peak hour demand condition.

- Peak Hour Demand
  - Service pressures should be maintained between a maximum of 100 psi and a minimum of 60 psi
  - The maximum velocity within the transmission system pipelines should be 10 fps; however, a pipeline velocity of 6 fps is desirable

A summary of the recommended recycled water system performance and operational criteria is presented in Table 6-3.

Table 6-3. Summary of Recommended Recycled Water System Performance and Operational Criteria

Component	Criteria	Remarks / Issues
Demand Condition Evaluation		
Peak Hour Demand	Provide capacity equal to peak hour demand during an 8-hour irrigation period	--
Recycled Water Treatment Capacity		
Recycled Water Treatment Capacity	Provide capacity equal to a maximum day demand	--
Recycled Water Storage Capacity		
Seasonal	Equal to volume required to balance the annual demands with the annual supply available	--
Operational	Equal to volume required to supply the demands of an eight-hour irrigation period during a maximum summer month with a 10 percent demand increase occurring for one hour	--
Total Water Storage Capacity	Seasonal + Operational	--
Pumping Facility Capacity		
Pumping Capacity	Provide capacity equal to peak hour demand within each pressure zone	Firm pumping capacity will not be required.
Recycled Water Transmission Line Sizing		
Diameter	16-inches in diameter or larger	--
Peak Hour Demand Condition	--	--
Minimum Pressure [psi]	60 psi	--
Maximum Pressure [psi]	100 psi	--
Maximum Velocity [fps]	10 fps	Pipeline velocity of 6 fps is desirable.
Hazen Williams "C" Factor	130	For consistency in hydraulic modeling.
Pipeline Material	C-900 PVC	

CHAPTER 7
Existing Potable Water System Evaluation

7.1 OVERVIEW

The purpose of this chapter is to first describe the City's existing potable water distribution system, including the corresponding hydraulic model update. Existing water system information was updated through the review of previous reports, maps, plans, record drawings, operation records, GIS files, and other available data provided to West Yost by City staff. Using this information, the City's current hydraulic model was then updated to represent the existing potable water system.

The remainder of the chapter presents an evaluation of the City's existing potable water distribution system and its ability to meet the recommended performance and operational criteria (previously described in Chapter 6) under existing water demand conditions. The evaluation includes an analysis of water storage capacity, pumping capacity, and the existing water system's ability to meet recommended water system performance and operational criteria under peak hour demand and maximum day demand plus fire flow scenarios. This evaluation does not include a condition assessment of the City's existing water system assets and does not cover replacement of existing infrastructure due to age or physical deterioration.

Evaluations, findings, and recommendations for addressing any deficiencies identified within the existing potable water distribution system are included. Recommendations were used to develop a Capital Improvement Program (CIP), which includes an estimate of probable construction costs. The recommended existing potable water system CIP is described further in Chapter 10.

The following sections of this chapter describe the components of the City's existing potable water distribution system evaluation:

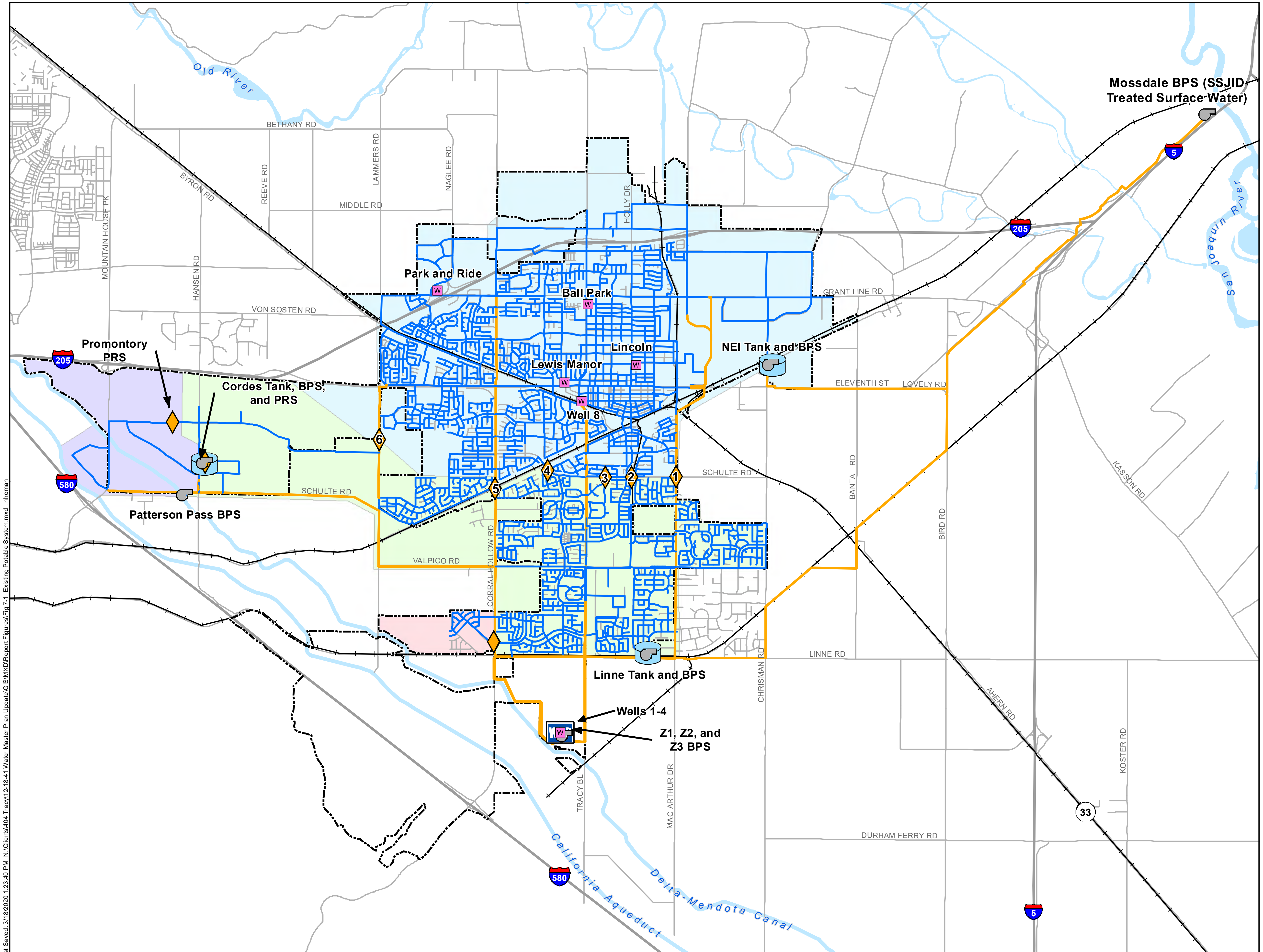
- Description of Existing Potable Water System Facilities
- Hydraulic Model Update
- Existing Potable Water System Evaluation
- Summary of Recommended Existing Potable Water System Improvements

7.2 DESCRIPTION OF EXISTING POTABLE WATER SYSTEM FACILITIES

This section provides a summary of the City's existing potable water system facilities. The City's existing potable water system facilities are located throughout the water service area as shown on Figure 7-1. Additional details regarding each facility are presented below.

7.2.1 John Jones Water Treatment Plant

The City's JJWTP is located just north of the DMC in the southern portion of the City as shown on Figure 7-1. The JJWTP was originally constructed in 1979, expanded in 1988, and then expanded again in 2008. It currently has a treatment capacity of 30 mgd.



0 2,750 5,500

Scale in Feet

Symbology

- Pressure Regulating Station
- Booster Pump Station
- Groundwater Well
- Storage Tank
- John Jones Water Treatment Plant

Pipeline Diameter

- Less than 18-inches
- Greater than or equal to 18-inches

Pressure Zone

- Zone 1
- Zone 2
- Zone 3 (IPC/PPBP)
- Ellis Reduced Zone
- City Limits

Notes:
1. All facilities included in the existing system hydraulic model are shown. Not all existing facilities were included in the model. See Section 7.3.2 for details.
2. Pressure Zones represent the approximate boundaries after the IPC zone split is implemented.
3. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
4. Lewis Manor Well is currently inactive.

Figure 7-1

Existing Potable Water System Facilities

City of Tracy
Water System Master Plan Update

The most recent expansion added treatment through granulated activated carbon and ultraviolet light disinfection. Granulated activated carbon removes dissolved organic compounds contained in the water, and ultraviolet light disinfection provides an additional level of treatment. Several new process upgrades including new flocculation/sedimentation basins, washwater basins, and chemical addition facilities were also added during the expansion. The site plan, process schematic, and hydraulic profile from the JJWTP Expansion Project is provided in Appendix B.

The City operates three surface water intake pumps at the JJWTP with the capacity to pump a total of approximately 27 mgd of raw surface water from the DMC to the JJWTP for treatment. The key characteristics of the existing surface water intake pumps are summarized in Table 7-1.

Table 7-1. Existing Surface Water Intake Pumps[(a)]

Intake Pump Name	Year Installed	Production Capacity, mgd	Pump Type	Motor Horsepower	Motor Type
Pump No. 1	2008	14[(b)]	Vertical Turbine	150	VFD[(c)]
Pump No. 2	2008	14[(b)]	Vertical Turbine	150	VFD[(c)]
Pump No. 3	2008	14[(b)]	Vertical Turbine	150	VFD[(c)]

(a) Source: JJWTP Expansion Project, Sheet G-8 (Carollo Engineers).
(b) Intake pumps were designed for 15 mgd. However, testing of the installed pumps determined that the actual production capacity of each pump is 14 mgd. In addition, due to the hydraulics of the JJWTP intake, the maximum intake pumping capacity with all three pumps running is 27 mgd.
(c) Variable Frequency Drive.

7.2.2 South County Water Supply Project

The City, in partnership with the cities of Manteca, Lathrop and Escalon, and SSJID, constructed a new surface water treatment plant near Woodward Reservoir in Stanislaus County and new transmission pipelines to deliver treated surface water to each city. The City's treated surface water allocation from the SCWSP is 17 mgd of treatment capacity and 11,120 af/yr of water supply.

Treated surface water from the surface water treatment plant located near Woodward Reservoir is conveyed to the City through a dedicated 36-inch diameter transmission main and pumped to the City by the Mossdale Pump Station located at the intersection of Manthey and Stewart Roads (see Figure 7-1). Water pumped from the Mossdale Pump Station first fills the City's Linne and NEI storage tanks through 18-inch and 30-inch diameter transmission mains before being pumped into the City's distribution system to serve system demands. The Mossdale Pump Station is operated by SSJID.

7.2.3 Groundwater Wells

The City currently has eight groundwater production wells that provide the City's potable water system with groundwater supply. Currently, the Lewis Manor Well is inactive due to high levels of manganese. As discussed in Chapter 5, a ninth well, Well 8, was constructed in 2004 to be used for the City's ASR Program, but can also be used as an extraction well to serve water demands directly under normal and/or emergency conditions.

The groundwater wells located at the JJWTP (Wells 1-4) pump directly into the Chlorine Contact Basin or Clearwell #2, where the groundwater is blended with the finished surface water and chlorinated prior to distribution. Groundwater from the other remaining wells located in Zone 1 is chlorinated at each well site and pumped directly into the distribution system.

The locations of these existing groundwater wells are shown on Figure 7-1. Table 7-2 presents a summary of these existing groundwater well facilities with key characteristics such as design capacity and age.

Table 7-2. Existing Groundwater Wells

Well Name/Number	Well Location/Address	Year Drilled	Total Well Depth (Casing Depth), ft	Casing Diameter, inches	Depth of Perforated Zone, ft[a]	Design Capacity, gpm	Production Capacity, mgd
Well 1	JJWTP	1986	1,010 (1,000)	16"	450-550 580-980	1,500	2.2
Well 2	JJWTP	1989	990 (870)	16"	420-850	2,000	2.9
Well 3	JJWTP	1989	1,020 (900)	16"	420-890	2,000	2.9
Well 4	JJWTP	1989	1,020 (950)	16"	380-940	2,000	2.9
Lincoln Well	Lincoln Park	1990	1,000 (1,000)	16"	490-980	2,500	3.6
Well 5[b] (Lewis Manor Well) (Currently Inactive)	902 Twelfth Street (north of Eleventh Street between Tracy Boulevard and Corral Hollow Road)	2000	1,015 (1,000)	18"	410-480 601-630 650-670 805-830 900-930 965-990	2,500	3.6
Well 6 (Park& Ride Well)	2650 North Naglee Road (North of I-205 adjacent to West Valley Mall)	2001/02	1,250 (1,216)	18"	550-598 610-636 656-678 738-754 774-796 966-982 1,014-1,122 1,176-1,196	2,000	2.9
Well 7 (Ball Park Well)	2001 Bessie Avenue (east of Tracy Boulevard south of Grant Line Road)	2002	1,070 (894)	18"	550-598 570-732 850-874	2,500	3.6
Well 8[c]	Tracy Boulevard and Sixth Street	2004	850 (850)	18"	370-460 510-640 680-820	2,500	3.6

(a) Source: GEI Consultants, Summary of Groundwater Conditions November 2007 through November 2008, dated January 23, 2009.
(b) Well is currently inactive due to high manganese levels.
(c) Well 8 can be operated as an injection/extraction well as part of the City's ASR Program.

7.2.4 Water Storage Facilities

The City currently operates five treated water storage reservoirs (two clearwells and three storage tanks). Table 7-3 presents a summary of these existing storage facilities with key characteristics such as storage capacity and age. As shown, the City currently has a total potable water storage capacity of approximately 16.2 MG. However, Clearwell #1 operates as a chlorine contact basin and cannot be counted as system storage capacity. Therefore, the total available potable water storage capacity is reduced to approximately 15.5 MG. The locations of the City's three storage tanks are shown on Figure 7-1 (the two clearwells are located at the JJWTP).

Table 7-3. Existing Treated Water Storage Facilities

Storage Facility Name	Storage Type	Material	Year Constructed	Storage Capacity, MG
Clearwells				
#1[(a)]	Partially Buried Tank	--	1978	0.66
#2[(b)]	Partially Buried Tank	--	1987	4.0
Storage Tanks				
Linne	Fully Buried Tank	Concrete	2005	7.1
NEI	Partially Buried Tank	Concrete	2002	2.4
Cordes	Partially Buried Tank	Concrete	2015[(c)]	2.0
			Total Storage Capacity, MG	**16.2**
			Total Available Storage Capacity, MG	**15.5[(d)]**

(a) Clearwell #1 has a design capacity of 1.0 MG, but it has been reduced to 0.66 MG due to the weir within Clearwell #1. Also known as the Chlorine Contact Basin.
(b) Clearwell #2 has a design capacity of 5.6 MG, but it has been reduced to 4.0 MG due to the weir within Clearwell #1.
(c) Although it was constructed in 2015, the Cordes Tank was not put into service until November 2019.
(d) Does not include Clearwell #1 as it is operated as a Chlorine Contact Basin and cannot be counted as system storage capacity.

7.2.5 Booster Pump Stations

The City currently has eight booster pump stations.[25] The locations of these existing booster pump stations are shown on Figure 7-1 (Zone 1, Zone 2, and Zone 3 booster pump stations are located at the JJWTP). Table 7-4 presents a summary of the existing booster pump stations with key characteristics such as design capacity and number of booster pumps.

The booster pumps located at the JJWTP pump treated surface water supply (from USBR) stored in Clearwell #2 into the City's potable water system. The booster pumps located at the Linne and NEI storage tanks pump treated surface water supply (from SSJID) stored in their respective storage tanks into the City's potable water system. The Cordes Booster Pump Station (BPS) pumps treated surface water supply from the Cordes Tank and serves customers located in the PPBP and the IPC development.

[25] The Patterson Pass Booster Pump Station is inactive since the Cordes Booster Pump Station is now operating. The Zone 4 Booster Pump Station is operational, but is not included in the existing system evaluation because Zone 4 has just started development.

Table 7-4. Existing Booster Pump Stations											
Booster Pump Station Name	Location	Year Installed	Pump 1, gpm	Pump 2, gpm	Pump 3, gpm	Pump 4, gpm	Pump 5, gpm	Pump 6, gpm	Rated Capacity[(a)], gpm	Firm Capacity[(b)], gpm	Firm Capacity[(b)], mgd
Zone 1[(c)]	JJWTP	2000	12,000	12,000					24,000	12,000	17.3
Zone 2[(c)]	JJWTP	1987	3,300	6,700	6,700	3,300			20,000	13,300	19.2
Zone 3	JJWTP	2018	2,600	2,600	370				5,570	2,970	4.3
Zone 4[(d)]	JJWTP	2018	1,225	1,225	1,225	--[(e)]			3,675	2,450	3.5
Linne[(c)]	Linne Tank	2005	4,865	4,865	4,865	4,865			19,460	14,595	21.0
NEI[(c)]	NEI Tank	2001	1,400	1,400	1,400	1,400			5,600	4,200	6.0
Patterson Pass[(c,f)]	Schulte Road, west of Hansen Road	2010	1,000	1,000	1,000	1,000			4,000	3,000	4.3
Cordes[(c)]	Cordes Tank	2015[(g)]	675	675	1,600	1,600	1,600	1,600	7,750	6,150	8.9

(a) Maximum pumping capacity of entire pump station.

(b) Assumes that the largest booster pump at the pump station is offline.

(c) Pumps are equipped with variable frequency drives.

(d) Existing potable water system infrastructure for Zone 4 is not shown on Chapter 7 figures because Zone 4 has just started development and was not included in the existing system evaluation.

(e) The City plans to add a fourth 1,225 gpm pump to the Zone 4 BPS in the future.

(f) Patterson Pass BPS is currently on standby and will eventually be decommissioned.

(g) Although it was installed in 2015, the Cordes BPS was not put into service until November 2019.

7.2.6 Pressure Regulating Stations

The City currently has ten pressure regulating stations (PRS) and two pressure reducing valves (PRV) as shown on Figure 7-1 (Zone 4 PRS and Northington Drive PRV are not shown because the areas served by these facilities have just started development). All of the PRS except the Cordes PRS and Promontory Parkway PRS are currently active. Once the IPC zone split occurs (see Section 7.2.7), these two PRS will be placed into service. The IPC zone split will permanently convert several of the existing buildings in the IPC development to be served directly from Zone 2 (these buildings are currently served by Zone 3 in the interim).

Each PRS contains a valve which is used to regulate flow into the downstream pressure zone or sustain pressure within the upstream pressure zone depending on the system pressures within each pressure zone. Each PRS can operate in two different modes:

- Pressure Sustaining Valve (PSV) – The valve will maintain a specified pressure in the upstream pressure zone. If the pressure increases above the valve's set point, the valve will open and release water into the downstream pressure zone.
- Pressure Reducing Valve (PRV) – The valve will allow flow into the downstream pressure zone if the pressure in the downstream pressure zone falls below a specified set point. When the pressure is below the valve's set point, the valve will remain open until the pressure increases.

Although the stations can operate in two different ways, most stations primarily operate in one of the two modes. The primary function of PRS #1 – #6, the Summit Drive PRS, and the Zone 4 PRS is that of a PSV, while the primary function of the Cordes PRS and the Promontory Parkway PRS will be that of a PRV. The two PRVs (Summit Drive and Northington Drive) can only operate in the pressure reducing mode. Table 7-5 presents a summary of these existing pressure regulating stations and pressure reducing valves with key characteristics such as upstream and downstream pressure zones, valve size, and pressure setting.

Table 7-5. Existing Pressure Regulating Stations and Pressure Reducing Valves					
Facility Name	Upstream Pressure Zone	Downstream Pressure Zone	Valve Size, inches	Elevation, ft	Pressure Setting (upstream/ downstream), psi
Pressure Regulating Station					
#1	Zone 2	Zone 1	12	63.67	83/56
#2	Zone 2	Zone 1	8	66.57	79/53
#3	Zone 2	Zone 1	6	71.19	78/52
#4	Zone 2	Zone 1	10	64.53	80/54
#5	Zone 2	Zone 1	12	68.29	79/53
#6	Zone 2	Zone 1	12	69.0	78/54
Summit Drive	Zone 3	Zone 2	10	160.0	100/60
Cordes[(a)]	Zone 3	Zone 2	16	147.8	76/36
Promontory Parkway[(a)]	Zone 3	Zone 2	12	149.0	75.5/35.5
Zone 4[(b)]	Zone 4	Zone 3	8	204.5	105/90
Pressure Reducing Valve					
Summit Drive	Zone 3	Ellis Reduced Zone	12	160.0	--/70
Northington Drive[(c)]	Zone 3	Ellis Reduced Zone	12	164.0	--/70

(a) Cordes PRS and Promontory Parkway PRS are currently inactive. They will be placed into service when the IPC zone split occurs.
(b) Existing potable water system infrastructure for Zone 4 is not shown on Chapter 7 figures because Zone 4 has just started development and was not included in the existing system evaluation.
(c) Northington Drive PRV is not shown on Chapter 7 figures because it was not included in the existing system evaluation.

7.2.7 Pressure Zone Boundaries

The City's existing potable water system consists of four interconnected pressure zones (Zone 1, Zone 2, Zone 3, and Ellis Reduced Zone) which are isolated from each other by pressure regulating stations, pressure reducing valves, and closed system valves. Zone 3 (previously called City-Side Zone 3) is currently split into two isolated portions: one which serves the Ellis Reduced Zone, and one which serves the International Park of Commerce and the Patterson Pass Business Park (Zone 3 - IPC/PPBP). A fifth pressure zone, Zone 4 (previously called Tracy Hills Zone 3), has just started development and is therefore not included in this existing system evaluation. Note that documents produced prior to this WSMP Update refer to these pressure zones using the old nomenclature.

Zone 1 extends from the northern City limits south to Schulte Road and is the most developed of the four pressure zones. Therefore, it has more transmission pipelines to convey water throughout the zone. Zone 1 is primarily served from the 36-inch diameter transmission main in Tracy Boulevard either by gravity or via the Zone 1 BPS, and from the NEI Tank and BPS located at the eastern edge of Zone 1. There are also two major water transmission mains located on the east and west sides of Zone 1 which help distribute water to the lower elevations of the zone: an 18-inch diameter transmission main in Corral Hollow Road and a 20-inch diameter transmission main in MacArthur Drive. During periods of peak demand or in an emergency, Zone 1 can also be served by the five groundwater wells located within Zone 1 or by Zone 2 facilities via PRS #1-#6.

Zone 2 extends from Schulte Road south to Linne Road and is mostly comprised of residential and light industrial land use. Water demands in Zone 2 are primarily served by the 24-inch diameter transmission main in Corral Hollow Road, which extends from the Zone 2 BPS at the JJWTP north and west towards Patterson Pass BPS and the IPC, and by the Linne Tank and BPS.

The Ellis Reduced Zone currently consists of the Ellis Specific Plan development located south of Valpico Road and west of Corral Hollow Road. The Ellis Reduced Zone is served by the 20-inch diameter Zone 3 transmission main in Corral Hollow Road which extends from the Zone 3 BPS at the JJWTP to the intersection of Middlefield Drive and Corral Hollow Road.

The Zone 3 - IPC/PPBP pressure zone currently includes the PPBP (*i.e.,* Safeway and Costco) and all of the existing IPC development. This zone is currently served by the Cordes BPS, which supplies water from the Cordes Tank. The Cordes Tank is filled by the Zone 2 transmission mains in Schulte Road and Hansen Road. As discussed above, although all of the IPC development is currently served by Zone 3 – IPC/PPBP, several of the existing buildings are located within the Zone 2 elevation range. The City plans to split the existing IPC water distribution system into two portions: one served by Zone 2 and one served by Zone 3 - IPC/PPBP. To accomplish this, the 16-inch diameter pipeline in Promontory Parkway between Hansen Road and Lammers Road, which is currently constructed but not active, will placed into service as a Zone 2 pipeline. The Cordes PRS and Promontory Parkway PRS (both currently inactive) will be activated to provide support to Zone 2 from Zone 3 in the event of an emergency. This IPC zone split is expected to occur in the spring or summer of 2020.

Figure 7-1 shows the approximate boundaries of each pressure zone after the IPC zone split occurs. A schematic of the City's potable water system is provided in Appendix C. Table 7-6 provides a summary of the existing pressure zone boundaries with key characteristics such as service elevations and static pressure ranges.

Table 7-6. Existing Pressure Zone Boundaries

Pressure Zone	Nominal Hydraulic Grade, ft	Nominal Range of Service Elevations, ft	Static Pressure Range, psi	Supply Sources
Zone 1	195	0 - 75	40 - 75	JJWTP via 36-inch Main, NEI Tank, Wells, and Pressure Regulating Stations
Zone 2	270	75 - 150	40 - 85[(a)]	JJWTP via Zone 2 Pumps and Linne Tank
Zone 3 - IPC/PPBP (formerly City-Side Zone 3)	368	150 - 245	55 - 95[(a)]	Cordes Tank via Zone 2
Ellis Reduced Zone	323	140 - 185	60 - 80	JJWTP via Zone 3 Pumps

(a) Per the California Plumbing Code, services which experience pressures exceeding 80 psi are required to be fitted with a pressure reducing valve.

7.2.8 Transmission and Distribution System Pipelines

Based on the City's existing hydraulic model, there are approximately 280 miles of existing pipelines in the City's water service area.[26] Pipelines in the existing potable water distribution system range from 4 to 42-inches in diameter. Pipeline materials consist mainly of asbestos cement (AC), cast iron (CI), and ductile iron (DI). The City's existing transmission and distribution system pipeline network is shown on Figure 7-1[27].

7.2.9 SCADA System

The City has a SCADA (Supervisory Control and Data Acquisition) system installed to provide for remote operation and monitoring of its facilities. Most of the major existing distribution facilities have SCADA installed except for PRS #1-#6. Well 8 has SCADA installed, but cannot be remotely operated by the SCADA system.

7.3 HYDRAULIC MODEL UPDATE

A computer simulation model (hydraulic model) transforms information about the physical system into a mathematical model that solves for various demand conditions. The hydraulic model then generates information on pressure, flow, velocity and head loss that can be used to analyze system performance and identify system deficiencies. A hydraulic model can also be used to verify the adequacy of recommended or proposed system improvements.

The City currently has a hydraulic model developed to simulate its potable water system performance. As part of this Citywide Water System Master Plan Update, an update of the current potable water system hydraulic model was performed to ensure that the hydraulic model accurately reflects the City's existing water system. This section summarizes the tasks completed to update the City's current hydraulic model of its potable water distribution system.

7.3.1 Existing Hydraulic Model Description

The City's current hydraulic model of its existing potable water system was last comprehensively updated for the 2012 Citywide Water System Master Plan. Since then, West Yost has been frequently updating the City's hydraulic model with new and proposed facilities to perform developer studies and other water system analyses requested by the City. The resulting developer hydraulic model contains existing facilities from the 2012 WSMP, existing facilities constructed since the 2012 WSMP was completed, and proposed facilities which have not yet been constructed.

For this Citywide Water System Master Plan Update, West Yost first reviewed the developer hydraulic model and coordinated with the City to determine which system facilities and pipelines have actually been constructed since the 2012 WSMP. Existing facilities which have been

[26] The City's existing hydraulic model is not an all pipes model; therefore, the exact length of existing system pipelines is not known.

[27] Pipelines not included in the existing system evaluation are not shown on Figure 7-1. This includes all existing Zone 4 pipelines as well as some existing pipelines in the IPC and the Ellis Specific Plan developments (these pipelines are included in the future system evaluation which is described in Chapter 8).

constructed since the 2012 WSMP were reviewed to ensure that they accurately represented existing conditions and were incorporated into the existing potable water system model. This task is discussed in more detail below.

7.3.2 Review of Existing Water System Facilities

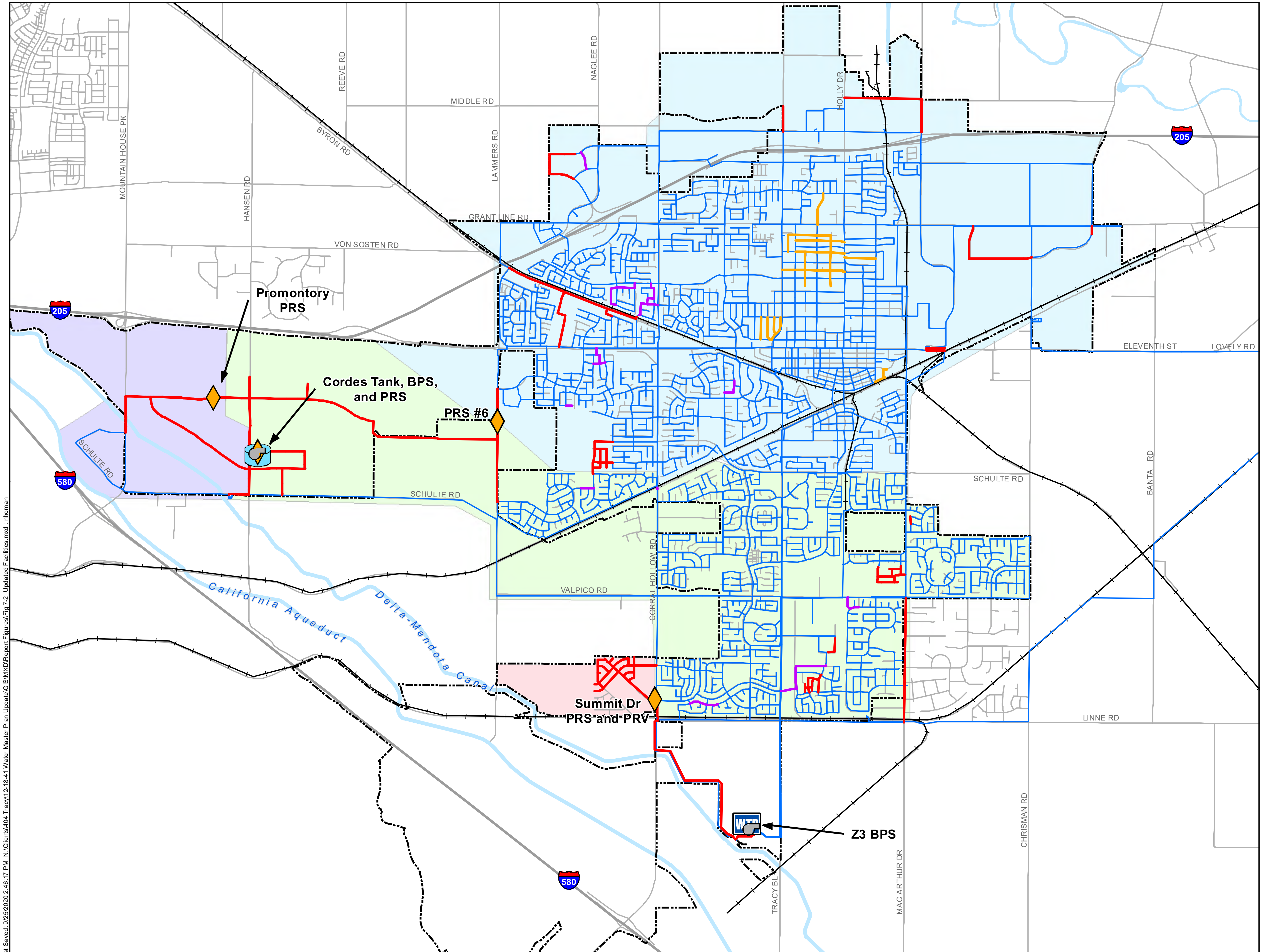
Based on a review of the available facilities data on the existing potable water system, which was provided to West Yost by City staff, the following facilities have been added or revised in the City's existing system hydraulic model since the 2012 WSMP:

- PRS #6 and major 20-inch diameter transmission main in Lammers Road
- 24-inch diameter transmission main in MacArthur Drive
- Cordes Tank, BPS, and PRS
- Major IPC development pipelines
- Promontory Parkway PRS
- Zone 3 BPS
- Zone 3 transmission main in Corral Hollow Road
- Ellis Specific Plan development pipelines
- Summit Drive PRS and PRV
- Other various new pipeline improvements
- Pipelines with incorrect diameters or alignments

As discussed below (see Section 7.4.1), potable water demands for the existing system hydraulic model were allocated based on 2017 meter data. Therefore, some facilities which serve water to areas without demands in 2017 were not included in the existing system hydraulic model (but are included in the future system hydraulic model described in Chapter 8). These facilities include:

- Zone 4 infrastructure, including the Zone 4 BPS, Zone 4 PRS, and major transmission and distribution pipelines
- Northington Drive PRV
- Some pipelines in the IPC development
- Some pipelines in the Ellis Specific Plan development

Figure 7-2 illustrates the locations of the new and revised facilities that were incorporated into the current hydraulic model to accurately represent the City's existing potable water distribution system.



0 2,000 4,000
Scale in Feet

Symbology

- New Pressure Regulating Station
- New Booster Pump Station
- New Storage Tank
- John Jones Water Treatment Plant
- New Pipeline Constructed Since the 2012 WSMP
- Added Pipeline (for Model Refinement)
- Updated Pipeline (for Model Refinement)
- Previously Modeled Pipeline from 2012 WSMP

Pressure Zone

- Zone 1
- Zone 2
- Zone 3 (IPC/PPBP)
- Ellis Reduced Zone
- City Limits

Notes:
1. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.

TRACY

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Figure 7-2

New and Revised Existing System Facilities

City of Tracy
Water System Master Plan Update

7.3.3 Review of Existing Water System Operations

The hydraulic model was last calibrated as part of the model update performed for the 2012 WSMP. Recalibration of the model was not considered necessary for this update, since the majority of pipelines added to the hydraulic model since the last update are new pipelines with known roughness factors. However, West Yost coordinated with City operations staff to confirm that the model accurately reflects existing and planned facility operations. Key changes made to facility operations since the 2012 WSMP include the following:

- In the decade after delivery of SSJID water to the City began, the City preferentially used SSJID water over USBR water to supply its customers. During these years, the JJWTP would shut down for long periods in the winter. However, in recent years the City has begun to use a more balanced mix of USBR and SSJID water.
- The Zone 1 BPS at the JJWTP has been seldom used in recent years due to decreased water demands.
- The City's wells are primarily used as backup sources of supply in the summer.
- The Lewis Manor well is inactive due to high manganese levels.
- The Cordes Tank and BPS now serve Zone 3 IPC/PPBP, and the Patterson Pass BPS (which previously served the same area) has been placed on standby.
- The Zone 3 BPS now serves the Ellis Reduced Zone.
- Booster pump station VFD settings have been adjusted since the 2012 WSMP.

Controls in the existing system hydraulic model have been updated to reflect these operational changes.

In addition, controls in the existing system hydraulic model were updated to reflect system operation changes which will occur in the next year (2020) after the planned IPC zone split is implemented. Key changes made to facility operations to reflect the IPC zone split include:

- Activating the 16-inch diameter pipeline in Promontory Parkway between Hansen Road and Lammers Road
- Activating the Cordes PRS and Promontory Parkway PRS
- Closing and opening valves to isolate Zone 2 and Zone 3 – IPC/PPBP from each other

7.4 EXISTING POTABLE WATER SYSTEM EVALUATION

This section presents the evaluation of the City's existing potable water distribution system and its ability to meet the City's recommended performance and operational criteria (previously presented in Chapter 6) under existing demand conditions. This evaluation includes an analysis of existing surface water treatment capacity, storage capacity, pumping capacity, and a hydraulic analysis of the water system's performance under maximum day demand plus fire flow and peak hour demand scenarios. Recommended improvements for addressing any identified existing potable water distribution system deficiencies are summarized in *Section 7.5 Summary of Recommended Existing Potable Water System Improvements*.

7.4.1 Existing Potable Water Demands

The water demands in the City's water system model were previously allocated based on spatially-located 2006 meter data and scaled up using the City's 2007 water production data. For this Citywide Water System Master Plan Update, the previous water demands were updated based on spatially-located 2017 meter data. The location of allocated water meters is shown on Figure 7-3. Allocated demands located in PPBP and IPC were scaled up to the total recorded flow through the Patterson Pass BPS in 2017 to account for water loss and construction meters. Because this area of the City has been growing rapidly, recent water production data was considered the most representative of existing water use in the PPBP and IPC. Allocated demands in all other areas were scaled up to the City's average water production from 2005 through 2013. Due to the recent drought and associated conservation measures, water production data from 2014 through 2017 were considered less representative of existing water use in these areas. Table 7-7 summarizes the City's existing potable water demands by pressure zone.

Table 7-7. Existing Potable Water Demands by Pressure Zone

Pressure Zone		Average Day Demand[a]		Maximum Day Demand[b]		Peak Hour Demand[c]	
		gpm	mgd	gpm	mgd	gpm	mgd
Zone 1		7,124	10.3	12,111	17.4	20,660	29.8
Zone 2[d]		3,856	5.6	6,555	9.4	11,182	16.1
Zone 3	PPBP[e]	392	0.6	667	1.0	1,138	1.6
	IPC[f]	26	0.04	44	0.1	75	0.1
Ellis Reduced Zone		18	0.03	31	0.0	53	0.1
Total		**11,417**	**16.4**	**19,408**	**27.9**	**33,108**	**47.7**

(a) Based on spatially located 2017 water meter data. Meters located in PPBP and IPC were scaled up to represent recent (2017) data from the Safeway meter (796 af/yr). All other meters were scaled up to represent the City's average water production from 2005 - 2013 (17,620 af/yr).
(b) Maximum day demand is 1.7 times the average day demand.
(c) Peak hour demand is 2.9 times the average day demand.
(d) Includes water demands from IPC water meters that will be served by Zone 2 after the IPC zone split (FedEx and Medline buildings).
(e) Water demands from PPBP are not included in the City's water production totals because the water supply for this area is purchased by PPBP from the Byron Bethany Irrigation District. However, the City is responsible for providing water treatment and delivery services to PPBP.
(f) Excludes water demands from IPC water meters that will be served by Zone 2 after the IPC zone split. Includes demands from Amazon, Smucker's, and Buildings 3 and 4.

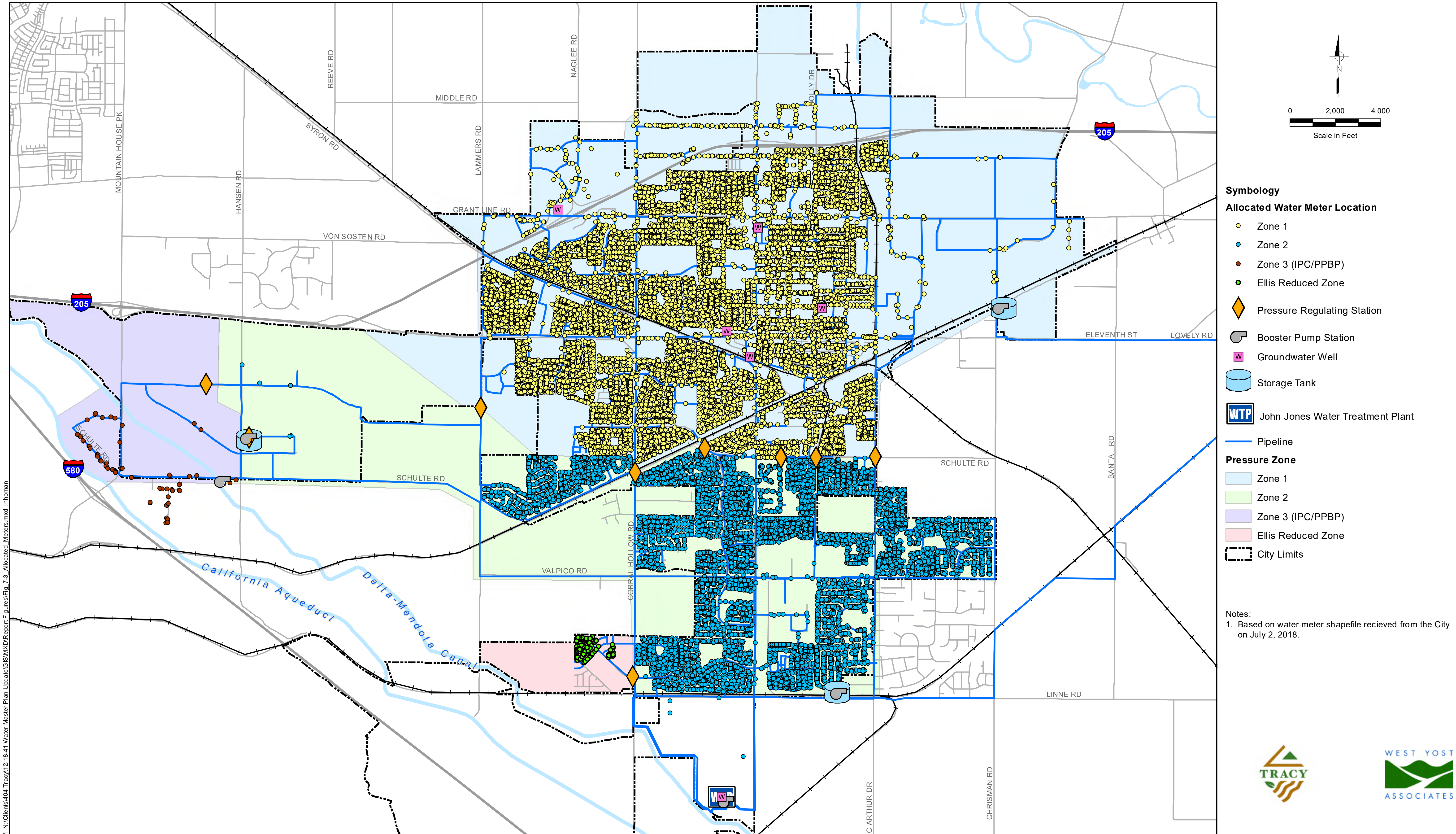


Figure 7-3

Allocated Water Meters

City of Tracy
Water System Master Plan Update

7.4.2 Existing Water System Facilities Evaluation

To evaluate the existing potable water system, analyses addressing the following system facilities were conducted:

- Surface Water Treatment Capacity
- Storage Capacity
- Pumping Capacity
- Critical Supply Facilities

The results from the existing potable water system facilities analyses are discussed below.

7.4.2.1 Water Treatment Capacity

Sufficient water treatment capacity from the existing JJWTP, the City's treated surface water supplies from the South County Water Supply Project, and groundwater wells should be available to meet the City's existing maximum day demand condition. In addition, the City's goal is to have sufficient surface water treatment capacity to meet the existing maximum month demand without relying on groundwater. Table 7-8 indicates that the City has sufficient water treatment and capacity to meet existing maximum day demands and that the City's current surface water treatment capacity is sufficient to meet existing maximum month potable water demands.

Table 7-8. Comparison of Available and Required Water Treatment Capacity, mgd

Demand Condition	JJWTP[(a)]	South County Water Supply Project[(b)]	Groundwater	Total Treated Water Capacity	Existing Maximum Day Demand	Surface Water Capacity Surplus or (Deficit)
Maximum Day	27	17	21.7[(c)]	65.7	28	38
Maximum Month[(d)]	27	17	0.0[(e)]	44.0	25	19

(a) Supplied from Zone 1 36-inch diameter transmission main, Zone 2 BPS, and Zone 3 BPS. Although the JJWTP is designed to supply 30 mgd, the actual maximum pumping capacity of the intake pumps is 27 mgd.
(b) Supplied from Linne Road and NEI Booster Pump Stations.
(c) Equivalent to firm groundwater pumping capacity, assuming that 20 percent of the City's wells would be out of service (*i.e.*, approximately two wells: one in Zone 1, and one at the JJWTP).
(d) Estimated to be 90 percent of maximum day demands.
(e) The City's goal is to meet maximum month demands without relying on groundwater supply.

7.4.2.2 Storage Capacity

The principal advantages that storage provides for the water system are the ability to equalize demands on supply sources, production facilities, and transmission mains; to provide emergency storage in case of supply failure; and to provide water to fight fires. The City's water service area has two sources of available storage: above-ground storage (*i.e.*, clearwells and storage tanks) and storage available through the groundwater basin. Together, these two sources of storage must be sufficient to meet the City's operational, emergency, and fire flow storage criteria. The volumes required for each of these three storage components are listed below:

- Operational Storage: 30 percent of a maximum day demand
- Emergency Storage: 1.5 times an average day demand
- Fire Flow Storage: The required fire flow rates multiplied by their associated fire flow duration periods, as required by the City's Fire Department. For larger pressure zones (*i.e.,* Zones 1 and 2), two concurrent fire flow events were assumed for the storage capacity analysis. However, the recommended fire flow storage does not include the volume associated with sprinkler flows.

Because the City's potable water supply includes supply from groundwater wells, the groundwater basin can account for a portion of the recommended emergency storage, in the form of a groundwater credit. However, the following criteria must be met to use the groundwater supply to offset the need to provide above-ground storage:

- Groundwater supply is of potable water quality and can be reliably accessed (*i.e.*, wells are equipped with on-site emergency generators)
- Groundwater supply is not already relied upon to meet the City's average day demand requirements
- Groundwater supply is of firm groundwater supply availability (*i.e.*, assumes 20 percent of wells will be out of service at any given time)
- Sufficient water distribution facilities are available to distribute this water to demand area

In addition, the City currently has two independent sources of treated surface water supply, and some quantity of the total treated surface water supply capacity can also account for a portion of the recommended emergency storage. The treated surface water credit assumes that the smaller of the treated surface water supply sources can be available to offset a portion of the emergency storage requirement. However, the following criteria must be met to use treated surface water supply to offset the need to provide above-ground storage:

- Treated surface water supply can be reliably accessed (*i.e.*, treated surface water supply facility is equipped with on-site emergency generator)
- Sufficient treated surface water booster pumping facilities are available to distribute water to demand areas

In summary, the Emergency Storage Credit is equal to the sum of the groundwater and treated surface water supply credits. However, the Emergency Storage Credit can only provide a maximum storage credit equal to the City's required emergency storage volume.

The existing potable water storage facilities, in conjunction with the available Emergency Storage Credit, were evaluated to determine whether the City's existing potable water system has sufficient storage capacity to provide the required operational, emergency, and fire flow storage. Table 7-9 provides a detailed summary of the City's existing available potable water storage capacity, Emergency Storage Credit, and required storage capacity. Table 7-9 indicates that the City currently has a potable water storage capacity surplus of approximately 4.2 MG in Zone 1, Zone 2, and Ellis Reduced Zone, and a 0.7 MG surplus in Zone 3 - IPC/PPBP.

7.4.2.3 Pumping Capacity

The pumping capacity in the City's existing potable water system was evaluated to assess its ability to deliver a reliable firm capacity to the existing water service area. Firm capacity assumes a reduction in total pumping capacity to account for pumps that are out of service at any given time due to mechanical breakdowns, maintenance, water quality, or other operational issues. At each booster pump station, firm booster pumping capacity was defined as the total booster pump station capacity with the largest pump out of service. For groundwater well pumps, the firm groundwater pumping capacity assumed that 20 percent of the wells would be out of service at any given time.

The pumping capacity criterion for the City, described previously in Chapter 6, requires the City's potable water system to have sufficient firm pumping capacity to meet the greater of either a maximum day demand with two simultaneous fire flow events (one fire flow event in smaller pressure zones) or a peak hour demand. In addition, sufficient firm treated water pumping capacity should be available to meet a maximum day demand condition.

Table 7-10 provides a detailed summary of the City's existing available firm pumping capacity at each pump station and provides a comparison between the City's available firm pumping capacity and the requirements stated above. This pumping capacity analysis indicates that the City's existing booster and groundwater pumping capacity can sufficiently meet the pumping capacity criterion for the existing water service area during the governing flow scenario in each pressure zone.

7.4.2.4 Critical Supply Facilities

All critical pumping facilities should be equipped with an on-site, emergency backup power generator to provide pumping capacity during a power outage. Critical pumping facilities are defined as those facilities that provide service to pressure zone(s) and/or service area(s) which do not have sufficient emergency storage, and that meet at least one of the following criteria:

- The largest pumping facility that provides water to a particular pressure zone and/or service area
- A facility that provides the sole source of water to single or multiple pressure zones and/or service areas
- A pumping facility that provides water from a supply turnout
- A pumping facility that provides water from key groundwater supply wells (depends on capacity, quality, and location)

Table 7-9. Comparison of Available and Required Water Storage Capacity

<table>
<tr><th rowspan="3">Station</th><th rowspan="3">Status</th><th colspan="5">Available Storage Capacity, MG</th><th colspan="5">Required Storage Capacity, MG</th><th rowspan="3">Storage Surplus (Deficit), MG</th></tr>
<tr><th rowspan="2">Reservoir Capacity</th><th colspan="3">Emergency Storage Credit</th><th rowspan="2">Total Available Storage</th><th rowspan="2">Operational[d]</th><th rowspan="2">Emergency[e]</th><th rowspan="2">Fire Flow</th><th rowspan="2" colspan="2">Total Required Storage</th></tr>
<tr><th>Groundwater Credit[a]</th><th>Treated Surface Water Supply Credit[b]</th><th>Total Emergency Storage Credit[c]</th></tr>
<tr><td colspan="13">Zone 1, Zone 2, and Ellis Reduced Zone[f]</td></tr>
<tr><td>NEI</td><td>Active</td><td>2.4</td><td>--</td><td rowspan="12">25.50</td><td rowspan="12">23.76</td><td rowspan="12">37.26</td><td rowspan="12">8.08</td><td rowspan="12">23.76</td><td rowspan="12">1.14[i]</td><td rowspan="12" colspan="2">32.97</td><td rowspan="12">4.2</td></tr>
<tr><td>Lincoln Well</td><td>Active</td><td>--</td><td>5.40</td></tr>
<tr><td>Lewis Manor Well</td><td>Inactive</td><td>--</td><td>--</td></tr>
<tr><td>Park and Ride Well</td><td>Active</td><td>--</td><td>4.32</td></tr>
<tr><td>Ball Park Well</td><td>Active</td><td>--</td><td>5.40</td></tr>
<tr><td>Well 8[g]</td><td>Active</td><td>--</td><td>--</td></tr>
<tr><td>Linne</td><td>Active</td><td>7.1</td><td>--</td></tr>
<tr><td>Well 1[h]</td><td>Active</td><td>--</td><td>--</td></tr>
<tr><td>Well 2[g,h]</td><td>Active</td><td>--</td><td>--</td></tr>
<tr><td>Well 3[g,h]</td><td>Active</td><td>--</td><td>--</td></tr>
<tr><td>Well 4[g,h]</td><td>Active</td><td>--</td><td>--</td></tr>
<tr><td>Clearwell #2</td><td>Active</td><td>4.0</td><td>--</td></tr>
<tr><td colspan="13">Zone 3 IPC/PPBP</td></tr>
<tr><td>Cordes</td><td>Active</td><td>2.0</td><td>--</td><td>0.00</td><td>0.90[j]</td><td>2.90</td><td>0.31</td><td>0.90</td><td>0.96[k]</td><td colspan="2">2.17</td><td>0.7</td></tr>
</table>

(a) Credit based on 1.5 days of pumping capacity from active groundwater wells with on-site backup power because the required emergency storage capacity is equal to 1.5 times the average day demand. See Table 7-2 for individual well capacity.

(b) Credit based on 1.5 days of available treatment capacity (17 mgd) from the SCWSP because the required emergency storage capacity is equal to 1.5 times the average day demand.

(c) Equal to the sum of the groundwater and treated surface water supply credits; however, the maximum credit is equal to the required emergency storage capacity.

(d) Based on 30 percent of a maximum day demand (see Table 7-7).

(e) Based on 1.5 times the average day demand (see Table 7-7).

(f) The Ellis Reduced Zone is currently isolated from the Cordes Tank and BPS.

(g) Well does not contribute to Groundwater Credit because it does not have on-site backup power.

(h) Well does not contribute to Groundwater Credit because water produced by the well must be blended with chlorinated water from the JJWTP prior to distribution. The JJWTP is assumed to be offline in an emergency.

(i) Based on storage required for two concurrent fire flow events; a Single Family Residential fire flow and an Industrial fire flow (see Table 6-1).

(j) Surplus Treated Surface Water Supply Credit from other pressure zones can be used to provide emergency storage for Zone 3.

(k) Based on storage required for an Industrial fire flow (see Table 6-1).

Table 7-10. Comparison of Available and Required Firm Pumping Capacity

Pump Station	Backup Power	Status	Firm Capacity[a], gpm	Total Firm Pumping Capacity from Supply Sources, gpm[b]	Existing Maximum Day Demand, gpm	Pumping Capacity from Supply Sources Surplus (Deficit), gpm[b]	Total Firm Pumping Capacity, gpm	Existing Maximum Day Demand with Fire Flow Event(s), gpm	Existing Peak Hour Demand, gpm	Pumping Capacity Surplus (Deficit), gpm[b]
Zones 1 and 2										
NEI	✓	Active	4,200	44,106	19,377[d]	24,728	51,095	24,666[e]	31,842	19,253
Zone 1	✓	Active	12,000							
Lincoln Well	✓	Active	2,500							
Lewis Manor Well	✓	Inactive	--							
Park and Ride Well	✓	Active	2,000							
Ball Park Well	✓	Active	2,500							
Well 8		Active	--							
Linne	✓	Active	14,595							
Zone 2	✓	Active	13,300							
Well 1[c]	✓	Active	--							
Well 2[c]		Active	--							
Well 3[c]		Active	--							
Well 4[c]		Active	--							
Zone 3 IPC/PPBP										
Cordes	✓	Active	6,150	NA[g]	NA[g]	NA[g]	6,150	5,211[h]	1,213	939
Patterson Pass[f]	✓	Inactive	--							
Ellis Reduced Zone										
Zone 3	✓	Active	2,970	2,970	31	2,939	2,970	1,531[i]	53	1,439

(a) Firm booster pumping capacity was defined as the total booster pump station capacity with the largest pump out of service and firm groundwater pumping capacity assumed that 20 percent of the City's wells would be out of service (i.e., approximately two wells: one in Zone 1, and one at the JJWTP).

(b) Pumping capacity surplus (deficit) is the total available firm pumping capacity minus the greater of the maximum day demand with required fire flow event(s) or peak hour demand.

(c) Wells 1-4 located at JJWTP pump directly into the Chlorine Contact Basin or Clearwell #2; therefore, these wells do not provide additional pumping capacity to the system.

(d) Includes maximum day demand for Zone 3 IPC/PPBP.

(e) Maximum day demand plus a 1,500 gpm Single Family Residential fire flow and a simultaneous 4,500 gpm Industrial fire flow.

(f) Patterson Pass BPS is inactive since the Cordes BPS is now operating; therefore, it does not provide additional pumping capacity to the system.

(g) Zone 3 IPC/PPBP is supplied treated water via Zone 2 facilities.

(h) Maximum day demand plus a 4,500 gpm Industrial fire flow.

(i) Maximum day demand plus a 1,500 gpm Single Family Residential fire flow.

As shown previously in Table 7-10, most of the City's existing pumping facilities have on-site emergency backup power installed, except for Wells 2 through 4 and Well 8[28]. However, these wells do not meet the criteria listed above and are not considered critical supply facilities. Therefore, the City is currently equipped with sufficient backup power generators to provide pumping capacity during a power outage at its most critical pumping facilities.

7.4.3 Existing Water System Hydraulic Analysis

The system performance criteria recommended for and results of the existing potable water distribution system hydraulic analysis are discussed below.

7.4.3.1 Existing Water System Performance Criteria

Steady state hydraulic analyses using the updated hydraulic model were conducted to help identify areas of the existing potable water system that do not meet the recommended system performance criteria as presented previously in Chapter 6. The results of the existing potable water system evaluation are presented below for the following scenarios:

- Peak Hour Demand—A peak hour flow condition was simulated for the existing water distribution facilities to evaluate their capability to meet a peak hour demand scenario. Peak hour demands are met by the combined supply from treated surface water, storage tanks, and groundwater.
- Maximum Day Demand plus Fire Flow—To evaluate the existing potable water system under the maximum day demand plus fire flow scenario, individual fire flow demands were first assigned and simulated at various locations within the City's water service area. InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow while meeting the maximum day demand plus fire flow performance criteria. Additional fire flow simulations were also performed to simulate a condition equal to a maximum day demand with two concurrent fire flow events. Maximum day plus fire flow demands are met by the combined supply from treated surface water and storage tanks.

The recommended system performance criteria for each scenario are discussed in more detail below.

7.4.3.1.1 Peak Hour Demand Scenario

As shown in Table 7-7, the peak hour demand for the existing water service area was calculated to be 33,108 gpm (47.7 mgd). This peak hour demand represents a peaking factor of 2.9 times the average day demand. During a peak hour demand scenario, a minimum pressure of 40 psi must be maintained throughout the water system. In addition, maximum head losses for distribution mains should not exceed 7 ft/kft and maximum velocities should not exceed 8 fps. For transmission mains, maximum head losses should not exceed 3 ft/kft and maximum velocities should not exceed 6 fps.

[28] Well 8 currently has a plug-in adapter installed to allow interconnection to a portable generator.

7.4.3.1.2 Maximum Day Demand plus Fire Flow Scenario

As shown in Table 7-7, the maximum day demand for the existing water service area was calculated to be 19,408 gpm (32.9 mgd). This maximum day demand represents a peaking factor of 1.7 times the average day demand. Fire flow demands were assigned and simulated at various locations within the City's water service area to determine if the minimum residual pressure criterion of 20 psi could be met during a maximum day demand plus fire flow scenario[29]. Fire flow demands were assigned based on General Plan land use designations and are summarized below in Table 7-11.

Table 7-11. Recommended Fire Flow Requirements[a]

Land Use Category	Fire Flow, gpm	Duration, hours
Single Family Residential[b]	1,500	2
Multi-Family Residential[c]	2,500	2
Commercial/Office[d]	3,500[f]	4
Industrial	4,500[f]	4
Institutional[e]	4,500[f]	4

(a) Specific fire flow requirements were determined from Table B105.1 of the 2016 CFC and depend on construction type and fire flow calculation area. Non-residential fire flow requirements are based on the assumption that an automatic sprinkler system has been installed. See Table 6-1 for further explanation of how the fire flow requirements were developed.
(b) Includes Very Low and Low Density Residential land uses.
(c) Includes Medium and High Density Residential land uses.
(d) Includes Commercial, Office, Downtown, and Village Center land uses.
(e) Includes Medical, Public Facilities, School, Airport, Church, and Cemetery land uses.
(f) Fire flow includes a 500 gpm demand for on-site sprinkler flow, which is not included in the recommended fire flow storage volume.

The City's water system should also have the capability to meet a system demand condition equal to the occurrence of a maximum day demand with two concurrent fire flow events in the larger pressure zones (*i.e.*, Zones 1 and 2). It is assumed that the two fire flow events will consist of one smaller single family residential fire flow combined with another larger industrial fire flow. This conservative assumption of two simultaneous fire flow demands will help stress the City's water system and determine if the existing water system can provide reliable service during high demand conditions. Consequently, two concurrent fire flow demands were simulated at various locations within Zones 1 and 2 during a maximum day demand condition to determine if the minimum residual pressure criterion of 20 psi could be met during simultaneous fire flow events.

[29] The maximum pipeline head loss and maximum pipeline velocity criteria for a maximum day demand plus fire flow scenario were not applied to the City's existing water system. Because fire flow conditions occur infrequently, no improvements for the existing water system would be recommended if a location failed to meet these secondary criteria if the primary pressure criterion was met.

7.4.3.2 Recommended Improvement Criteria

The system performance criteria described above were used to evaluate the existing potable water system during peak hour demand and maximum day demand plus fire flow scenarios. The existing potable water system is expected to deliver peak hour flow and maximum day demand plus fire flow within the acceptable pressure, velocity and head loss ranges as identified in the system performance criteria presented in Chapter 6. However, the system was evaluated using pressure as the primary criterion. If necessary, recommended improvements needed to comply with the system performance criteria were added to the existing potable water system model to fix any deficiencies found and are discussed below.

7.4.3.3 Existing Water System Evaluation Results

The results from the hydraulic model for the peak hour demand and maximum day demand plus fire flow analyses are presented below.

7.4.3.3.1 Peak Hour Demand Scenario

During a peak hour demand scenario, results indicate that the existing potable water system is capable of maintaining the City's minimum pressure criterion of 40 psi at all existing service locations, as shown on Figure 7-4. Under this scenario, system pressures at existing service locations ranged from 40 to 85 psi. It should be noted that, per the California Plumbing Code, services which experience pressures exceeding 80 psi are required to be fitted with a pressure reducing valve.

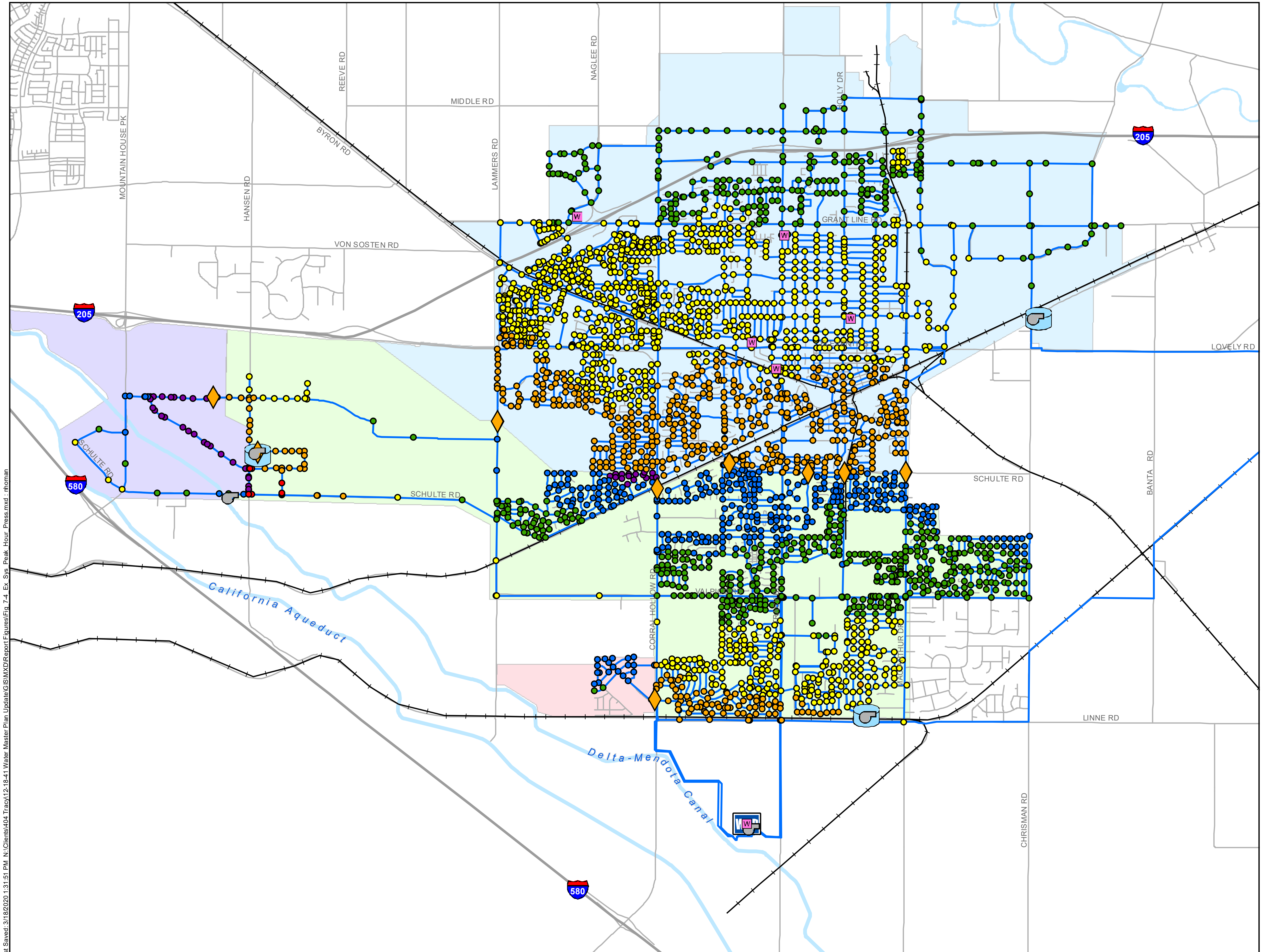
As shown on Figure 7-5, there are two locations within the existing system where the distribution system pipelines did not meet the maximum velocity criterion of 8 fps during a peak hour demand scenario. The following list details pipelines in the existing potable water system that exceeded the maximum velocity criterion and summarizes any recommended improvements.

- Location #1: The 12-inch diameter discharge pipeline from the Ball Park Well off of Tracy Boulevard had a velocity of 8.3 fps.

  Recommendation:
  No mitigation is recommended for the 12-inch diameter discharge pipeline from the Ball Park Well, because pipeline velocity is a secondary criterion and no improvements for pipelines exceeding the velocity criterion in the existing potable water system are recommended unless the primary criterion (pressure) is not met.

- Location #2: The 12-inch diameter distribution pipeline located in Sixth Street immediately east of the 36-inch diameter transmission main tie-in had a velocity of 8.3 fps.

  Recommendation:
  No mitigation is recommended for the 12-inch diameter discharge pipeline in Sixth Street immediately east of the 36-inch diameter transmission main tie-in, because pipeline velocity is a secondary criterion and no improvements for pipelines exceeding the velocity criterion in the existing potable water system are recommended unless the primary criterion (pressure) is not met.



0 2,000 4,000
Scale in Feet

Symbology

Peak Hour Pressure

- Less than 40 psi
- 40 psi to 50 psi
- 50 psi to 60 psi
- 60 psi to 70 psi
- 70 psi to 80 psi
- Greater than 80 psi
- Pressure Regulating Station
- Booster Pump Station
- Groundwater Well
- Storage Tank
- John Jones Water Treatment Plant
- Pipeline

Pressure Zone

- Zone 1
- Zone 2
- Zone 3 (IPC/PPBP)
- Ellis Reduced Zone

Notes:
1. The City's existing hydraulic model is not an all pipes model. Therefore, not all existing pipes are shown or evaluated.
2. Per the California Plumbing Code, services which experience pressures exceeding 80 psi are required to be fitted with a pressure reducing valve.

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Figure 7-4

Existing System Pressures Peak Hour Demand

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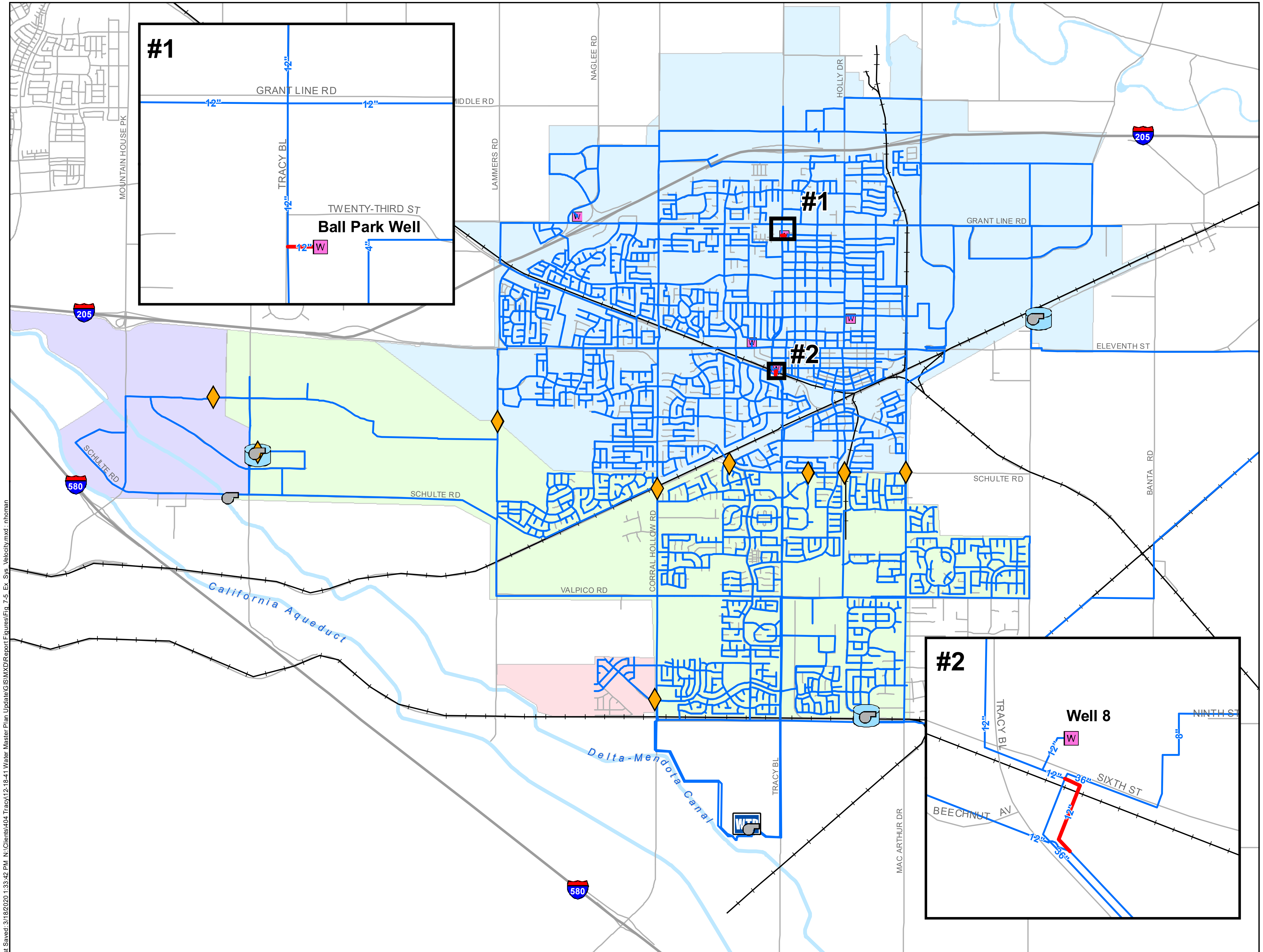

Symbology

Pipeline Diameter ≥ 18-inches

- Velocity ≤ 6 fps
- Velocity > 6 fps

Pipeline Diameter < 18-inches

- Velocity ≤ 8 fps
- Velocity > 8 fps

- Pressure Regulating Station
- Booster Pump Station
- Groundwater Well
- Storage Tank
- John Jones Water Treatment Plant

Pressure Zone

- Zone 1
- Zone 2
- Zone 3 (IPC/PPBP)
- Ellis Reduced Zone

0 2,000 4,000
Scale in Feet

Notes:
1. The City's existing hydraulic model is not an all pipes model. Therefore, not all existing pipes are shown or evaluated.

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Figure 7-5

Existing Pipeline Velocities Peak Hour Demand

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7.4.3.3.2 Maximum Day Demand plus Fire Flow Scenario

Fire flow demands were assigned based on Table 7-11 and simulated at various locations within the City's water service area. InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow while meeting a minimum residual pressure of 20 psi within the existing water system during a maximum day demand scenario.

As shown on Figure 7-6, the results from the hydraulic model indicate that there are seven fire flow junctions, grouped into four areas, where the available fire flow is less than the minimum required fire flow. The following list details the areas in the existing potable water system that failed to meet the fire flow requirements and summarizes any recommended improvements.

- Location #1: The hydrant at the southern end of Rhonda Way is surrounded by industrial land use, which has a fire flow requirement of 4,500 gpm. This hydrant is served by an 8-inch diameter distribution pipeline in Rhonda Way which terminates at the hydrant. The available fire flow simulated at this hydrant while maintaining a 20 psi minimum residual pressure was approximately 3,640 gpm.

  <u>Recommendation</u>:

  No mitigation is recommended for the hydrant at the southern end of Rhonda Way because the deficient hydrant is located on a short dead-end line. The deficient hydrant is less than 300 ft away from a hydrant at the intersection of Rhonda Way and Larch Road which is capable of providing 4,500 gpm at 20 psi residual pressure.

- Location #2: Four hydrants within the neighborhood located east of Tracy Boulevard, south of Juanita Market, west of Holly Drive, and north of Carlton Way are not capable of meeting minimum fire flow requirements. This neighborhood is located in an older part of the City, and many of the distribution pipelines in the neighborhood are 4-inches or 6-inches in diameter with low C-factors. The northern-most deficient hydrant, at the intersection of Wall Street and 20th Street, was assigned a fire flow requirement of 1,500 gpm, but could only provide approximately 1,230 gpm. The other three deficient hydrants, located at the intersections of Wall Street and Emerson Avenue, Emerson Avenue and Court Drive, and Court Drive and Lowell Avenue, were assigned a fire flow requirement of 2,500 gpm, but could only provide approximately 820 gpm, 1,590 gpm, and 2,350 gpm, respectively.

  <u>Recommendation</u>:

  It is recommended that the existing pipelines in 20th Street between Bessie Avenue and Parker Avenue, Wall Street between Lowell Avenue and 20th Street, Emerson Avenue between Bessie Avenue and Holly Drive, Court Drive between Whittier Avenue and Lowell Avenue, and Lowell Avenue between Parker Avenue and Holly Drive be replaced with new 8-inch diameter pipelines to improve fire flow to this area.

- Location #3: The hydrant at the intersection of School Street and Ninth Street was assigned a fire flow requirement of 2,500 gpm due to the high density residential units located along School Street. This hydrant is currently served by an 8-inch diameter distribution pipeline in School Street which terminates east of the hydrant. The available fire flow simulated at this hydrant while maintaining a 20 psi minimum residual pressure was approximately 2,330 gpm.

  Recommendation:

  It is recommended that a new 12-inch diameter pipeline be installed in Ninth Street between School Street and Tenth Street.

- Location #4: The hydrant at the intersection of Tracy Boulevard and Fourth Street was assigned a fire flow requirement of 2,500 gpm due to the medium density residential units located in the vicinity. This hydrant is served by an existing 4-inch diameter pipeline in Tracy Boulevard and an existing 6-inch diameter pipeline in Fourth Street. The available fire flow simulated at this hydrant while maintaining a 20 psi minimum residual pressure was approximately 1,350 gpm.

  Recommendation:

  It is recommended that the existing 4-inch diameter pipeline in Tracy Boulevard north of Mount Diablo Avenue be replaced with a new 12-inch diameter pipeline to improve the fire flow to this area. This improvement was previously recommended in the 2012 WSMP.

Four additional fire flow simulations were performed within the hydraulic model to simulate a condition equal to a maximum day demand with two concurrent fire flow events. Two concurrent fire flow events were simulated during a maximum day demand condition to determine if the minimum residual pressure criterion of 20 psi could be met. Figure 7-7 shows the locations of the additional fire flow simulations. Locations were selected within each pressure zone based on the existing land use designations and spatial distance from supply sources to stress the City's water system. As summarized in Table 7-12, results from the hydraulic model indicate that all four of the concurrent fire flow simulations met the minimum residual pressure criterion of 20 psi.

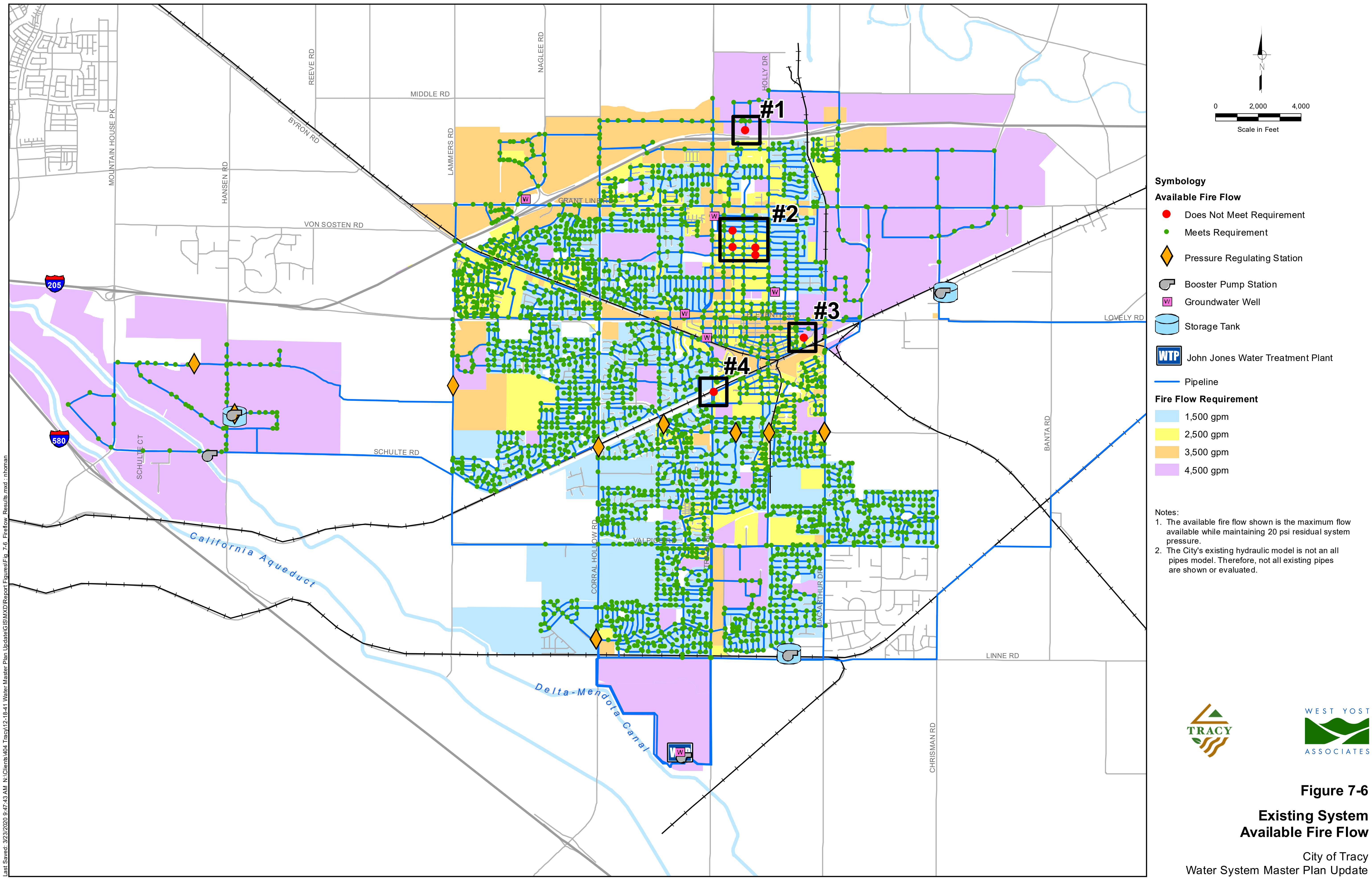

Figure 7-6

Existing System Available Fire Flow

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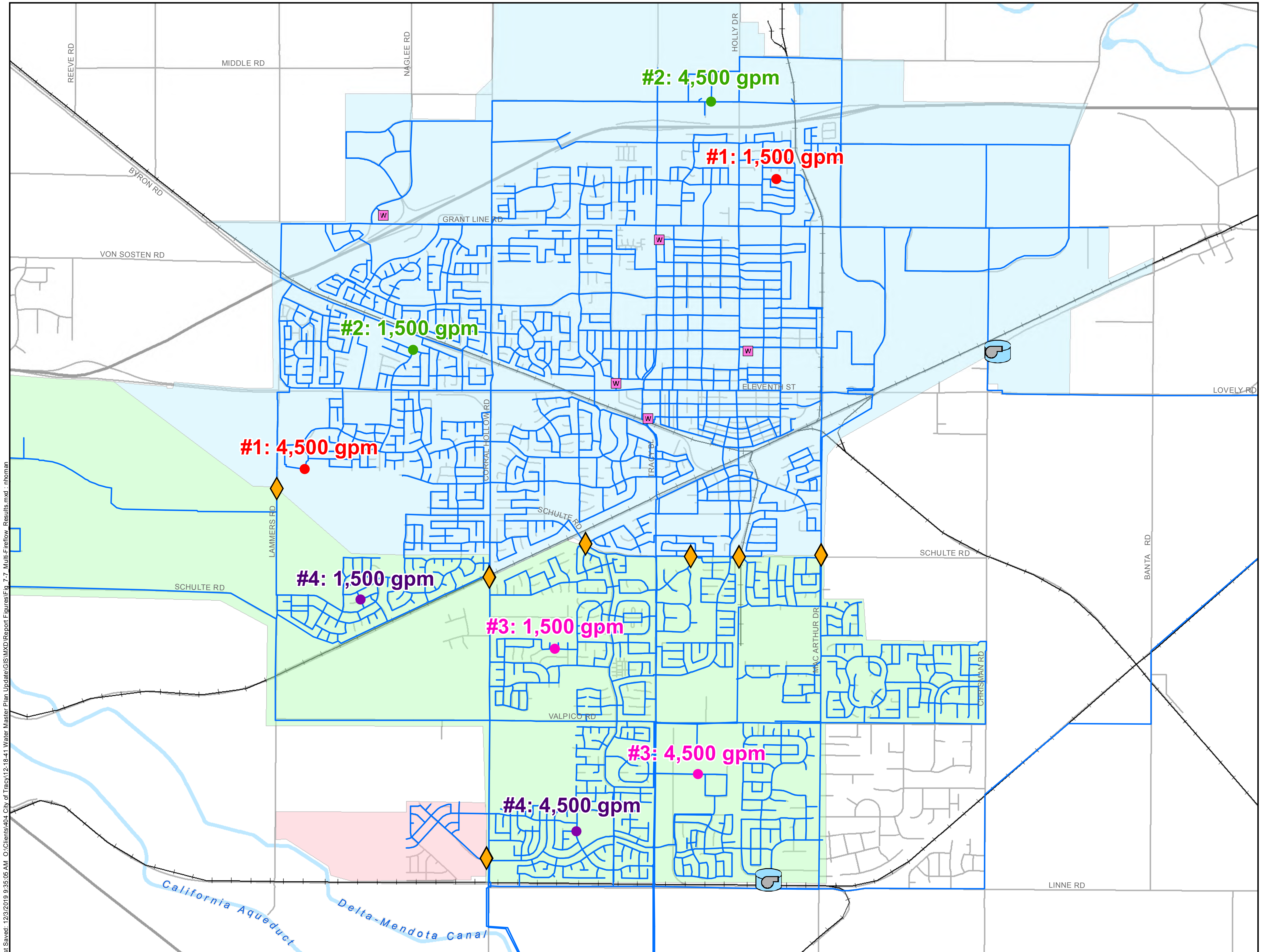

Symbology

Simultaneous Fire Flows

- Location #1
- Location #2
- Location #3
- Location #4
- Pressure Regulating Station
- Booster Pump Station
- Groundwater Well
- Storage Tank
- John Jones Water Treatment Plant
- Existing Pipeline

Pressure Zone

- Zone 1
- Zone 2
- Ellis Reduced Zone

Notes:
1. The City's existing hydraulic model is not an all pipes model. Therefore, not all existing pipes are shown or evaluated.

Figure 7-7

Locations of Additional Simultaneous Fire Flow Simulations

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Table 7-12. Results of Additional Fire Flow Simulations

Pressure Zone	Location #	Fire Flow Demand, gpm[(a)]	Residual Pressure, psi
Zone 1	1	1,500	51
		4,500	32
	2	1,500	52
		4,500	45
Zone 2	3	1,500	67
		4,500	52
	4	1,500	67
		4,500	32

(a) It is assumed that the two concurrent fire flow events will consist of one smaller Single Family Residential fire flow combined with another larger Industrial fire flow.

7.5 SUMMARY OF RECOMMENDED EXISTING POTABLE WATER SYSTEM IMPROVEMENTS

The recommended hydraulic improvements for the existing potable water distribution system are summarized below. These existing system improvements are recommended based on existing water demands, and are not triggered by future new development. It should be noted that these recommendations only identify facility improvements at a master plan level and do not necessarily include all required on-site infrastructure nor constitute design of improvements. Subsequent detailed design is required to determine the exact sizes and final locations of these proposed improvements. Recommended improvements are based on available information on the City's existing water system and existing water demands as presented in Table 7-7.

It should also be noted that the existing hydraulic model is not an "all pipes" model (*i.e.*, not all smaller diameter pipelines are included); therefore, the hydraulic simulations performed as discussed above may not identify all necessary water system hydraulic improvements. While some small diameter pipelines which were not previously included in the hydraulic model were added in this Citywide Water System Master Plan as part of the model refinement process, there may still be other small diameter pipelines not represented in the hydraulic model. Consequently, it is recommended that City staff review older parts of the water system where smaller diameter pipelines are typically found and consider possible upsizing of these lines as the City plans for future pipeline renewal and replacement projects. Ongoing replacement of older and/or smaller diameter pipelines will improve the available fire flow capacity of the existing potable water system.

Pipeline Hydraulic Capacity Improvements

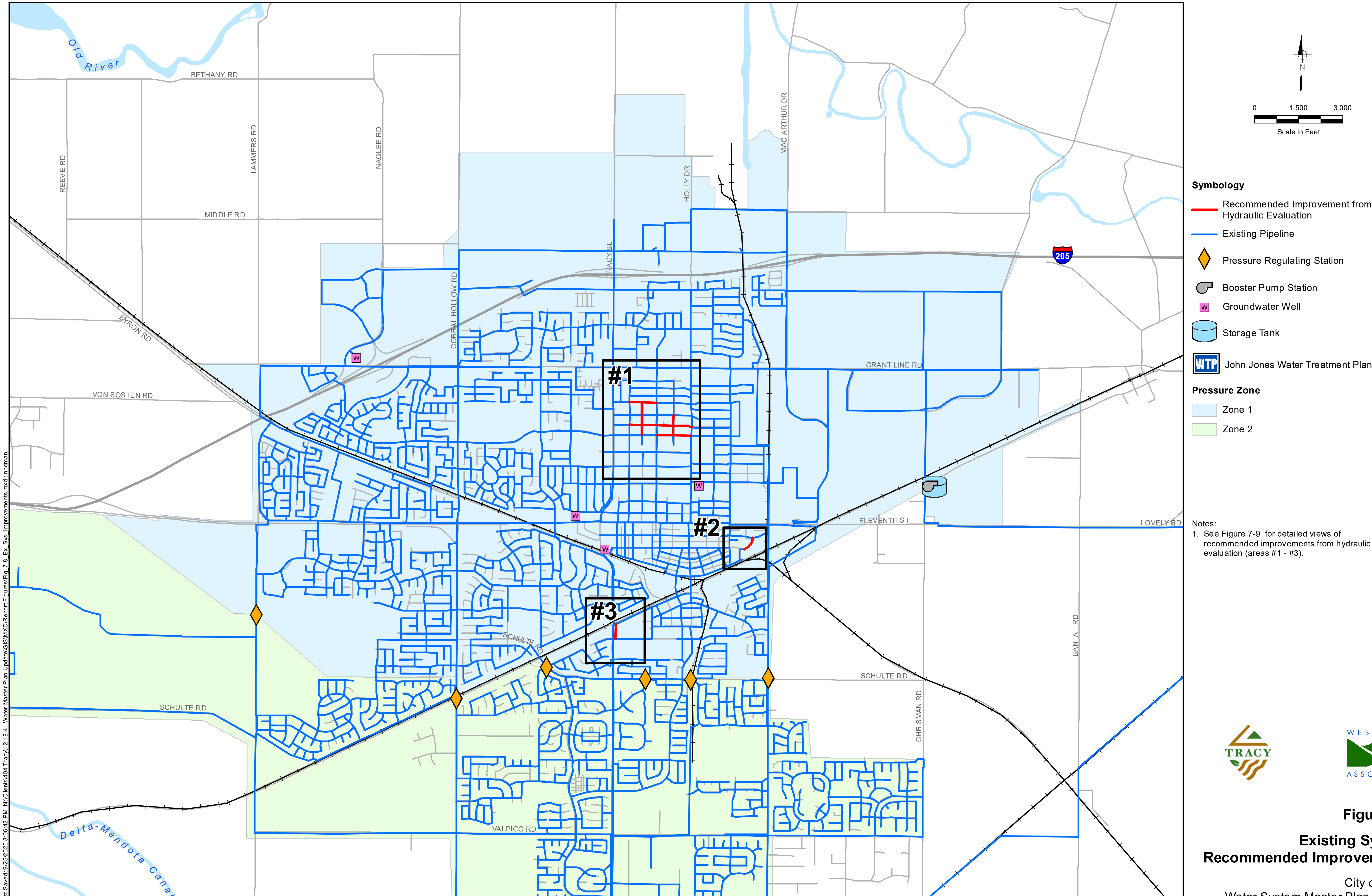
The locations of all recommended pipeline improvements are shown on Figure 7-8.

Several pipeline improvements are recommended to mitigate existing fire flow deficiencies. These fire flow deficiencies are not triggered by projected future water demands from new development. The existing water system infrastructure in the areas listed below is insufficient to meet the fire flow requirements based on existing land use and water demands. As such, planning and design for these improvements should be prioritized. Detailed locations of these improvements are shown on Figure 7-9.

- Improvement #1: Replace the existing pipelines in 20th Street between Bessie Avenue and Parker Avenue, Wall Street between Lowell Avenue and 20th Street, Emerson Avenue between Bessie Avenue and Holly Drive, Court Drive between Whittier Avenue and Lowell Avenue, and Lowell Avenue between Parker Avenue and Holly Drive with approximately 6,000 linear feet (lf) of new 8-inch diameter pipelines
- Improvement #2: Install approximately 515 lf of 12-inch diameter pipeline in Ninth Street between School Street and Tenth Street
- Improvement #3: Replace approximately 485 lf of existing 4-inch diameter pipeline in Tracy Boulevard north of Mount Diablo Avenue with new 12-inch diameter pipeline; this improvement was previously recommended in the 2012 WSMP

7.5.1 Pipeline Renewal and Replacement

As the City's water system ages, older water pipelines will deteriorate and have decreased hydraulic capacity and greater chance of leaking or breaking. To address this, the City should implement a renewal and replacement (R&R) program to proactively replace at-risk water pipelines before they fail. This Citywide Water System Master Plan Update does not include a condition assessment of existing facilities or development of a renewal and replacement (R&R) program. Therefore, it is recommended that the City perform a separate study which evaluates the condition of existing water system assets and develops a prioritized list for asset replacement based on age, material, failure history, and other parameters.



Notes:
1. See Figure 7-9 for detailed views of recommended improvements from hydraulic evaluation (areas #1 - #3).

Figure 7-8

Existing System Recommended Improvements

City of Tracy
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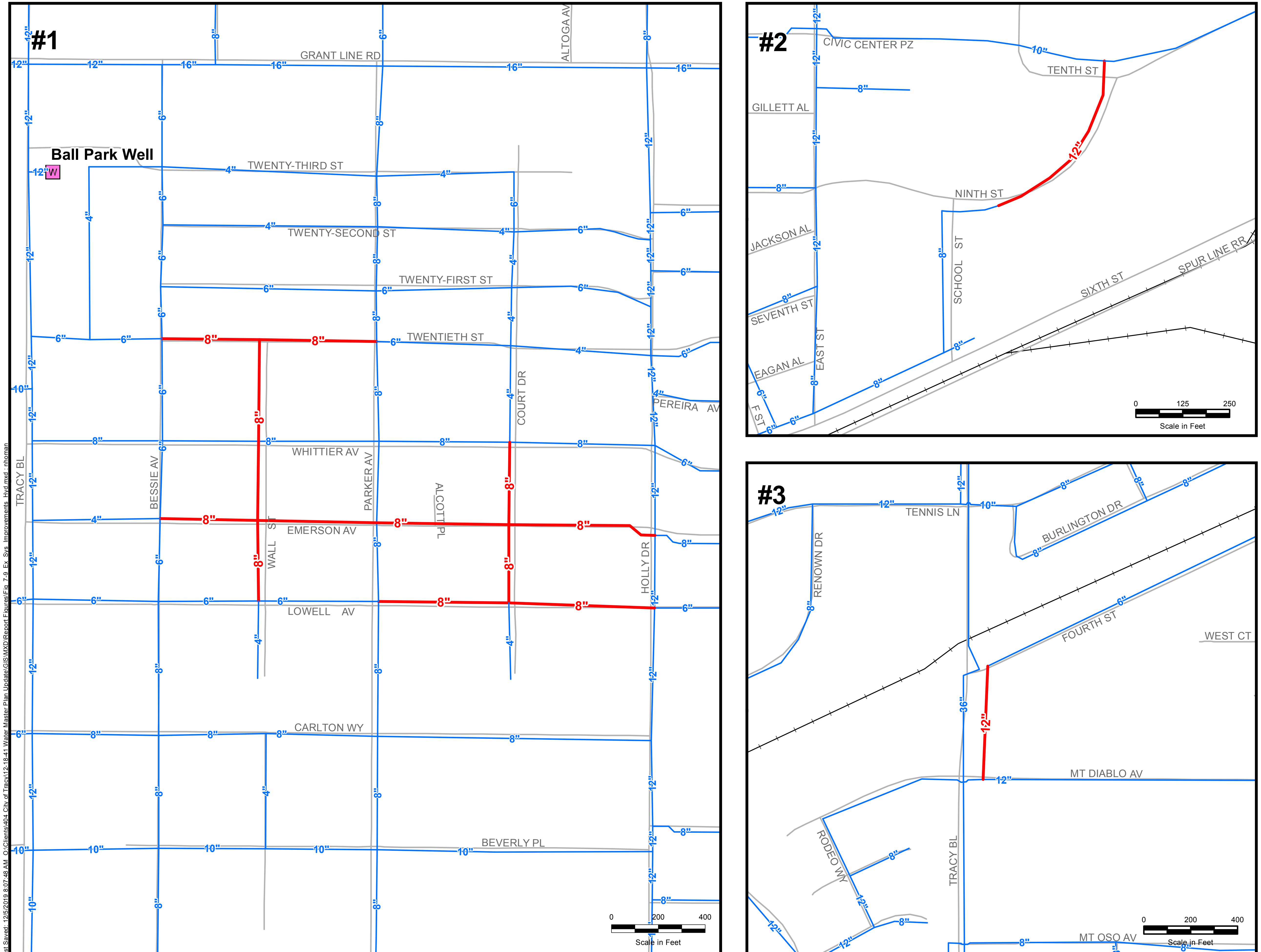

N

Symbology

- W Groundwater Well
- Recommended Improvement from Hydraulic Evaluation
- Existing Pipeline

Notes:
1. See Figure 7-8 for the locations of the recommended improvements.

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Figure 7-9

Existing System Recommended Improvements from Hydraulic Evaluation

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CHAPTER 8
Future Potable Water System Evaluation

8.1 OVERVIEW

The purpose of this chapter is to present the development and evaluation of the City's proposed potable water backbone transmission and distribution system for the 2025 and buildout timeframes. This chapter identifies the additional improvements that will be required in addition to the existing potable water system infrastructure improvements (described in Chapter 7) to support the City's projected potable water demands in the future. Development of the future potable water system includes an evaluation of the following: (1) the required future water treatment, storage and pumping capacity; and (2) the future water system's ability to meet recommended water system performance and operational criteria under maximum day demand plus fire flow and peak hour demand scenarios. The future water system was evaluated at both the 2025 and buildout timeframes. The future water system was not evaluated at the 2040 timeframe discussed in Chapters 4 and 5 because new water system facilities should be sized to accommodate buildout demands. Future updates to the WSMP may evaluate the 2040 timeframe as a near-term condition.

Using the City's recommended performance and operational criteria described in Chapter 6, preliminary sizing of major transmission pipelines and facilities required to serve future development projects was developed based on the projected potable water demands presented in Chapter 4. To evaluate the suitability of these preliminary sized facilities to meet the recommended performance and operational criteria, they were subsequently incorporated into the hydraulic model of the existing potable water system (evaluated in Chapter 7). This updated hydraulic model of the future potable water system was then used to evaluate maximum day demand plus fire flow and peak hour demand conditions for the 2025 and buildout timeframes to identify any deficiencies and to refine the preliminary sizing of major transmission pipelines and facilities.

Evaluations, findings, and recommendations for supporting projected future potable water demands and addressing any deficiencies identified within the future potable water backbone transmission and distribution system are included in this chapter. Recommendations were used to develop a CIP, which includes an estimate of probable construction costs for Master Plan Program facilities. The recommended potable water system CIP is described further in Chapter 10.

The following sections of this chapter describe the components of the City's future potable water backbone transmission and distribution system evaluation:

- Pressure Zone Recommendations
- Projected Future Potable Water Demands
- Future Potable Water System Facility Evaluation
- Future Potable Water System Performance Evaluation
- Summary of Recommended Future Potable Water System Improvements

To assist in the evaluation of the City's overall future potable water system, the future infrastructure recommended in this chapter includes the infrastructure required to serve the Tracy Hills development and, for consistency, is based on the adopted water use, peaking factors, and system performance criteria described in previous chapters of this WSMP Update. Although the Tracy Hills development is located within separate and distinct pressures zones from the rest of the City, West Yost has included the Tracy Hills development in the future potable water system evaluation because it will be a part of the City's overall future potable water system operations since it will be served directly from the City's JJWTP. The Tracy Hills Phase 1 water system infrastructure included in this WSMP Update is based on prepared plans and drawings, and the infrastructure for Tracy Hills Phases 2 through 5 is based on the Tracy Hills Water Study prepared by RJA in December 2014. However, projected land use for Tracy Hills used in this WSMP Update is not from the Tracy Hills Water Study, but is instead based on development data provided by the City's Planning Department, as discussed in Chapter 3 and presented in Appendix A. Including the Tracy Hills development in the 2025 and buildout hydraulic model evaluations ensures that the future potable water system will be adequate to serve potable water demands to the entire City (including Tracy Hills) and can provide water service at acceptable system pressures and pipeline velocities. Because planning for future phases of Tracy Hills is subject to change, the sizing of any future water system improvements to serve Tracy Hills should be confirmed based on the latest development plans and associated water demand projections.

8.2 PRESSURE ZONE RECOMMENDATIONS

The City's existing potable water system currently consists of several interconnected pressure zones (Zone 1, Zone 2, Zone 3, and Ellis Reduced Zone). With the exception of the Tracy Hills development, all of the City's future development projects will be located in one of these existing pressure zones. In addition to the planned IPC re-zoning discussed in Chapter 7, there are two planned re-zoning projects which will alter the existing pressure zone boundaries in the 2025 and buildout time frames.

Zone 3 (formerly called City-Side Zone 3) is currently split into two isolated portions: one which serves the Ellis Reduced Zone, and one which serves the International Park of Commerce and the Patterson Pass Business Park. The City plans to connect these two isolated portions by constructing new transmission pipelines and by re-zoning some existing transmission pipeline from Zone 2 to Zone 3. A detailed description of the planned modifications to the City's water system required to fully integrate Zone 3 are provided in Appendix D. The City plans to install new PRVs at the intersection of Schulte Road and Bud Lyons Way and the intersection of Schulte Road and Pavillion Parkway to avoid stagnant water in the dead-end Zone 2 pipelines created by the re-zoning. Once Zone 3 is fully integrated, the Zone 3 BPS will primarily be used to fill the Cordes Tank. The Cordes BPS will serve the integrated Zone 3 and the Ellis Reduced Zone (via several PRVs) when the Cordes Tank is not being filled. For this WSMP Update, it was assumed that this re-zoning project will be complete by 2025.

Another re-zoning project, referred to as "Plan C", will re-zone a small area bounded by Middlefield Drive to the north, Whirlaway Lane to the east, Linne Road to the south, and Corral Hollow Road to the west from Zone 2 to Zone 3. As currently zoned, the Plan C area experiences low pressures because it is located at the top of Zone 2. To improve pressure in the Plan C area, a new Zone 3 transmission pipeline will be constructed. This transmission pipeline will exit the JJWTP from the east and tie into the existing pipeline in Linne Road, which will also be re-zoned to Zone 3. This new Zone 3 pipeline will support the Plan C area and provide redundant transmission capacity for Zone 3. To prevent service pressures from exceeding 80 psi in the Plan C area after re-zoning, the City plans to install PRVs at the intersection of Middlefield Drive and Corral Hollow Road and at the Whirlaway pipeline connection to Linne Road. The City also plans to install four new PRVs to separate the Plan C area from the Zone 2 service areas to the north and east. These PRVs will prevent stagnant water from forming in the dead-end pipelines created by the re-zoning. It should be noted that alternative approaches to resolving the stagnant water issue may be possible and should be further evaluated before proceeding with this improvement. It was assumed that the Plan C re-zoning will not occur by 2025 and is therefore only included in the buildout evaluation. Funding for this improvement will be provided through Plan C funds.

In order to serve water demands in the Tracy Hills development, which is located at higher elevations than the City's existing customers, the City plans to add three additional pressure zones onto the existing service area, called Zones 4, 5, and 6. These pressure zones were previously referred to as Tracy Hills Zone 3, Tracy Hills Zone 4, and Tracy Hills Zone 5, respectively. Note that documents produced prior to this Water System Master Plan Update use the old nomenclature. As currently planned, these pressure zones will be exclusive to the proposed Tracy Hills development. Although the service elevations of Zone 3 and Zone 4 partially overlap, the two pressure zones will operate at different hydraulic grades and will be hydraulically separate.

The approximate boundaries of the existing and proposed pressure zones and the locations of future development projects are shown on Figure 8-1. Table 8-1 provides a summary of the existing and proposed pressure zone boundaries with key characteristics such as service elevations and static pressure ranges.

System pressures at some service elevations in the Tracy Hills development are expected to be high (up to 118 psi or more) due to the service elevation ranges proposed for Zones 5 and 6 as developed in the Tracy Hills Water Study (RJA, 2014). To be consistent with the study, the proposed service elevation ranges for Zones 5 and 6 were not adjusted for this Citywide WSMP Update. However, it is recommended that these proposed pressure zones for the Tracy Hills development be reviewed and redefined, if possible, to reduce the occurrence of such high system pressures.

As discussed in Chapter 6, the highest recommended system pressure for the Citywide WSMP Update is 100 psi and any water service connections located in areas with service connection pressures exceeding 80 psi will require the installation of individual PRVs to reduce the pressure below 80 psi.

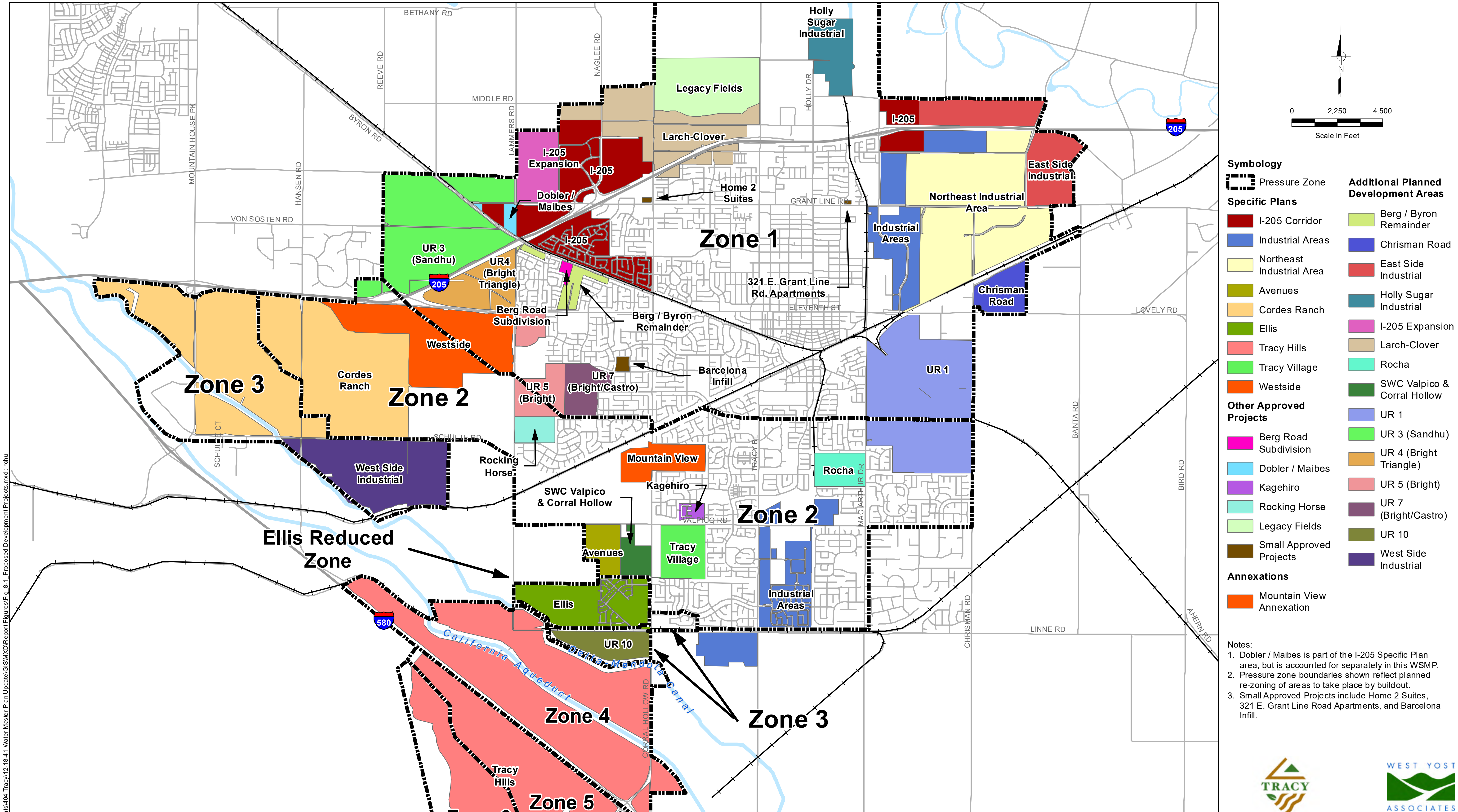


Figure 8-1

Proposed Development Areas and Pressure Zone Boundaries

City of Tracy
Water System Master Plan Update

Table 8-1. Existing and Proposed Pressure Zone Boundaries

Pressure Zone	Nominal Hydraulic Grade, ft	Nominal Range of Service Elevations, ft	Static Pressure Range, psi
Zone 1	195	0 - 75	40 - 75
Zone 2	270	75 - 150	40 - 85[a]
Zone 3 (formerly City-Side Zone 3)	368	150 - 245	55 - 95[a]
Ellis Reduced Zone	323	140 - 185	60 - 80
Zone 4 (formerly Tracy Hills Zone 3)	425	209 - 325	43 - 93[a]
Zone 5 (formerly Tracy Hills Zone 4)[b]	580	305 - 470	47 - 118[a]
Zone 6 (formerly Tracy Hills Zone 5)[b]	735	460 - 630	45 - 118[a]

(a) Per the California Plumbing Code, services which experience pressures exceeding 80 psi are required to be fitted with a pressure reducing valve.
(b) Based on Tracy Hills Water Study prepared by RJA, December 2014.

8.3 PROJECTED FUTURE POTABLE WATER DEMANDS

Future potable water demands were developed based on the additional projected future land use information provided by the City, and the adopted unit water demand factors as described in Chapter 4. Based on the existing and proposed pressure zone boundaries, the projected potable water demands were calculated and categorized by pressure zone. Table 8-2 summarizes the City's 2025 potable water demands (including existing demands) by pressure zone. Table 8-3 summarizes the City's buildout potable water demands (including existing and 2025 demands) by pressure zone. Table 8-4 provides additional detail of the projected average day water demands at buildout for each future development project by pressure zone (not including existing demands).

Table 8-2. 2025 Potable Water Demands by Pressure Zone							
Pressure Zone		Average Day Demand[(a)]		Maximum Day Demand[(b)]		Peak Hour Demand[(c)]	
		gpm	mgd	gpm	mgd	gpm	mgd
Zone 1		7,590	10.9	12,903	18.6	22,011	31.7
Zone 2		4,251	6.1	7,227	10.4	12,329	17.8
Zone 3	PPBP[(d)]	392	0.6	667	1.0	1,138	1.6
	Ellis Reduced Zone	186	0.3	316	0.5	540	0.8
	Other	474	0.7	806	1.2	1,375	2.0
Zone 4		370	0.5	629	0.9	1,074	1.5
Total		**13,264**	**19.1**	**22,550**	**32.5**	**38,467**	**55.4**

(a) Equal to existing water demands plus projected 2025 water demands presented in Table 4-16.
(b) Maximum day demand is 1.7 times the average day demand.
(c) Peak hour demand is 2.9 times the average day demand.
(d) Water demands from PPBP are not included in the City's water production totals because the water supply for this area is purchased by PPBP from the Byron Bethany Irrigation District. However, the City is responsible for providing water treatment and delivery services to PPBP.

Table 8-3. Buildout Potable Water Demands by Pressure Zone							
Pressure Zone		Average Day Demand[(a)]		Maximum Day Demand[(b)]		Peak Hour Demand[(c)]	
		gpm	mgd	gpm	mgd	gpm	mgd
Zone 1		11,249	16.2	19,123	27.5	32,622	47.0
Zone 2		5,816	8.4	9,887	14.2	16,866	24.3
Zone 3	PPBP[(d)]	392	0.6	667	1.0	1,138	1.6
	Ellis Reduced Zone	342	0.5	582	0.8	993	1.4
	Other	1,286	1.9	2,185	3.1	3,728	5.4
Zone 4		1,187	1.7	2,018	2.9	3,443	5.0
Zone 5		568	0.8	965	1.4	1,646	2.4
Zone 6[(e)]		309	0.4	526	0.8	897	1.3
Total		**21,149**	**30.5**	**35,954**	**51.8**	**61,333**	**88.3**

(a) Equal to existing water demands plus projected buildout water demands presented in Table 4-16.
(b) Maximum day demand is 1.7 times the average day demand.
(c) Peak hour demand is 2.9 times the average day demand.
(d) Water demands from PPBP are not included in the City's water production totals because the water supply for this area is purchased by PPBP from the Byron Bethany Irrigation District. However, the City is responsible for providing water treatment and delivery services to PPBP.
(e) Tracy Hills demands were allocated by pressure zone based on recent land use data provided by the City's planning division. The proportion of Tracy Hills demands allocated to Zone 6 in this WSMP is significantly greater than allocated to Zone 6 (formerly Tracy Hills Zone 5) in the Tracy Hills Water Study prepared by RJA (December 2014). Demands should be confirmed using the most recent land use data before development of Zones 5 and 6 begins.

Table 8-4. Summary of Buildout Average Day Potable Water Demands by Development Project[a,b]

	Zone 1		Zone 2		Zone 3 and Ellis Reduced Zone		Zone 4		Zone 5		Zone 6		Total	
Project or Development Area	gpm	percent of total	gpm	percent of total	gpm	percent of total	gpm	percent of total	gpm	percent of total	gpm	percent of total	gpm	percent of total
UR 5 (Bright)	181.79	4.14%		0.00%		0.00%		0.00%		0.00%		0.00%	181.79	1.81%
UR 7 (Bright/Castro)	136.40	3.10%		0.00%		0.00%		0.00%		0.00%		0.00%	136.40	1.36%
Rocking Horse		0.00%	63.37	3.08%		0.00%		0.00%		0.00%		0.00%	63.37	0.63%
Tracy Village		0.00%	183.40	8.91%		0.00%		0.00%		0.00%		0.00%	183.40	1.82%
UR 1	535.24	12.18%	219.02	10.64%		0.00%		0.00%		0.00%		0.00%	754.26	7.50%
Ellis		0.00%		0.00%	324.35	21.10%		0.00%		0.00%		0.00%	324.35	3.23%
Avenues		0.00%	134.59	6.54%		0.00%		0.00%		0.00%		0.00%	134.59	1.34%
UR 10		0.00%		0.00%	87.91	5.72%		0.00%		0.00%		0.00%	87.91	0.87%
Tracy Hills		0.00%		0.00%		0.00%	1,187.29	100.00%	567.61	100.00%	309.45	100.00%	2064.35	20.53%
Westside	389.47	8.87%	389.47	18.92%		0.00%		0.00%		0.00%		0.00%	778.94	7.75%
Cordes Ranch		0.00%	464.82	22.58%	627.36	40.82%		0.00%		0.00%		0.00%	1092.17	10.86%
UR 4 (Bright Triangle)	239.63	5.45%		0.00%		0.00%		0.00%		0.00%		0.00%	239.63	2.38%
UR 3 (Sandhu)	437.60	9.96%	69.79	3.39%		0.00%		0.00%		0.00%		0.00%	507.39	5.05%
I-205 Expansion	325.93	7.42%		0.00%		0.00%		0.00%		0.00%		0.00%	325.93	3.24%
West Side Industrial		0.00%		0.00%	492.57	32.05%		0.00%		0.00%		0.00%	492.57	4.90%
East Side Industrial	280.33	6.38%		0.00%		0.00%		0.00%		0.00%		0.00%	280.33	2.79%
Larch-Clover	402.17	9.15%		0.00%		0.00%		0.00%		0.00%		0.00%	402.17	4.00%
Chrisman Road	89.42	2.04%		0.00%		0.00%		0.00%		0.00%		0.00%	89.42	0.89%
Rocha		0.00%	144.91	7.04%		0.00%		0.00%		0.00%		0.00%	144.91	1.44%
Berg/Byron Remainder	116.54	2.65%		0.00%		0.00%		0.00%		0.00%		0.00%	116.54	1.16%
Berg Road Subdivision	16.84	0.38%		0.00%		0.00%		0.00%		0.00%		0.00%	16.84	0.17%
SWC Valpico & Corral Hollow		0.00%	79.07	3.84%		0.00%		0.00%		0.00%		0.00%	79.07	0.79%
Kagehiro		0.00%	55.70	2.71%		0.00%		0.00%		0.00%		0.00%	55.70	0.55%
Dobler/Maibes	24.13	0.55%		0.00%		0.00%		0.00%		0.00%		0.00%	24.13	0.24%
Holly Sugar Industrial	113.61	2.59%		0.00%		0.00%		0.00%		0.00%		0.00%	113.61	1.13%
Northeast Industrial Area	446.12	10.15%		0.00%		0.00%		0.00%		0.00%		0.00%	446.12	4.44%
Industrial Areas Specific Plan		0.00%	146.92	7.14%		0.00%		0.00%		0.00%		0.00%	146.92	1.46%
I-205 Corridor Specific Plan	46.93	1.07%		0.00%		0.00%		0.00%		0.00%		0.00%	46.93	0.47%
Mountain View		0.00%	54.38	2.64%		0.00%		0.00%		0.00%		0.00%	54.38	0.54%
Legacy Fields	32.44	0.74%		0.00%		0.00%		0.00%		0.00%		0.00%	32.44	0.32%
Small Approved Projects[c]	202.69	4.61%	0.00	0.00%		0.00%		0.00%		0.00%		0.00%	202.69	2.02%
Infill (misc.)	375.96	8.56%	53.02	2.58%	4.87	0.32%		0.00%		0.00%		0.00%	433.85	4.32%
Total	**4,393.25**	**100%**	**2,058.45**	**100%**	**1,537.05**	**100%**	**1,187.29**	**100%**	**567.61**	**100%**	**309.45**	**100%**	**10,053.10**	**100%**

(a) Water demands shown are for new development only and do not include existing potable water demands. See Appendix A for detailed demand calculations by project or development area.

(b) Water demands shown include UAFW.

(c) Includes Home 2 Suites, 321 E. Grant Line Road Apartments, and Barcelona Infill.
Also includes the following identified projects within the I-205 Corridor Specific Plan area: Sierra Hills, Grant Line Road Apartments, Aspire II, Harvest.

8.4 FUTURE POTABLE WATER SYSTEM FACILITY EVALUATION

To develop the future potable water system, analyses addressing the following system facilities were conducted:

- Water Treatment Capacity
- Water Storage Capacity
- Pumping Capacity
- Critical Supply Facilities

The results from the future potable water system facilities analyses are discussed below. Recommendations for supporting projected future potable water demands and addressing any deficiencies identified within the future potable water backbone transmission and distribution system are summarized in *Section 8.6 Summary of Recommended Future Potable Water System Improvements*.

8.4.1 Water Treatment Capacity

Sufficient water treatment capacity from the JJWTP, the South County Water Supply Project, and groundwater wells will be required to meet the City's 2025 and buildout maximum day demand conditions. In addition, the City's goal is to have sufficient surface water treatment capacity to meet the 2025 and buildout maximum month demands without relying on groundwater.

Table 8-5 shows that the City's current water treatment capacity is sufficient to meet 2025 maximum day potable water demands and that the City's current surface water treatment capacity is sufficient to meet 2025 maximum month potable water demands.

Table 8-5. Comparison of Available and Required Water Treatment Capacity in 2025, mgd

Demand Condition	JJWTP[a]	South County Water Supply Project[b]	Groundwater	Total Treated Water Capacity	2025 Demand	Treated Water Capacity Surplus or (Deficit)
Maximum Day	27	15.5	21.7[c]	64.2	32	32
Maximum Month[d]	27	15.5	0.0[e]	42.5	29	13

(a) Supplied from Zone 1 36-inch diameter transmission main, Zone 2 BPS, Zone 3 BPS, and Zone 4 BPS. Although the JJWTP is designed to supply 30 mgd, the actual maximum pumping capacity of the intake pumps is 27 mgd.
(b) Supplied from Linne Road and NEI Booster Pump Stations. It is anticipated that as Manteca and Lathrop develop, Tracy's share of the deliverable capacity from this source will be reduced to 15.5 mgd.
(c) Equivalent to firm groundwater pumping capacity, assuming that 20 percent of the City's wells would be out of service (i.e., approximately two wells: one in Zone 1, and one at the JJWTP).
(d) Estimated to be 90 percent of maximum day demands.
(e) The City's goal is to meet maximum month demands without relying on groundwater supply.

Table 8-6 shows that the City's current water treatment capacity is sufficient to meet buildout maximum day potable water demands. Although the City's current surface water treatment capacity is not sufficient to meet buildout maximum month potable water demands, the deficit could be made up using 4 mgd of groundwater.

Table 8-6. Comparison of Available and Required Water Treatment Capacity at Buildout, mgd

Demand Condition	JJWTP[a]	South County Water Supply Project[b]	Groundwater	Total Treated Water Capacity	Buildout Demand	Treated Water Capacity Surplus or (Deficit)
Maximum Day	27	15.5	32.5[c]	75.0	52	23
Maximum Month[d]	27	15.5	0.0[e]	42.5	47	(4)

(a) Supplied from Zone 1 36-inch diameter transmission main, Zone 2 BPS, Zone 3 BPS, and Zone 4 BPS. Although the JJWTP is designed to supply 30 mgd, the actual maximum pumping capacity of the intake pumps is 27 mgd.
(b) Supplied from Linne Road and NEI Booster Pump Stations. It is anticipated that as Manteca and Lathrop develop, Tracy's share of the deliverable capacity from this source will be reduced to 15.5 mgd.
(c) Equivalent to firm groundwater pumping capacity, assuming that 20 percent of the City's wells would be out of service (i.e., approximately three wells: two in Zone 1, and one at the JJWTP). Includes the capacity of recommended wells to be constructed by buildout.
(d) Estimated to be 90 percent of maximum day demands.
(e) The City's goal is to meet maximum month demands without relying on groundwater supply.

Based on discussion with City staff, plans for a future 15 mgd expansion at the JJWTP were already envisioned and integrated into the planning and associated environmental review process during the most recent 15 mgd expansion (from 15 to 30 mgd) completed in 2008. Based on the updated future demand projections, an expansion of the JJWTP would not be required if the City is able to pump groundwater at a sustainable rate to supplement surface water treatment capacity. However, as a part of the City's wastewater permit, the City needs to reduce the use of the groundwater as part of its Salinity Reduction Plan, as well as to comply with the Groundwater Sustainability Plan prepared for compliance with the Sustainable Groundwater Management Act. As such, a future additional 10 mgd expansion of the JJWTP is recommended to provide the City with additional water treatment capacity, as well as operational flexibility and reliability, if the use of groundwater supplies needs to be limited or if there is a supply outage from South County Water Supply Project.

Additional JJWTP treated water storage and pumping facilities are also recommended at buildout. Based on the additional demands in Zone 3 at buildout, it is recommended that a new clearwell be constructed at the JJWTP to provide operational flexibility for the water treatment plant and to provide additional operational and emergency storage capacity to serve future developments. For this Citywide WSMP Update, it was assumed that the new clearwell will have a minimum active (useable) storage capacity of 1.0 MG. Buildout demands will also require new booster pumps to be installed at the JJWTP. *Section 8.4.3 Pumping Capacity* provides additional discussion regarding the additional treated surface water booster pumping capacity required at the JJWTP to serve buildout maximum day demands.

8.4.2 Water Storage Capacity

The principal advantages that storage provides for the water system are the ability to equalize demands on supply sources, production facilities, and transmission mains; to provide emergency storage in case of supply failure; and to provide water to fight fires. The City's water service area has two sources of available storage: above ground storage (i.e., clearwells and storage tanks) and storage available through the groundwater basin. Together, these two sources of storage must be sufficient to meet the City's operational, emergency, and fire flow storage criteria. The volumes required for each of these three storage components are listed below:

- Operational Storage: 30 percent of a maximum day demand
- Emergency Storage: 1.5 times an average day demand
- Fire Flow Storage: The required fire flow rates multiplied by their associated fire flow duration periods, as required by the City's Fire Department. For larger pressure zones, two concurrent fire flow events were assumed for the storage capacity analysis.[30] However, the recommended fire flow storage does not include the volume associated with sprinkler flows.

Because the City's potable water supply includes supply from groundwater wells, the groundwater basin can account for a portion of the recommended emergency storage, in the form of a groundwater credit. However, the following must be true to use the groundwater supply to offset the need to provide surface storage reservoirs:

- Groundwater supply is of potable water quality and can be reliably accessed (i.e., wells are equipped with on-site emergency generators)
- Groundwater supply is not already relied upon to meet the City's average day demand requirements
- Groundwater supply is of firm groundwater supply availability (i.e., assumes 20 percent of wells will be out of service at any given time)
- Sufficient water distribution facilities are available to distribute this water to demand areas

[30] Two concurrent fire flow events were not simulated in Zones 4, 5 and 6 for the Tracy Hills development because these smaller pressure zones do not justify the use of two simultaneous fire flow events.

In addition, the City currently has two independent sources of treated surface water supply, and some quantity of the total treated surface water supply capacity can also account for a portion of the recommended emergency storage. The treated surface water credit assumes that the smaller of the treated surface water supply sources can be available to offset a portion of the emergency storage requirement. However, the following must be true to use treated surface water supply to offset the need to provide above-ground storage:

- Treated surface water supply can be reliably accessed (i.e., treated surface water supply facility is equipped with on-site emergency generator)
- Sufficient treated surface water booster pumping facilities are available to distribute this water to demand areas

In summary, the Emergency Storage Credit is equal to the sum of the groundwater and treated surface water supply credits. However, the Emergency Storage Credit can only provide a maximum storage credit equal to the City's required emergency storage volume.

The existing potable water storage facilities (including the Tracy Hills At-Grade Tank, which is currently under construction), in conjunction with the available Emergency Storage Credit, were evaluated to determine whether the City's current potable water system has sufficient storage capacity within each pressure zone to provide the required operational, emergency, and fire flow storage for the 2025 and buildout timeframes.

Table 8-7 provides a comparison of the City's available potable water storage capacity and emergency storage credit with the required 2025 storage capacity. The comparison indicates that the City's existing facilities will be sufficient and that no additional storage facilities need to be constructed by 2025.

Table 8-8 provides a comparison of the City's available potable water storage capacity and emergency storage credit with the required buildout storage capacity. The comparison between the City's available and required storage capacities indicates that the City will have the following potable water storage capacity deficits within each pressure zone at buildout:

- Zones 1 and 2[31]: 0.2 MG
- Zone 3: 1.2 MG
- Zone 4: 0.6 MG
- Zone 5: 2.6 MG
- Zone 6: 1.1 MG

[31] Under existing conditions, Zones 1 and 2 are interconnected through six existing pressure regulating stations (PRS). Therefore, Zones 1 and 2 were evaluated together for the future potable water system facility evaluation.

Table 8-7. Comparison of Available and Required Water Storage Capacity in 2025

[A]	[B]	[C]	[D]	[E]	[F]	[G] = [C] + [F]	[H]	[I]	[J]	[K] = [H] + [I] + [J]	[L] = [G] - [K]
		Available Storage Capacity, MG					Required Storage Capacity, MG				
			Emergency Storage Credit								
Station	Status	Reservoir Capacity	Groundwater Credit[(a)]	Treated Surface Water Supply Credit[(b)]	Total Emergency Storage Credit[(c)]	Total Available Storage	Operational[(d)]	Emergency[(e)]	Fire Flow	Total Required Storage	Storage Surplus (Deficit), MG
Zone 1 and Zone 2											
NEI	Active	2.4	--	25.50	25.58	**39.08**	8.70	25.58	1.14[(h)]	**35.41**	**3.6**
Lincoln Well	Active	--	5.40								
Lewis Manor Well	Inactive	--	--								
Park and Ride Well	Active	--	4.32								
Ball Park Well	Active	--	5.40								
Well 8[(f)]	Active	--	--								
Linne	Active	7.1	--								
Well 1[(g)]	Active	--	--								
Well 2[(f,g)]	Active	--	--								
Well 3[(f,g)]	Active	--	--								
Well 4[(f,g)]	Active	--	--								
Clearwell #2	Active	4.0	--								
Zone 3 and Ellis Reduced Zone											
Cordes	Active	2.0	--	0.00	2.27[(i)]	**4.27**	0.77	2.27	1.14[(h)]	**4.19**	**0.1**
Zone 4											
Tracy Hills At-Grade	Under Construction	3.8	--	0.00	0.00	**3.75**	0.27	0.80	0.18[(j)]	**1.25**	**2.5**

(a) Credit based on 1.5 days of pumping capacity from active groundwater wells with on-site backup power because the required emergency storage capacity is equal to 1.5 times the average day demand. See Table 7-2 for individual well capacity.

(b) Credit based on 1.5 days of available treatment capacity (17 mgd) from the SCWSP because the required emergency storage capacity is equal to 1.5 times the average day demand.

(c) Equal to the sum of the groundwater and treated surface water supply credits; however, the maximum credit is equal to the required emergency storage capacity.

(d) Based on 30 percent of a maximum day demand (see Table 8-2).

(e) Based on 1.5 times the average day demand (see Table 8-2).

(f) Well does not contribute to Groundwater Credit because it does not have on-site backup power.

(g) Well does not contribute to Groundwater Credit because water produced by the well must be blended with chlorinated water from the JJWTP prior to distribution. The JJWTP is assumed to be offline in an emergency.

(h) Based on storage required for two concurrent fire flow events; a Single Family Residential fire flow and an Industrial fire flow (see Table 6-1).

(i) Surplus Treated Surface Water Supply Credit from other pressure zones can be used to provide emergency storage for Zone 3.

(j) Based on storage required for a Single Family Residential fire flow (see Table 6-1).

Table 8-8. Comparison of Available and Required Water Storage Capacity at Buildout

[A]	[B]	[C]	[D]	[E]	[F]	[G] = [C] + [F]	[H]	[I]	[J]	[K] = [H] + [I] + [J]	[L] = [G] - [K]
		Available Storage Capacity, MG					Required Storage Capacity, MG				
			Emergency Storage Credit								
Station	Status	Reservoir Capacity	Groundwater Credit[(a)]	Treated Surface Water Supply Credit[(b)]	Total Emergency Storage Credit[(c)]	Total Available Storage	Operational[(d)]	Emergency[(e)]	Fire Flow	Total Required Storage	Storage Surplus (Deficit), MG
Zone 1 and Zone 2											
NEI	Active	2.4	--	25.50	36.86	**50.36**	12.53	36.86	1.14[(h)]	**50.53**	(0.2)
Lincoln Well	Active	--	5.40								
Lewis Manor Well	Inactive	--	--								
Park and Ride Well	Active	--	4.32								
Ball Park Well	Active	--	5.40								
Well 8[(f)]	Active	--	--								
Linne	Active	7.1	--								
Well 1[(g)]	Active	--	--								
Well 2[(f,g)]	Active	--	--								
Well 3[(f,g)]	Active	--	--								
Well 4[(f,g)]	Active	--	--								
Clearwell #2	Active	4.0	--								
Zone 3 and Ellis Reduced Zone											
Cordes	Active	2.0	--	0.00	3.27[(i)]	**5.76**	1.48	4.36	1.14[(h)]	**6.99**	(1.2)
Zone 4											
Tracy Hills At-Grade	Under Construction	3.8	--	0.00	0.00	**3.75**	0.87	2.56	0.96[(j)]	**4.40**	(0.6)
Zone 5											
--	--	--	--	0.00	0.00	**0.00**	0.42	1.23	0.96[(j)]	**2.60**	(2.6)
Zone 6											
--	--	--	--	0.00	0.00	**0.00**	0.23	0.67	0.18[(k)]	**1.08**	(1.1)

(a) Credit based on 1.5 days of pumping capacity from active groundwater wells with on-site backup power because the required emergency storage capacity is equal to 1.5 times the average day demand. See Table 7-2 for individual well capacity.

(b) Credit based on 1.5 days of available treatment capacity (17 mgd) from the SCWSP because the required emergency storage capacity is equal to 1.5 times the average day demand.

(c) Equal to the sum of the groundwater and treated surface water supply credits; however, the maximum credit is equal to the required emergency storage capacity.

(d) Based on 30 percent of a maximum day demand (see Table 8-3).

(e) Based on 1.5 times the average day demand (see Table 8-3).

(f) Well does not contribute to Groundwater Credit because it does not have on-site backup power.

(g) Well does not contribute to Groundwater Credit because water produced by the well must be blended with chlorinated water from the JJWTP prior to distribution. The JJWTP is assumed to be offline in an emergency.

(h) Based on storage required for two concurrent fire flow events; a Single Family Residential fire flow and an Industrial fire flow (see Table 6-1).

(i) Surplus Treated Surface Water Supply Credit from other pressure zones can be used to provide emergency storage for Zone 3.

(j) Based on storage required for an Industrial or Institutional fire flow (see Table 6-1).

(k) Based on storage required for a Single Family Residential fire flow (see Table 6-1).

It should be noted that in the period before the future Clearwell #3 is completed, the full storage capacity in Clearwell #2 is not available. During normal operations, the water level in Clearwell #2 is maintained near the maximum water level, at water surface elevation (WSEL) 197.5 feet, approximately 11.5 feet above the floor. This maximum WSEL provides approximately 4 MG of storage in Clearwell #2. Under emergency conditions, the City is able to significantly draw down the WSEL in Clearwell #2 with the Zone 2 pumps. However, because the Zone 4 and Zone 5 pump station suction pipe cannot draw water from Clearwell #2 at a WSEL less than approximately five feet above the floor, the available storage in Clearwell #2 is currently limited to 2.25 MG. Until the Tracy Hills tanks are in service, sufficient operational, emergency, and fire flow storage must be maintained in Clearwell #2 to serve Tracy Hills and prevent dewatering of the Zone 4 and Zone 5 pumps.

Once in service, the Tracy Hills Zone 4 tank will provide sufficient operational, emergency, and fire storage for Zone 4. Similarly, the planned Zone 5 tank will provide sufficient operational, emergency, and fire storage for Zones 5 and 6 once constructed. With these tanks in service, the full volume of Clearwell #2 may be used in an emergency. Although this will dewater the Zone 4 and Zone 5 pumps, the Tracy Hills tanks will provide emergency supply to Zones 4 and 5 until service from the JJWTP can be restored. The water level in Clearwell #2 should still be maintained at greater than five feet above the floor for normal operations.

An additional clearwell (Clearwell #3) is proposed at the JJWTP and will be hydraulically connected to Clearwell #2 and the Zone 4 and Zone 5 pump stations. Once Clearwell #3 is constructed, the suction piping for the Tracy Hills pump stations will be connected to the pump wet well in Clearwell #3 at a low enough elevation to allow the Tracy Hills pump stations to continue in operation as long as volume remains in Clearwell #3, allowing the City to use the full volume of operational, emergency, and fire flow storage in both Clearwell #2 and Clearwell #3 without dewatering the Zone 4 and Zone 5 pumps.

Based on the storage capacity deficits identified in Table 8-8, Table 8-9 summarizes the recommended facility improvements to provide additional buildout storage capacity. The proposed specific facility improvements are based on those presented in the 2012 WSMP and in the Tracy Hills Water Study (RJA, December 2014), but were modified to reflect the reduced buildout storage capacity requirements.

Table 8-9. Comparison of Available, Proposed, and Required Water Storage Capacity at Buildout

[A]	[B]	[C]	[D]	[E]	[F]	[G] = [C] + [F]	[H]	[I]	[J]	[K] = [H] + [I] + [J]	[L] = [G] - [K]
		Available Storage Capacity, MG					Required Storage Capacity, MG				
			Emergency Storage Credit								
Station	Status	Reservoir Capacity	Groundwater Credit[(a)]	Treated Surface Water Supply Credit[(b)]	Total Emergency Storage Credit[(c)]	Total Available Storage	Operational[(d)]	Emergency[(e)]	Fire Flow	Total Required Storage	Storage Surplus (Deficit), MG
Zone 1 and Zone 2											
NEI	Active	2.4	--	25.50	36.86	**51.36**	12.53	36.86	1.14[(i)]	**50.53**	**0.8**
Lincoln Well	Active	--	5.40								
Lewis Manor Well	Inactive	--	--								
Park and Ride Well	Active	--	4.32								
Ball Park Well	Active	--	5.40								
Well 8[(f)]	Active	--	--								
Linne	Active	7.1	--								
Well 1[(g)]	Active	--	--								
Well 2[(f,g)]	Active	--	--								
Well 3[(f,g)]	Active	--	--								
Well 4[(f,g)]	Active	--	--								
Clearwell #2	Active	4.0	--								
Westside Tank	Proposed[(h)]	1.0	--								
Westside ASR Well	Proposed	--	5.40								
Wainwright ASR Well	Proposed	--	5.40								
Larsen Park ASR Well	Proposed	--	5.40								
Zone 3 and Ellis Reduced Zone											
Cordes	Active	2.0	--	0.00	4.86[(j)]	**7.36**	1.48	4.36	1.14[(i)]	**6.99**	**0.4**
JJWTP Clearwell #3	Proposed[(h)]	1.0	--								
Ellis ASR Well	Proposed	--	2.16								
Zone 4											
Tracy Hills At-Grade	Under Construction	3.8	--	0.00	0.00	**3.75**	0.87	2.56	0.96[(k)]	**4.40**	**(0.6)**
Zone 5											
Gravity Tank[(l)]	Proposed[(h)]	3.2	--	0.00	0.00	**3.2**	0.42	1.23	0.96[(k)]	**2.60**	**0.6**
Zone 6											
Gravity Tank[(m)]	Proposed[(h)]	1.1	--	0.00	0.00	**1.10**	0.23	0.67	0.18[(n)]	**1.08**	**0.0**

(a) Credit based on 1.5 days of pumping capacity from active groundwater wells with on-site backup power because the required emergency storage capacity is equal to 1.5 times the average day demand. See Table 7-2 for the individual capacity of existing wells. Proposed ASR wells in Zone 1 and Zone 2 were assumed to have a capacity of 2,500 gpm. The proposed Ellis ASR Well was assumed to have a capacity of 1,000 gpm.

(b) Credit based on 1.5 days of available treatment capacity (17 mgd) from the SCWSP because the required emergency storage capacity is equal to 1.5 times the average day demand.

(c) Equal to the sum of the groundwater and treated surface water supply credits; however, the maximum credit is equal to the required emergency storage capacity.

(d) Based on 30 percent of a maximum day demand (see Table 8-3).

(e) Based on 1.5 times the average day demand (see Table 8-3).

(f) Well does not contribute to Groundwater Credit because it does not have on-site backup power.

(g) Well does not contribute to Groundwater Credit because water produced by the well must be blended with chlorinated water from the JJWTP prior to distribution. The JJWTP is assumed to be offline in an emergency.

(h) Proposed reservoir capacity is the recommended active and useable reservoir storage capacity and does not include dead and freeboard storage, which will be determined during design.

(i) Based on storage required for two concurrent fire flow events; a Single Family Residential fire flow and an Industrial fire flow (see Table 6-1).

(j) Surplus Treated Surface Water Supply Credit from other pressure zones can be used to provide emergency storage for Zone 3.

(k) Based on storage required for an Industrial or Institutional fire flow (see Table 6-1).

(l) The Tracy Hills Water Study prepared by RJA (December 2014) recommended two Zone 5 (formerly Tracy Hills Zone 4) tanks with a combined capacity of 8.8 MG. Recommended Zone 5 capacity is significantly smaller than previously evaluated due to decrease in demand factors and emergency storage requirement. Sizing of the proposed tanks should be confirmed before development of Zone 5 begins.

(m) Based on previous recommendations from the Tracy Hills Water Study prepared by RJA (December 2014). Sizing of the proposed tank should be confirmed before development of Zone 6 begins.

(n) Based on storage required for a Single Family fire flow (see Table 6-1).

A portion of the buildout storage capacity requirement is met by additional Emergency Storage Credit provided by the new ASR wells recommended in Chapter 5. It was assumed that three of the ASR wells will be located in Zones 1 and 2, while the fourth ASR well will be located in Zone 3. The ASR well in Zone 3 was assumed to have a lower production capacity due to the less ideal aquifer conditions underlying Zone 3. All new wells should be equipped with ammonia addition.

It is recommended that the City construct a 1.0 MG pumped storage tank near the Westside Specific Plan development in Zone 1. In addition to providing additional storage capacity needed to meet the operational storage requirement for Zones 1 and 2, the Westside Tank would provide localized storage for the northwest sector of the City. Localized storage provides supply reliability in the chance that storage from the JJWTP or any other storage facility is unavailable for any reason.

It is recommended that the City construct a Clearwell (Clearwell #3) with a minimum volume of 1.0 MG at the JJWTP to provide additional storage capacity for Zone 3. In addition to providing storage, Clearwell #3 would provide operational flexibility for the JJWTP. Because of the additional operational flexibility that Clearwell #3 would provide, it is recommended that Clearwell #3 be constructed as soon as possible. As noted above, no additional storage facilities are required by 2025, but it is recommended that Clearwell #3 be constructed by no later than 2030.

It is also recommended that the City construct a 3.2 MG gravity storage tank in Zone 5 and a 1.1 MG gravity storage tank in Zone 6. The remaining 0.6 MG storage capacity deficit in Zone 4 is to be provided by Zone 5 via a PRV. It should be noted that the 3.2 MG capacity of the Zone 5 Tank recommended in this WSMP Update is significantly smaller than the 8.8 MG recommended in the Tracy Hills Water Study (RJA, December 2014) for several reasons: (1) since the Tracy Hills Water Study was conducted, the proposed land use plan for Tracy Hills has changed; (2) the water demand factors used to project demands for Tracy Hills in this WSMP Update are lower than those used in the Tracy Hills Water Study; and (3) the emergency storage capacity requirement used in this WSMP Update is lower than that used in the Tracy Hills Water Study. As proposed land use plans may continue to be refined, the size of the Zone 5 and Zone 6 tanks should be confirmed before development of Zones 5 and 6 begins.

8.4.3 Pumping Capacity

The existing and proposed pumping capacity in the City's potable water system was evaluated to assess its ability to deliver a reliable firm capacity to serve the water service area for the 2025 and buildout timeframes. Firm capacity assumes a reduction in total pumping capacity to account for pumps that are out of service at any given time due to mechanical breakdowns, maintenance, water quality, or other operational issues. At each booster pump station, firm booster pumping capacity was defined as the total booster pump station capacity with the largest pump out of service. For groundwater well pumps, the firm groundwater pumping capacity assumed that 20 percent of the wells could be out of service at any given time.

The pumping capacity criterion for the City, described previously in Chapter 6, requires the City's potable water system to have sufficient firm pumping capacity to meet the greater of either a maximum day demand with two simultaneous fire flow events[32] or a peak hour demand. In addition, sufficient firm treated water pumping capacity should be available to meet a maximum day demand condition.

Table 8-10 provides a comparison between the City's available firm pumping capacity and the required 2025 pumping capacity under different water demand conditions. The City's existing pumping facilities are sufficient to meet the 2025 pumping capacity requirements.

Table 8-11 provides a comparison between the City's available and proposed buildout firm pumping capacity for the different water demand scenarios. The proposed pumping facility improvements are based on:

- The necessity to deliver water from proposed storage facilities to the system
- The necessity to provide treated water pumping capacity to meet buildout maximum day demands (e.g., JJWTP Clearwell #3 pumps)
- The necessity for localized pumping capacity to support system pressure during periods of high demand (fire flow and peak hour)

The pumping capacity analysis indicates that the City's existing and proposed firm booster and groundwater pumping capacity will be sufficient to meet the pumping capacity criterion for the buildout water service area during the governing demand scenario within each pressure zone. It should be noted that Zones 5 and 6 will provide water supply by gravity, rather than by pumping, to meet potable water demands during maximum day plus fire flow and peak hour demand conditions.

It is recommended that the City construct Zone 1 and Zone 2 booster pumps at the proposed Westside Tank. Although the proposed capacity of these booster pumps is more than required to meet the Zone 1 and 2 pumping capacity requirements, the capacity of these pumps is needed to maintain sufficient system pressure during periods of high demand (fire flow and peak hour) in the northwest quadrant of the City.

It is also recommended that the City install additional Zone 3 booster pumps on the proposed Clearwell #3. It is recommended that these pumps have a capacity of at least 1,500 gpm to provide operational flexibility for the Zone 3 BPS.

A new Zone 5 BPS (located at the JJWTP) and a Zone 6 BPS must also be constructed to supply water to Zones 5 and 6, respectively. The Zone 5 BPS was sized based on the Tracy Hills Water Study (RJA, December 2014). The Zone 6 BPS recommended in this WSMP Update is larger than previously recommended in the Tracy Hills Water Study because the proposed land use plan for Tracy Hills has changed since the study was conducted. Sizing of the Zone 6 BPS should be confirmed before development of Zone 6 begins.

[32] Two concurrent fire flow events were not simulated in Zones 4, 5 and 6 for the Tracy Hills development because these smaller pressure zones do not justify the use of two simultaneous fire flow events.

Table 8-10. Comparison of Available and Required Firm Pumping Capacity in 2025

Pump Station	Backup Power	Status	Firm Capacity[a], gpm	Total Firm Pumping Capacity from Supply Sources, gpm[b]	2025 Maximum Day Demand, gpm	Pumping Capacity from Supply Sources Surplus (Deficit), gpm[b]	Total Firm Pumping Capacity, gpm	2025 Maximum Day Demand with Fire Flow Event(s), gpm	2025 Peak Hour Demand, gpm	Pumping Capacity Surplus (Deficit), gpm[c]
Zones 1 and 2										
NEI	✓	Active	4,200	44,106	20,131	23,975	51,095	26,839[e]	34,340	16,755
Zone 1	✓	Active	12,000							
Lincoln Well	✓	Active	2,500							
Lewis Manor Well	✓	Inactive	--							
Park and Ride Well	✓	Active	2,000							
Ball Park Well	✓	Active	2,500							
Well 8		Active	--							
Linne	✓	Active	14,595							
Zone 2	✓	Active	13,300							
Well 1[d]	✓	Active	--							
Well 2[d]		Active	--							
Well 3[d]		Active	--							
Well 4[d]		Active	--							
Zone 3 and Ellis Reduced Zone										
Cordes	✓	Active	6,150	2,970	1,790	1,180	9,120	7,676[e]	3,053	1,330
Patterson Pass[f]	✓	Inactive	--							
Zone 3	✓	Active	2,970							
Zone 4										
Zone 4	✓	Active	2,450	2,450	629	1,821	8,350	2,095[g]	1,074	6,221
Tracy Hills At-Grade	✓	Under Construction	5,900							

(a) Firm booster pumping capacity was defined as the total booster pump station capacity with the largest pump out of service and firm groundwater pumping capacity assumed that 20 percent of the City's wells would be out of service (i.e., approximately two wells: one in Zone 1, and one at the JJWTP).

(b) Maximum day water demands should be met through firm treated water pumping capacity. The firm pumping capacity available from NEI and Linne is limited to 17 mgd based on the available water supply from the SCWSP.

(c) Pumping capacity surplus (deficit) is the total firm pumping capacity minus the greater of the maximum day demand with required fire flow event(s) or peak hour demand.

(d) Wells 1-4 located at JJWTP pump directly into the Chlorine Contact Basin or Clearwell #2; therefore, these wells do not provide additional pumping capacity to the system.

(e) Equal to maximum day demand plus a 1,500 gpm Single Family Residential fire flow and a simultaneous 4,500 gpm Industrial fire flow.

(f) Patterson Pass BPS is inactive since the Cordes BPS is now operating; therefore, it does not provide additional pumping capacity to the system.

(g) Equal to maximum day demand plus a 1,500 gpm Single Family Residential fire flow.

Table 8-11. Comparison of Available, Proposed, and Required Firm Pumping Capacity at Buildout

Pump Station	Backup Power	Status	Firm Capacity[a], gpm	Total Firm Pumping Capacity from Supply Sources, gpm[b]	Buildout Maximum Day Demand, gpm	Pumping Capacity from Supply Sources Surplus (Deficit), gpm[b]	Total Firm Pumping Capacity, gpm	Buildout Maximum Day Demand with Fire Flow Event(s), gpm	Buildout Peak Hour Demand, gpm	Pumping Capacity Surplus (Deficit), gpm[c]
Zones 1 and 2										
NEI	✓	Active	4,200	44,106	29,010	15,096	57,995	35,754[e]	49,487	8,508
Zone 1	✓	Active	12,000							
Lincoln Well	✓	Active	2,500							
Lewis Manor Well	✓	Inactive	--							
Park and Ride Well	✓	Active	2,000							
Ball Park Well	✓	Active	2,500							
Well 8		Active	--							
Linne	✓	Active	14,595							
Zone 2	✓	Active	13,300							
Well 1[d]	✓	Active	--							
Well 2[d]		Active	--							
Well 3[d]		Active	--							
Well 4[d]		Active	--							
Westside Ranch Tank Zone 1	✓	Proposed	4,500							
Westside Ranch Tank Zone 2	✓	Proposed	2,400							
Westside Ranch ASR Well	✓	Proposed	--							
Wainwright ASR Well	✓	Proposed	--							
Larsen Park ASR Well	✓	Proposed	--							
Zone 3 and Ellis Reduced Zone										
Cordes	✓	Active	6,150	4,470	3,435	1,035	10,620	9,590[e]	5,859	1,185
Patterson Pass[f]	✓	Inactive	--							
Zone 3[g] – Clearwell #2 Pumps	✓	Active	2,970							
Zone 3[g] – Clearwell #3 Pumps	✓	Proposed	1,500							
Ellis ASR Well	✓	Proposed	--							
Zone 4										
Zone 4[h]	✓	Active	3,675	3,675	2,018	1,657	11,875	6,432[i]	3,443	5,357
Tracy Hills At-Grade[h]	✓	Under Construction	8,200							
Zone 5										
Zone 5[j]	✓	Proposed	2,410	2,410	1,491[k]	919	NA			
Zone 6										
Zone 6[l]	✓	Proposed	550	550	526	24	NA			

(a) Firm booster pumping capacity was defined as the total booster pump station capacity with the largest pump out of service and firm groundwater pumping capacity assumed that 20 percent of the City's wells would be out of service (i.e., approximately two wells: one in Zone 1, and one at the JJWTP). It was assumed that the proposed ASR wells do not contribute to pumping capacity in a normal hydrologic year.

(b) Maximum day water demands should be met through firm treated water pumping capacity. The firm pumping capacity available from NEI and Linne is limited to 17 mgd based on the available water supply from the SCWSP.

(c) Pumping capacity surplus (deficit) is the total firm pumping capacity minus the greater of the maximum day demand with required fire flow event(s) or peak hour demand.

(d) Wells 1-4 located at JJWTP pump directly into the Chlorine Contact Basin or Clearwell #2; therefore, these wells do not provide additional pumping capacity to the system.

(e) Equal to maximum day demand plus a 1,500 gpm Single Family Residential fire flow and a simultaneous 4,500 gpm Industrial fire flow.

(f) Patterson Pass BPS is inactive since the Cordes BPS is now operating; therefore, it does not provide additional pumping capacity to the system.

(g) Zone 3 pumps on Clearwell #2 and Clearwell #3 are considered a single booster pump station for purposes of determining firm capacity.

(h) Buildout firm capacity includes the capacity of an additional pump to be installed after 2025.

(i) Equal to maximum day demand plus a 4,500 gpm Industrial fire flow.

(j) Based on previous recommendations from the Tracy Hills Water Study prepared by RJA (December 2014). Water demands from Zone 5 (formerly Tracy Hills Zone 4) and Zone 6 (formerly Tracy Hills Zone 5) will be served from a single Zone 5 BPS located at the JJWTP. Water supplied by the Zone 5 BPS will be subsequently boosted by the Zone 6 BPS to serve Zone 6 water demands.

(k) Equal to maximum day demands for Zone 5 and Zone 6.

(l) Recommended firm pump station capacity is larger than previously recommended in Tracy Hills Water Study prepared by RJA (December 2014). Required firm capacity should be confirmed before Zone 6 begins development.

8.4.4 Critical Supply Facilities

All critical pumping facilities should be equipped with an on-site, emergency backup power generator to provide pumping capacity during a power outage. Critical pumping facilities are defined as those facilities that provide service to pressure zone(s) and/or service area(s) which do not have sufficient emergency storage, and that meet the following criteria:

- The largest pumping facility that provides water to a particular pressure zone and/or service area
- A facility that provides the sole source of water to single or multiple pressure zones and/or service areas
- A pumping facility that provides water from a supply turnout, or
- A pumping facility that provides water from key groundwater supply wells (depends on capacity, quality, and location)

As shown previously in Table 8-11, most of the City's existing pumping facilities have on-site emergency backup power installed, except for Wells 2 through 4 and Well 8[33]. As shown in Table 8-11, proposed future pumping facilities for the buildout potable water system are assumed to have an on-site backup power generator installed to improve supply reliability.

8.4.5 SCADA System Improvements

As stated in Chapter 7, the City does not have SCADA installed on PRS #1-#6. As the City's water system continues to grow and serve larger water demands, the ability to operate the system efficiently and properly regulate flow between zones will be essential. PRS #1-#6 can provide a significant amount of water supply from Zone 2 to Zone 1 and should be monitored to provide operators with complete real-time system operations data. The addition of SCADA system monitoring at PRS #1-#6 would provide operators with the ability to operate the City's water system more efficiently between the use of the Zone 1 BPS and the pressure regulating stations to maintain pressures in Zone 1. The addition of SCADA system monitoring to PRS #1-#6 would also provide the ability to create diurnal curves that are specific to each zone, which will help provide a better understanding of water demand patterns within each zone. Therefore, it is recommended that SCADA system monitoring of flow and pressure be installed at PRS #1-#6 to provide operators with additional understanding and flexibility in system operations.

Similarly, SCADA improvements at Well 8 to allow remote operation is also a recommended improvement to provide additional operational flexibility as the system continues to grow.

All new booster pump stations, storage tanks, groundwater wells, and PRVs should be equipped with SCADA for remote monitoring and operation.

[33] Well 8 currently has a plug-in adapter installed to allow interconnection to a portable generator. On-site backup power is not recommended due to site constraints.

8.4.6 Update of Future System Facilities in the Hydraulic Model

Facilities recommended based on the future potable water system facility evaluation were incorporated into the existing hydraulic model (including existing system improvements described in Chapter 7) to evaluate the performance of the proposed future potable water system. Major transmission pipelines were also added to distribute water to new demand areas. In addition, some smaller distribution pipelines were added to provide additional detail and system looping. The preliminary locations and sizes of some of the future facilities and pipelines were based on the following previously prepared reports/technical memoranda and/or data provided by the developers:

- Draft Peer Review and Hydraulic Evaluation for Tracy Hills Phase 1B and 1C (May 22, 2019), prepared by West Yost Associates
- Tracy Hills Water Study Technical Memorandum (December 5, 2014), prepared by Ruggeri-Jensen-Azar
- Water System Evaluation for the City of Tracy's Initial Pressure Zone 3 Area (June 3, 2013), prepared by West Yost Associates
- Ellis Specific Plan Water System Analysis - Phase 1 (August 13, 2015), prepared by West Yost Associates
- Hydraulic Evaluation of Ellis Specific Plan Phase 2 – The Gardens (December 9, 2016), prepared by West Yost Associates
- Draft Hydraulic Evaluation of Ellis Specific Plan Phase 3 – Town and Country (July 11, 2019), prepared by West Yost Associates
- Design Recommendations for Lammers Road Pipeline (September 25, 2019), prepared by West Yost Associates
- Hydraulic Evaluation of International Park of Commerce (IPC) Building 25 (July 28, 2017), prepared by West Yost Associates
- Hydraulic Evaluation of International Park of Commerce (IPC) Buildings 9, 10, and 14 (May 3, 2018), prepared by West Yost Associates
- Hydraulic Evaluation of Valpico and MacDonald Apartments (July 16, 2012), prepared by West Yost Associates
- Hydraulic Evaluation of Tracy Village Specific Plan (February 16, 2018), prepared by West Yost Associates
- Hydraulic Evaluation of Avenues Specific Plan (April 30, 2018), prepared by West Yost Associates
- Hydraulic Evaluation of South Lammers Road Development (May 20, 2015), prepared by West Yost Associates
- Berg Road Properties Development Water Distribution System Analysis (January 14, 2016), prepared by BlackWater Consulting Engineers, Inc.

- Improvement Plans for Kagehiro Phase 1 and Kagehiro Phase 2 (received on September 3, 2019) prepared by VVH Consulting Engineers
- Water Exhibit of International Park of Commerce for Prologis (received June 2018) provided by Kier and Wright

The proposed locations and sizing of facilities and pipelines described in the documents listed above were incorporated into the future potable water system hydraulic model. Locations of other future facilities and pipelines were based on the 2012 WSMP and recommendations from City staff. The 2012 WSMP facilities were modified as needed to account for existing potable water system facilities constructed since the 2012 WSMP, updated planning data, and the updated projected future water demands.

It should be noted that the elevations of new junctions that have been added into the hydraulic model were assigned based on their spatial location and the closest corresponding elevation contour.[34] These elevations may not accurately represent the actual elevation of water services since grading will typically occur during the construction of a new development project. However, these preliminary junction elevations are the best estimates of the proposed service elevations at this time. As future development projects are constructed, service elevations for each future development should be confirmed to correspond to the service elevation ranges developed for each pressure zone, as identified in Table 8-1, to meet the minimum and maximum system pressure criteria.

In addition to proposed future facilities, some existing facilities which were not included in the existing system hydraulic model (refer to *Section 7.3.2* for more information) were added to the future water system model. These facilities include:

- Zone 4 infrastructure, including the Zone 4 BPS, Zone 4 PRS, and major transmission and distribution pipelines
- Northington Drive PRV
- Some pipelines in the IPC development
- Some pipelines in the Ellis Specific Plan development

The Tracy Hills At-Grade Tank and BPS, which has been designed and is currently under construction, was also included in the future water system hydraulic model.

[34] Digital topology information was extracted as a GIS shapefile using the software program TopoDepot®. TopoDepot® provides elevation contours generated from the USGS National Elevation Database Digital Elevation Model.

To provide emergency and/or peaking water supply between pressure zones, the following future interconnections are recommended and were incorporated into the hydraulic model to allow for the flow of water between pressure zones[35]:

- Westside PRS – Supplies water from Zone 2 to Zone 1
- Avenues PRV – Supplies water from the Ellis Reduced Zone to Zone 2
- One (1) additional Ellis PRV – Supplies water from Zone 3 to the Ellis Reduced Zone
- Zone 4 PRV – Supplies water from Zone 5 to Zone 4
- Two (2) Zone 5 PRVs – Supply water from Zone 6 to Zone 5

All of the facilities discussed above were included in the buildout water system hydraulic model, however, not all future facilities were needed to serve 2025 demands. The 2025 water system model only includes future pipelines in areas expected to develop by 2025 (refer to Chapter 3 and Appendix A for details). None of the recommended future tanks, pump stations, or interconnections between pressure zones were included in the 2025 water system model. Figure 8-2 illustrates the locations of the proposed 2025 facilities and pipeline alignments.

Figure 8-3 illustrates the locations of the proposed buildout facilities and pipeline alignments. Preliminary pipeline sizes are not shown on Figure 8-2, as they will be refined based on hydraulic evaluations discussed below in *Section 8.5 Future Potable Water System Performance Evaluation*. Recommended pipeline sizes are presented in *Section 8.6 Summary of Recommended Future Potable Water System Improvements*.

[35] Pressure Regulating Stations (PRS) contain a combination of one pressure sustaining valve (PSV) and one pressure reducing valve (PRV) to control the flow of water between pressure zones.

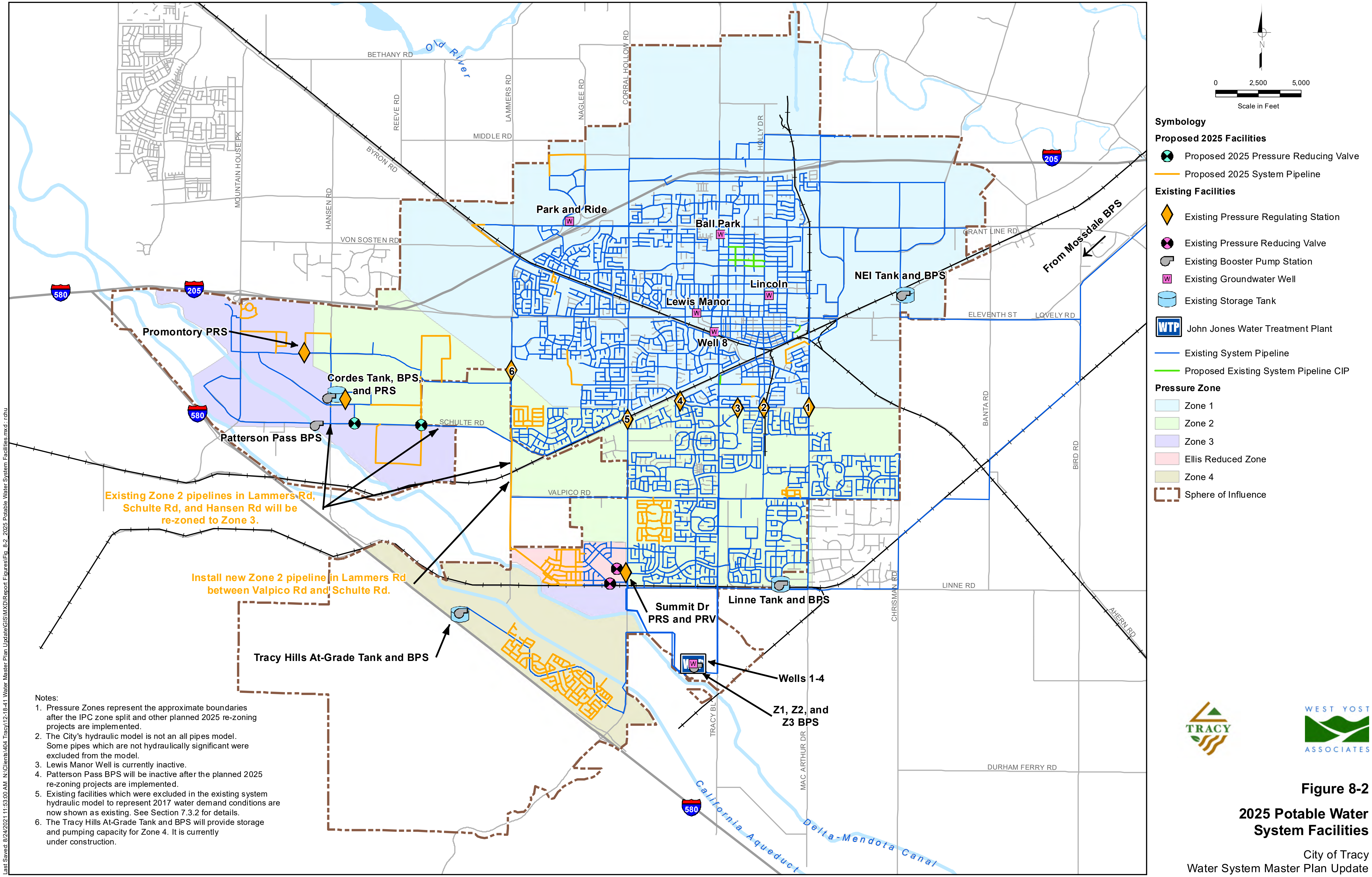
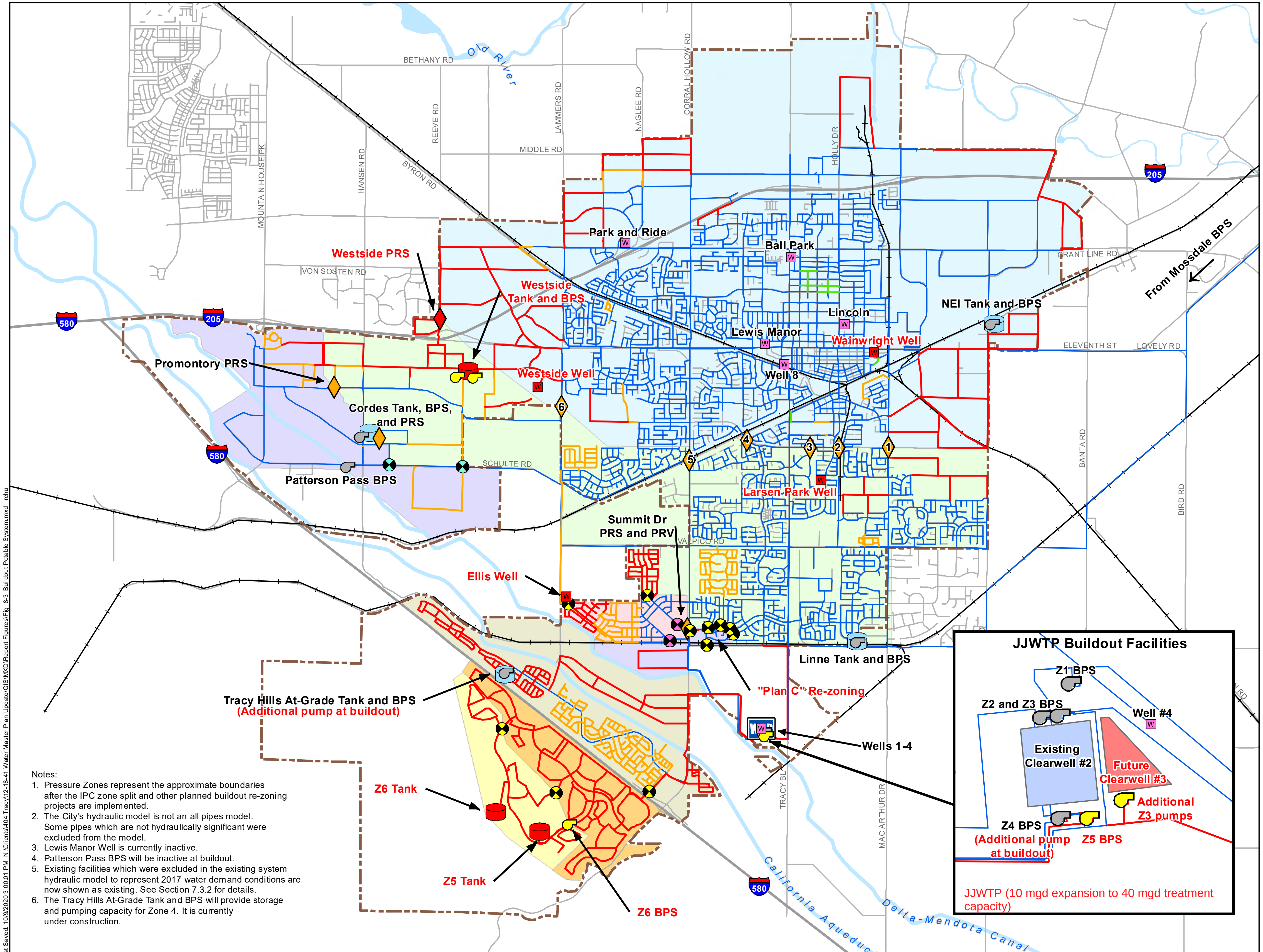


Figure 8-2

2025 Potable Water System Facilities

City of Tracy
Water System Master Plan Update



Notes:
1. Pressure Zones represent the approximate boundaries after the IPC zone split and other planned buildout re-zoning projects are implemented.
2. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
3. Lewis Manor Well is currently inactive.
4. Patterson Pass BPS will be inactive at buildout.
5. Existing facilities which were excluded in the existing system hydraulic model to represent 2017 water demand conditions are now shown as existing. See Section 7.3.2 for details.
6. The Tracy Hills At-Grade Tank and BPS will provide storage and pumping capacity for Zone 4. It is currently under construction.

N

0 2,500 5,000

Scale in Feet

Symbology

Proposed Buildout Facilities

- Buildout Pressure Regulating Station
- Buildout Pressure Reducing Valve
- Buildout Booster Pump Station
- Buildout Groundwater Well
- Buildout Storage Tank
- Buildout System Pipeline

Existing and 2025 Facilities

- Existing Pressure Regulating Station
- Existing Pressure Reducing Valve
- Proposed 2025 Pressure Reducing Valve
- Existing Booster Pump Station
- Existing Groundwater Well
- Existing Storage Tank
- WTP John Jones Water Treatment Plant
- Existing System Pipeline
- Proposed 2025 System Pipeline
- Proposed Existing System Pipeline CIP

Pressure Zone

- Zone 1
- Zone 2
- Zone 3
- Ellis Reduced Zone
- Zone 4
- Zone 5
- Zone 6
- Sphere of Influence

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Figure 8-3

Buildout Potable Water System Facilities

City of Tracy
Water System Master Plan Update

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8.5 FUTURE POTABLE WATER SYSTEM PERFORMANCE EVALUATION

To evaluate the performance of the City's proposed future potable water system, additional projected potable water demands were first allocated into the updated future system hydraulic model (see Tables 8-2 through 8-4). This updated hydraulic model was then used to evaluate the City's 2025 and buildout potable water backbone transmission and distribution systems and their ability to meet the City's recommended performance and operational criteria under future maximum day demand plus fire flow and peak hour demand scenarios.

The performance criteria recommended for and results of the future potable water backbone transmission and distribution system evaluation are discussed below. Recommendations for supporting projected future potable water demands and addressing any deficiencies identified within the future potable water backbone transmission and distribution system are summarized in *Section 8.6 Summary of Recommended Future Potable Water System Improvements*.

8.5.1 Future Water System Performance Criteria

Steady state hydraulic analyses using the updated future potable water system hydraulic model were conducted to help identify areas of the future potable water system that do not meet the recommended system performance criteria as presented previously in Chapter 6. The results of the future potable water system evaluation are presented below for the following potable water demand scenarios:

- Peak Hour Demand—A peak hour flow condition was simulated for the future water distribution facilities to evaluate their capability to meet a peak hour demand scenario. Peak hour demands are met by the combined supply from treated surface water, storage tanks, and groundwater.
- Maximum Day Demand plus Fire Flow—To evaluate the future potable water system under the maximum day demand plus fire flow scenario, individual fire flow demands were first assigned and simulated at various locations within the City's water service area. InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow while meeting the maximum day demand plus fire flow performance criteria. Additional fire flow simulations were also performed to simulate a condition equal to a maximum day demand with two concurrent fire flow events in the larger pressure zones. Maximum day plus fire flow demands are met by the combined supply from treated surface water, storage tanks, and groundwater.

The performance criteria and results for each scenario are discussed in more detail below.

8.5.1.1 Peak Hour Demand Scenario

As shown in Tables 8-2 and 8-3, the peak hour demands for the 2025 and buildout water service areas were calculated to be 38,467 gpm (55.4 mgd) and 61,333 gpm (88.3 mgd), respectively. Peak hour demand represents a peaking factor of 2.9 times the average day demand. During a peak hour demand scenario, a minimum pressure of 40 psi must be maintained throughout the water system. In addition, maximum head loss per thousand feet of distribution main should not exceed 7 ft/kft and maximum velocities should not exceed 8 fps. For transmission mains, maximum head loss per thousand feet of transmission main should not exceed 3 ft/kft and maximum velocities should not exceed 6 fps. Details of the system pressures and pipeline characteristics as simulated in the hydraulic model under the peak hour demand scenario are discussed below.

8.5.1.2 Maximum Day Demand plus Fire Flow Scenario

As shown in Tables 8-2 and 8-3, the maximum day demands for the 2025 and buildout water service areas were calculated to be 22,550 gpm (32.5 mgd) and 35,954 gpm (51.8 mgd), respectively. Maximum day demand represents a peaking factor of 1.7 times the average day demand. Fire flow demands were assigned and simulated at various locations within the City's water service area to determine if the minimum residual pressure criterion of 20 psi could be met during a maximum day demand plus fire flow scenario. Fire flow demands in future development areas were assigned based on proposed land use, and are summarized below in Table 8-12.

Table 8-12. Recommended Fire Flow Requirements[a]

Land Use Category	Fire Flow, gpm	Duration, hours
Single Family Residential[b]	1,500	2
Multi-Family Residential[c]	2,500	2
Commercial/Office[d]	3,500[e]	4
Industrial	4,500[e]	4
Institutional[f]	4,500[e]	4

(a) Specific fire flow requirements were determined from Table B105.1 of the 2016 CFC, and depend on construction type and fire flow calculation area. Non-residential fire flow requirements are based on the assumption that an automatic sprinkler system has been installed. See Table 6-1 for further explanation of how the fire flow requirements were developed.
(b) Includes Very Low and Low Density Residential land uses.
(c) Includes Medium and High Density Residential land uses.
(d) Includes Commercial, Office, Downtown, and Village Center land uses.
(e) Fire flow includes a 500 gpm demand for on-site sprinkler flow, which is not included in the recommended fire flow storage volume.
(f) Includes Medical, Public Facilities, School, Airport, Church, and Cemetery land uses.

The City's water system should also have the capability to meet a system demand condition equal to the occurrence of a maximum day demand with two concurrent fire flow events in the larger pressure zones (Zone 1, Zone 2, and Zone 3). It is assumed that the two fire flow events will consist of one smaller single family residential fire flow combined with another larger industrial fire flow. This conservative assumption of two simultaneous fire flow demands will help stress the City's water system, and determine if the future water system can provide reliable service during high demand conditions. Consequently, two concurrent fire flow demands were simulated at various locations within the City's water service area during a maximum day demand condition to determine if the minimum residual pressure criterion of 20 psi could be met during simultaneous fire flow events.

8.5.2 Recommended Improvements Criteria

The performance criteria described above was used to evaluate the future potable water system during peak hour demand and maximum day demand plus fire flow scenarios. The future potable water system is expected to deliver peak hour flow and maximum day demand plus fire flow within the acceptable pressure, velocity and head loss ranges as identified in the performance criteria presented in Chapter 6. However, the system was evaluated using pressure as the primary criterion. If necessary, recommended improvements needed to comply with the performance criteria were added to the future potable water system to fix any deficiencies found and are discussed below.

8.5.3 2025 Water System Evaluation Results

The results from the 2025 hydraulic model for the peak hour demand and maximum day demand plus fire flow analyses are presented below.

8.5.3.1 2025 Peak Hour Demand Scenario

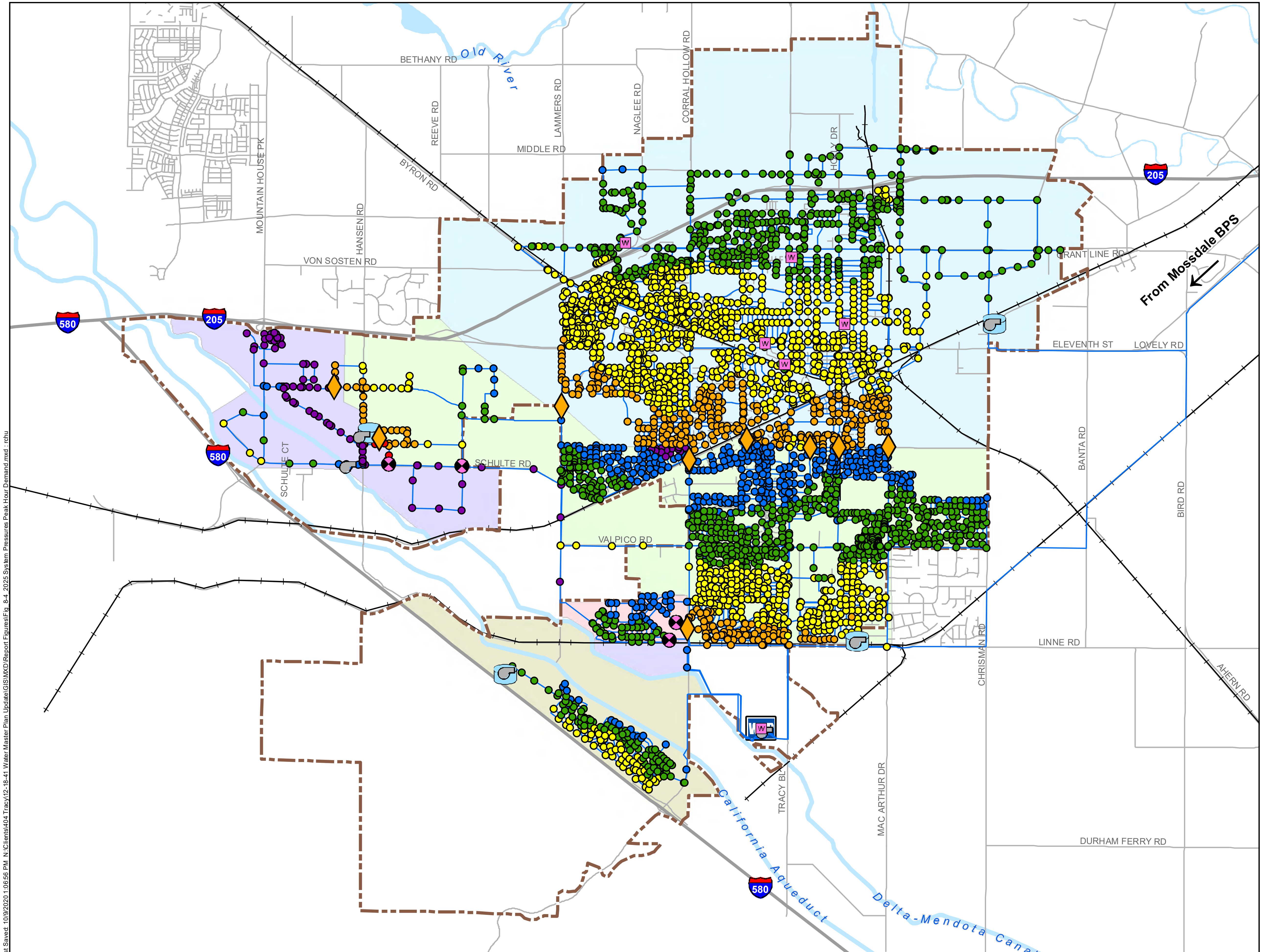
During a peak hour demand scenario, results indicate that the 2025 potable water system could adequately deliver peak hour demands to meet the City's minimum pressure criterion of 40 psi at all existing and future service locations as illustrated on Figure 8-4. Under this scenario, system pressures at service locations ranged from 40 to 113 psi. It should be noted that, per the California Plumbing Code, any individual service connection pressure exceeding 80 psi will require the installation of an individual PRV. As discussed previously, new junction elevations in the hydraulic model may not accurately represent the actual elevation of water services since grading will typically occur during the construction of a new development. Therefore, the system pressures simulated by the hydraulic model are best estimates of the proposed service pressures at this time. It is recommended that as the water system infrastructure for future development projects are designed, the proposed service elevations for each future development project should correspond to the service elevation ranges developed for each pressure zone (see Table 8-1) and that additional hydraulic analyses should be performed to confirm that the recommended minimum and maximum system pressure criteria can be met.

As illustrated on Figure 8-5, there is one location within the 2025 system where the distribution system pipelines did not meet the maximum velocity criterion of 8 fps during a peak hour demand scenario. The following list details pipelines in the 2025 potable water system that exceeded the maximum velocity criterion and summarizes any recommended improvements.

- The existing 12-inch diameter distribution pipelines which cross the railroad tracks between Sixth Street and Tracy Boulevard east of the 36-inch diameter transmission main tie-in had a velocity of 11.4 fps.

  Recommendation:

  It is recommended that the existing 12-inch diameter pipelines located between Sixth Street and Tracy Boulevard east of the 36-inch diameter transmission tie-in be replaced with a new 18-inch diameter pipeline. The recommended diameter of the new pipeline is sized to accommodate buildout demands.



0 2,500 5,000
Scale in Feet

Symbology

Peak Hour Pressure

- Less than 40 psi
- 40 psi to 50 psi
- 50 psi to 60 psi
- 60 psi to 70 psi
- 70 psi to 80 psi
- Greater than 80 psi
- Pressure Regulating Station
- Pressure Reducing Valve
- Booster Pump Station
- Groundwater Well
- Storage Tank
- WTP John Jones Water Treatment Plant
- Pipeline

Pressure Zone

- Zone 1
- Zone 2
- Zone 3
- Ellis Reduced Zone
- Zone 4
- Sphere of Influence

Notes:
1. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
2. Per the California Plumbing Code, services which experience pressures exceeding 80 psi are required to be fitted with a pressure reducing valve.

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Figure 8-4

2025 System Pressures Peak Hour Demand

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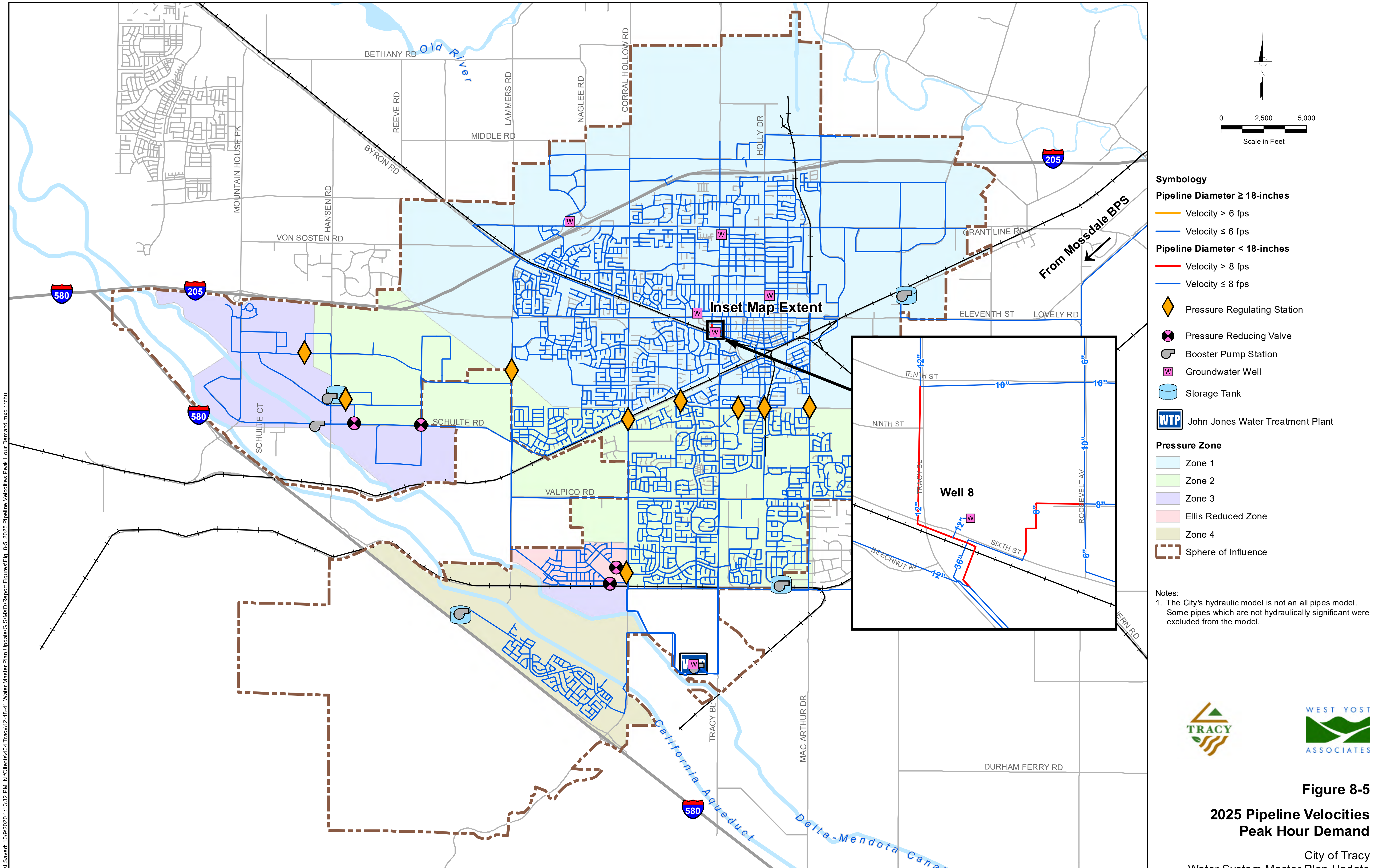


Figure 8-5

2025 Pipeline Velocities Peak Hour Demand

City of Tracy
Water System Master Plan Update

- The existing 12-inch diameter distribution pipelines located in Sixth Street west of the 36-inch diameter transmission main tie-in and in Tracy Boulevard between Sixth Street and Tenth Street, had a velocity of 9.4 fps.

  Recommendation:

  It is recommended that the existing 12-inch diameter pipeline in Sixth Street west of the 36-inch diameter transmission main tie-in, the 12-inch diameter pipeline in Tracy Boulevard between Sixth Street and Eleventh Street, and a 40 ft section of existing 12-inch diameter pipeline in Eleventh Street, be replaced with new 24-inch diameter pipeline. The recommended diameter of the new pipeline is sized to accommodate buildout demands.

8.5.3.2 2025 Maximum Day Demand plus Fire Flow Scenario

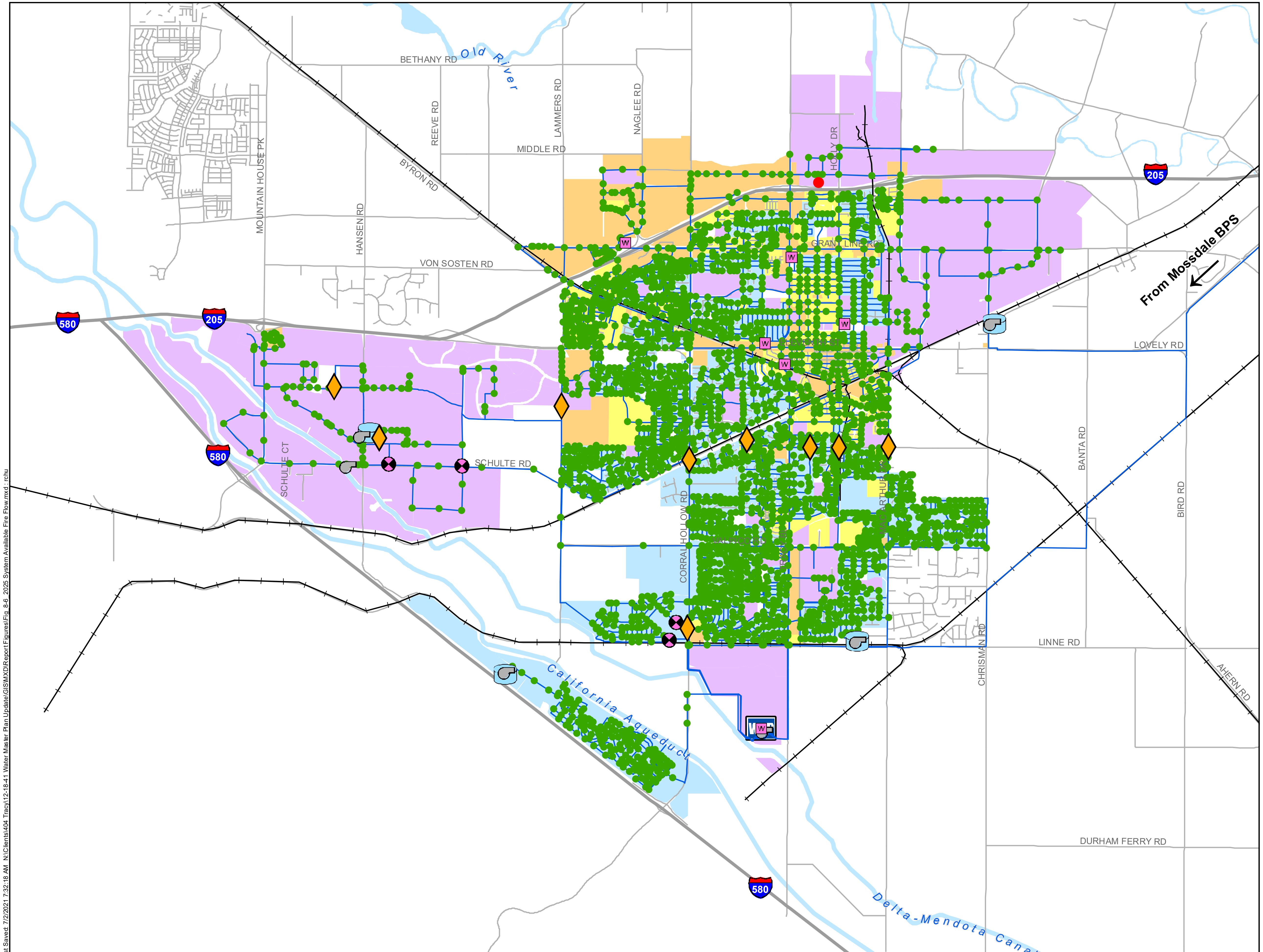
Fire flow demands were assigned based on the fire flow requirements summarized in Table 8-12 and simulated at various locations within the City's 2025 water service area. InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow (while meeting the maximum day demand plus fire flow minimum residual pressure of 20 psi and the maximum velocity performance criteria in proposed pipelines of 12 fps) at each fire flow junction within the 2025 water system during a maximum day demand scenario. Figure 8-6 illustrates the results of the 2025 maximum day plus fire flow evaluation. With the exception of the hydrant located at the southern end of Rhonda Way (discussed in Chapter 7), results indicate that all evaluated locations within the model were able to meet the minimum fire flow requirements.

Six additional fire flow simulations were performed within the 2025 system hydraulic model to simulate a condition equal to a maximum day demand with two concurrent fire flow events. Figure 8-7 illustrates the locations of the additional fire flow simulations. Locations were selected within each pressure zone based on the existing and proposed land use designations and spatial distance from supply sources to stress the City's water system. As summarized in Table 8-13, results from the hydraulic model indicate that all six of the concurrent fire flow simulations met the minimum residual pressure criterion of 20 psi.

Table 8-13. Results of Additional Fire Flow Simulations for 2025 System

Pressure Zone	Location #	Fire Flow Demand, gpm[a]	Residual Pressure, psi
Zone 1	1	1,500	48
		4,500	30
	2	1,500	50
		4,500	44
Zone 2	3	1,500	67
		4,500	52
	4	1,500	66
		4,500	33
	5	1,500	60
		4,500	26
Zone 3	6	1,500	48
		4,500	31

(a) It is assumed that the two concurrent fire flow events will consist of one smaller Single Family Residential fire flow combined with another larger Industrial fire flow.



Symbology

Available Fire Flow

- Does Not Meet Requirement
- Meets Requirement
- Pressure Regulating Station
- Pressure Reducing Valve
- Booster Pump Station
- Groundwater Well
- Storage Tank
- John Jones Water Treatment Plant
- Pipeline

Fire Flow Requirement

- 1,500 gpm
- 2,500 gpm
- 3,500 gpm
- 4,500 gpm

Notes:
1. The available fire flow shown is the maximum flow available while maintaining 20 psi residual system pressure and velocities of less than 12 fps in proposed pipelines.
2. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.

Figure 8-6

2025 System Available Fire Flow

City of Tracy
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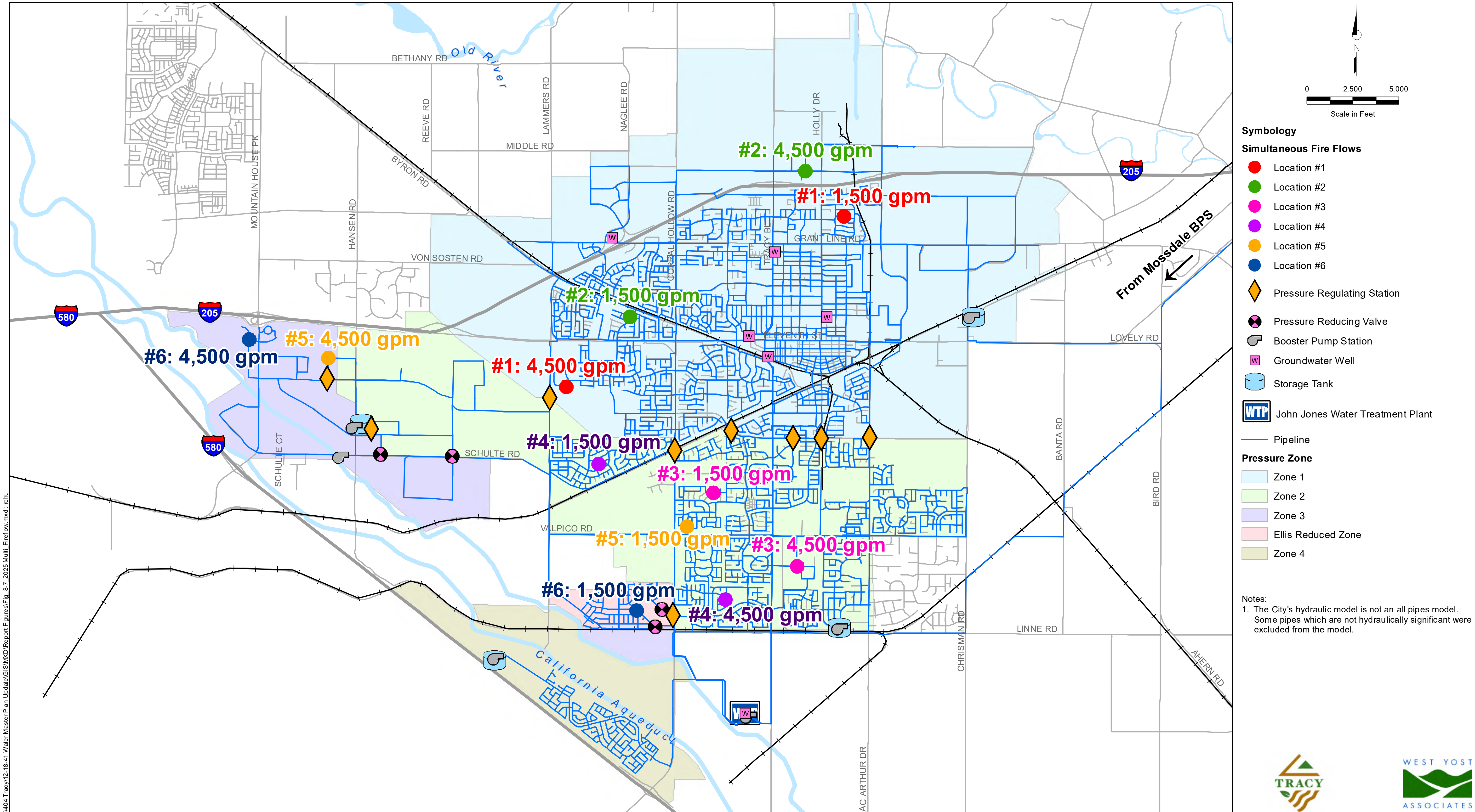

Figure 8-7

2025 System Locations of Additional Simultaneous Fire Flow Simulations

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Water System Master Plan Update

8.5.4 Buildout Water System Evaluation Results

The results from the buildout hydraulic model for the peak hour demand and maximum day demand plus fire flow analyses are presented below. The results assume that the recommended 2025 pipeline replacements discussed in *Section 8.5.3.1 2025 Peak Hour Demand Scenario* are constructed before buildout.

8.5.4.1 Buildout Peak Hour Demand Scenario

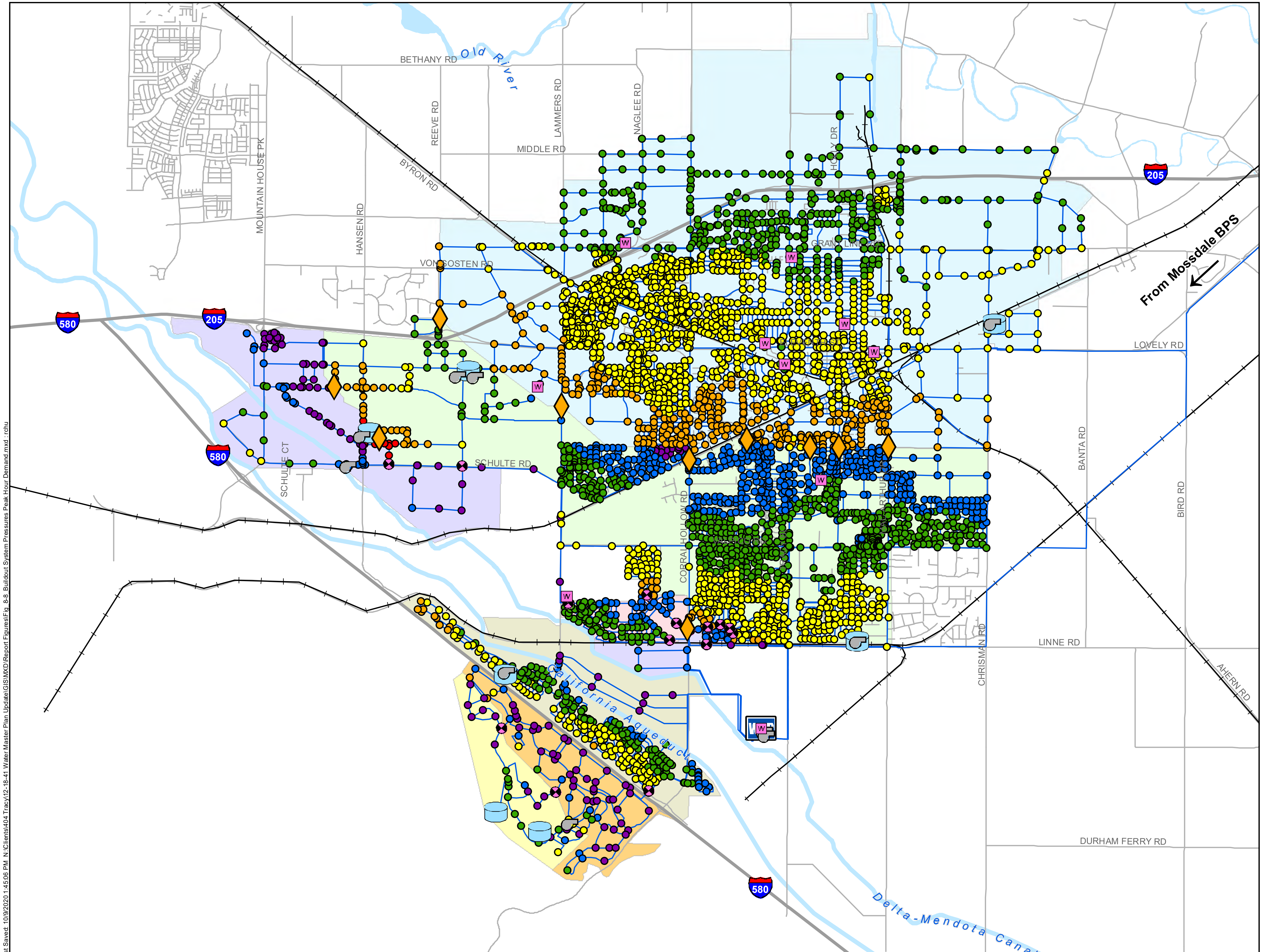
During a peak hour demand scenario, results indicate that the buildout potable water system could adequately deliver peak hour demands to meet the City's minimum pressure criterion of 40 psi at all existing and future service locations as illustrated on Figure 8-8. Under this scenario, system pressures at service locations ranged from 40 to 118 psi. It should be noted that, per the California Plumbing Code, any individual service connection pressure exceeding 80 psi will require the installation of an individual PRV. As discussed previously, new junction elevations in the hydraulic model may not accurately represent the actual elevation of water services since grading will typically occur during the construction of a new development. Therefore, the system pressures simulated by the hydraulic model are best estimates of the proposed service pressures at this time. It is recommended that as the water system infrastructure for future development projects are designed, the proposed service elevations for each future development project should correspond to the service elevation ranges developed for each pressure zone (see Table 8-1) and that additional hydraulic analyses should be performed to confirm that the recommended minimum and maximum system pressure criteria can be met.

As illustrated on Figure 8-9, there is one location within the buildout system where the transmission system pipelines did not meet the maximum velocity criterion of 6 fps during a peak hour demand scenario. The following list details pipelines in the buildout potable water system that exceeded the maximum velocity criterion and summarizes any recommended improvements.

- The existing 18-inch diameter transmission pipeline in Tracy Boulevard between Linne Road and Windsong Drive had velocities ranging from 6.0 fps to 6.5 fps.

  Recommendation:

  No mitigation is recommended for the 18-inch diameter pipeline in Tracy Boulevard because the simulated velocities are only slightly higher than the maximum criterion of 6 fps. In addition, upsizing this pipeline does not provide a significant improvement in system pressures.



0 2,500 5,000
Scale in Feet

Symbology

Peak Hour Pressure

- Less than 40 psi
- 40 psi to 50 psi
- 50 psi to 60 psi
- 60 psi to 70 psi
- 70 psi to 80 psi
- Greater than 80 psi
- Pressure Regulating Station
- Pressure Reducing Valve
- Booster Pump Station
- Groundwater Well
- Storage Tank
- WTP John Jones Water Treatment Plant
- Pipeline

Pressure Zone

- Zone 1
- Zone 2
- Zone 3
- Ellis Reduced Zone
- Zone 4
- Zone 5
- Zone 6

Notes:
1. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
2. Per the California Plumbing Code, services which experience pressures exceeding 80 psi are required to be fitted with a pressure reducing valve.

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Figure 8-8

Buildout System Pressures Peak Hour Demand

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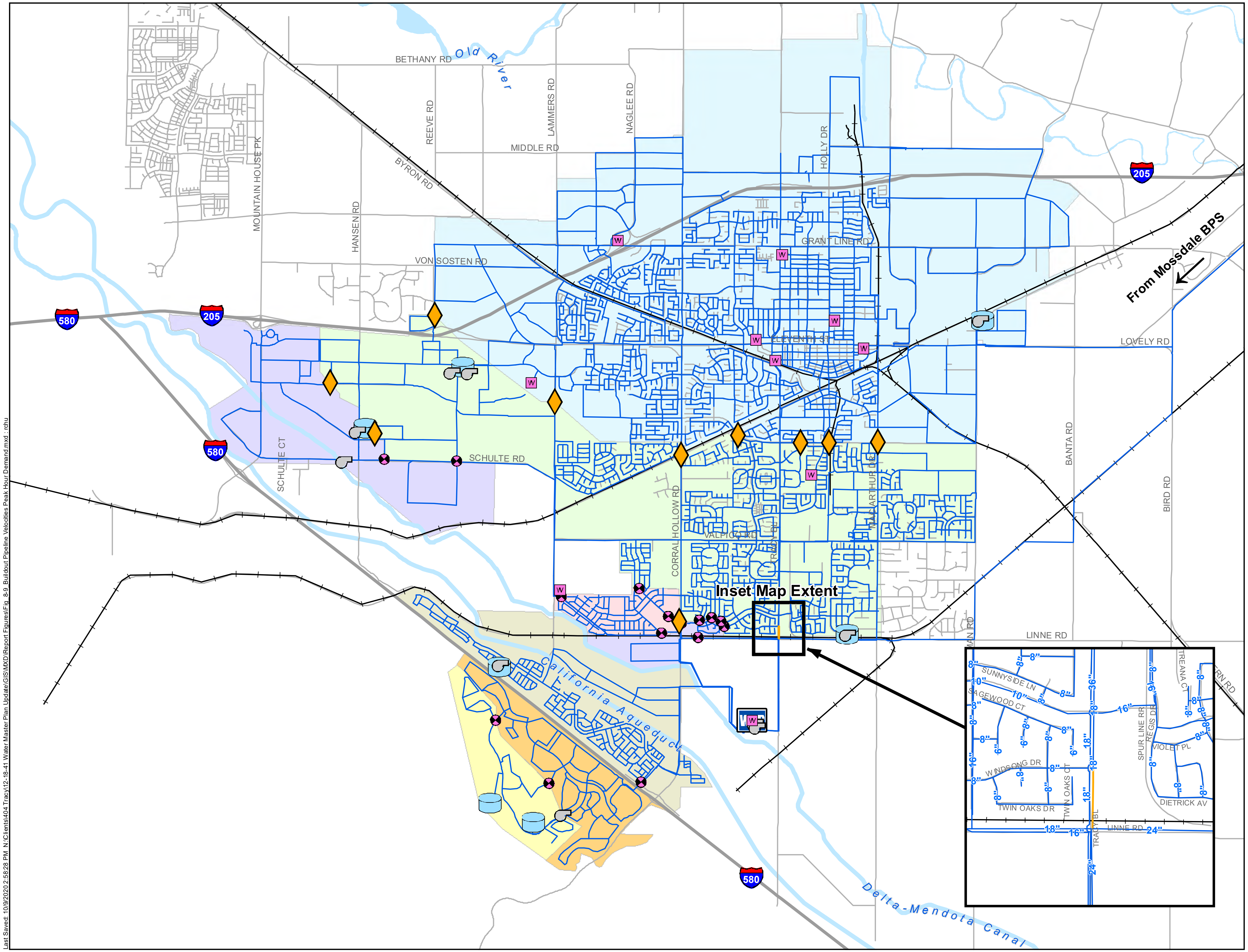


Figure 8-9

Buildout Pipeline Velocities Peak Hour Demand

City of Tracy
Water System Master Plan Update

8.5.4.2 Buildout Maximum Day Demand plus Fire Flow Scenario

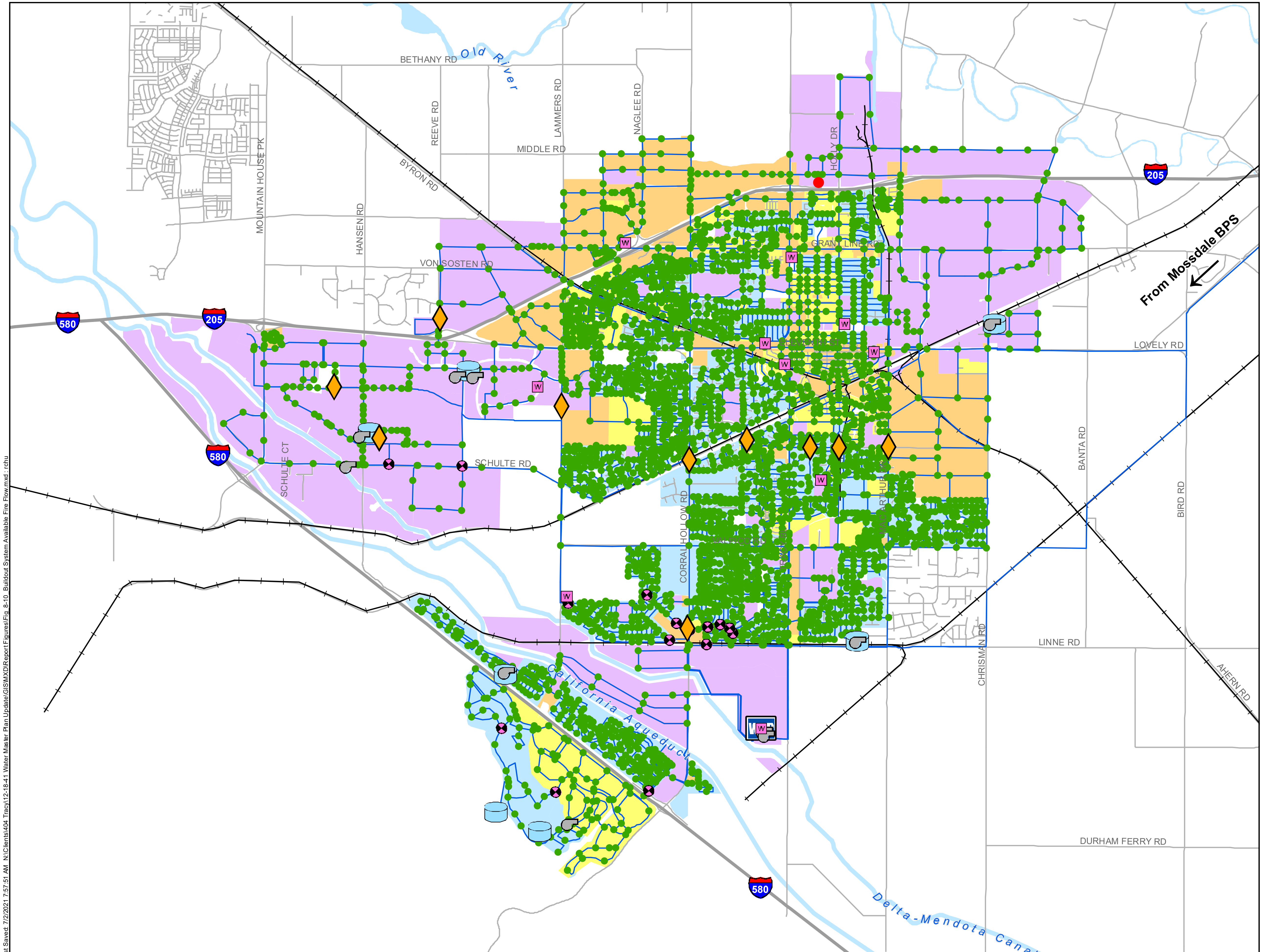
Fire flow demands were assigned based the fire flow requirements summarized in Table 8-12 and simulated at various locations within the City's buildout water service area. InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow (while meeting the maximum day demand plus fire flow minimum residual pressure of 20 psi and the maximum velocity performance criteria in proposed pipelines of 12 fps) at each fire flow junction within the buildout water system during a maximum day demand scenario. Figure 8-10 illustrates the results of the buildout maximum day plus fire flow evaluation. With the exception of the hydrant located at the southern end of Rhonda Way (discussed in Chapter 7), results indicate that all evaluated locations within the model were able to meet the minimum fire flow requirements.

Seven additional fire flow simulations were performed within the buildout system hydraulic model to simulate a condition equal to a maximum day demand with two concurrent fire flow events. Figure 8-11 illustrates the locations of the additional fire flow simulations. Locations were selected within each pressure zone based on the existing and proposed land use designations and spatial distance from supply sources to stress the City's water system. As summarized in Table 8-14, results from the hydraulic model indicate that all seven of the concurrent fire flow simulations met the minimum residual pressure criterion of 20 psi.

Table 8-14. Results of Additional Fire Flow Simulations for Buildout System

Pressure Zone	Location #	Fire Flow Demand, gpm[(a)]	Residual Pressure, psi
Zone 1	1	1,500	54
		4,500	40
	2	1,500	56
		4,500	50
	7	1,500	43
		4,500	39
Zone 2	3	1,500	68
		4,500	55
	4	1,500	68
		4,500	34
	5	1,500	61
		4,500	31
Zone 3	6	1,500	70
		4,500	60

(a) It is assumed that the two concurrent fire flow events will consist of one smaller Single Family Residential fire flow combined with another larger Industrial fire flow.



0 2,500 5,000
Scale in Feet

Symbology

Available Fire Flow

- Does Not Meet Requirement
- Meets Requirement
- Pressure Regulating Station
- Pressure Reducing Valve
- Booster Pump Station
- Groundwater Well
- Storage Tank
- WTP John Jones Water Treatment Plant
- Pipeline

Fire Flow Requirement

- 1,500 gpm
- 2,500 gpm
- 3,500 gpm
- 4,500 gpm

Notes:

1. The available fire flow shown is the maximum flow available while maintaining 20 psi residual system pressure and velocities of less than 12 fps in proposed pipelines.
2. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
3. The buildout storage and pumping capacity analysis include a maximum fire flow requirement of 4,500 gpm in Zone 5 to account for the potential construction of a school in Zone 5. However, because the location of this potential school is unknown, fireflow requirements were limited to 2,500 gpm in Zone 5 in the hydraulic analysis. Once the location of the school is known, additional analysis should be performed to determine which pipelines must be upsized to accomodate the higher fire flow requirement.

Figure 8-10

Buildout System Available Fire Flow

City of Tracy
Water System Master Plan Update

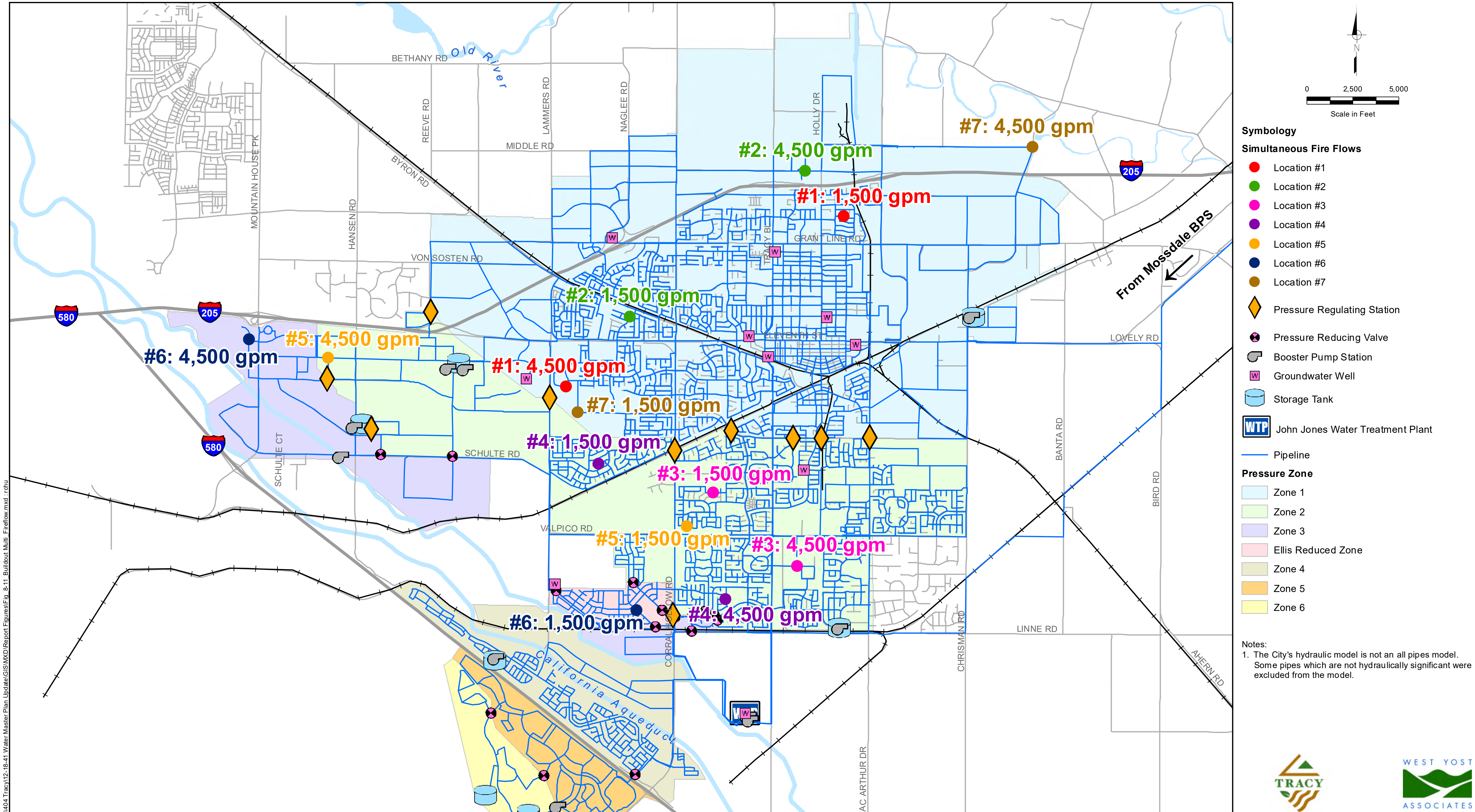


Figure 8-11

Buildout System Locations of Additional Simultaneous Fire Flow Simulations

City of Tracy
Water System Master Plan Update

8.6 SUMMARY OF RECOMMENDED FUTURE POTABLE WATER SYSTEM IMPROVEMENTS

The recommended backbone potable water system improvements required to serve future potable water demands are summarized below and shown on Figure 8-12 and Figure 8-13. These future system improvements are triggered by additional demands from new development, unlike the improvements discussed in Chapter 7. It should be noted that these recommendations only identify facility improvements at a master plan level and do not necessarily include all required on-site infrastructure nor constitute design of improvements. Subsequent detailed design is required to determine the exact sizes and final locations of these proposed facility improvements.

The evaluation of the City's future water system is dependent on:

- Projected future development projects and land use data (refer to Chapter 3)
- Adopted water use factors (refer to Chapter 4)
- Adopted peaking factors (refer to Chapter 4)
- Characteristics and capabilities of existing water supply facilities (refer to Chapter 5)
- City water system performance criteria (refer to Chapter 6)

If any of these are significantly altered, the recommendations listed below may need to be reevaluated and revised.

It should also be noted that the future hydraulic model is not an "all pipes" model (i.e., not all smaller diameter pipelines are included); therefore, the hydraulic simulations performed as discussed above may not identify all necessary water system improvements. Consequently, it is recommended that further hydraulic evaluations be performed as additional details are provided for each future development project.

8.6.1 2025 System Improvements

The recommended backbone potable water system improvements required to serve 2025 potable water demands are summarized below. Planning and design for these improvements should be conducted so that these improvements are constructed and operational by 2025.

8.6.1.1 Pipelines

- To serve 2025 water demands, install approximately 73,020 linear feet of new pipelines ranging in diameter from 12 to 24 inches as shown on Figure 8-12
- To serve 2025 water demands, install additional new pipelines of 10 inches in diameter or less within individual development projects; the length of small diameter pipelines needed to serve 2025 water demands is unknown, as not all 2025 development areas have detailed water system infrastructure plans prepared
- To serve 2025 water demands, upsize approximately 1,390 linear feet of existing pipelines as shown on Figure 8-13

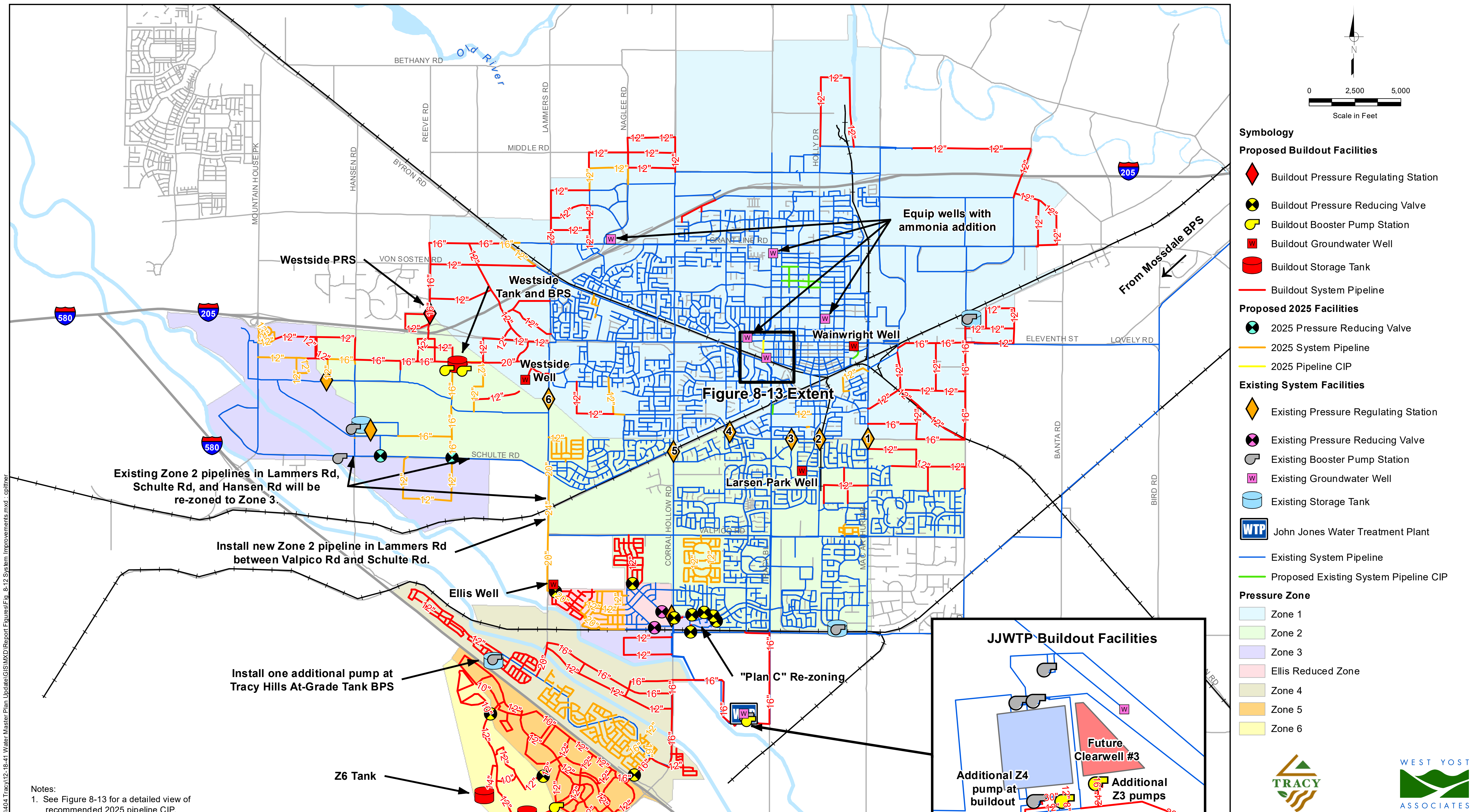


Figure 8-12
Proposed Future Water System Recommended Improvements

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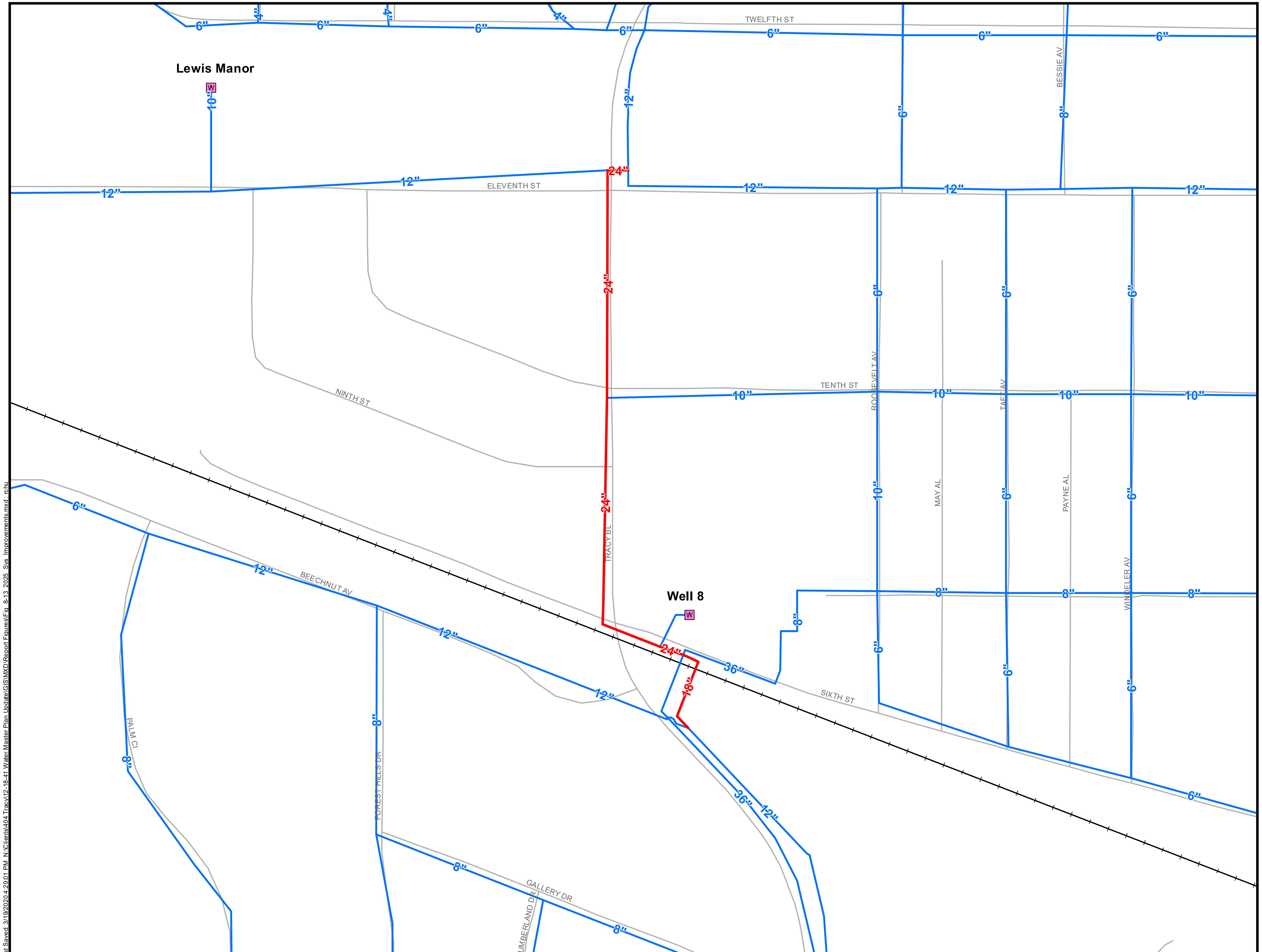
Water System Master Plan Update



N

0 100 200

Scale in Feet

Symbology

- Recommended 2025 Improvement
- Existing Pipeline
- Groundwater Well

Notes:
1. See Figure 8-12 for the location of the recommended improvements.

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Figure 8-13

2025 System Recommended Pipeline CIP

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Water System Master Plan Update

8.6.1.2 Interconnections

- Install two new mainline PRVs before the transmission main in Schulte Road is re-zoned to Zone 3
- Install an individual PRV on any water service connection with a static pressure exceeding 80 psi

8.6.1.3 Re-Zoning

- Re-zone the existing transmission mains in Lammers Road, Schulte Road, and Hansen Road from Zone 2 to Zone 3 as described in Appendix D

8.6.1.4 Groundwater Wells

- Provide ammonia addition for existing City wells (Lincoln Well, Lewis Manor Well, Park & Ride Well and Ball Park Well) (as noted below under Buildout System Improvements, all future wells are also recommended to be equipped with ammonia addition)
- A feasibility study is recommended to develop an implementation plan for future ASR expansion (see additional discussion in Chapter 5)

8.6.2 Buildout System Improvements

The recommended backbone potable water system improvements required to serve buildout potable water demands are summarized below.

8.6.2.1 Storage Facilities

Planning and design of these new storage facilities should be conducted so that the proposed facilities are constructed and operational in time to serve their respective service areas (e.g., Westside, Zone 5 or Zone 6). Because of the additional operational flexibility that Clearwell #3 would provide, it is recommended that Clearwell #3 be constructed as soon as possible. As noted above, no additional storage facilities are required by 2025, but it is recommended that Clearwell #3 be constructed by no later than 2030.

Note: Because the actual dimensions of each proposed storage facility have not been determined, the storage facility sizes below do not include dead and freeboard storage requirements, which will be determined during design.

- Westside Tank: Install a new storage tank with a minimum active storage capacity of 1.0 MG
- JJWTP Clearwell #3: Install a new clearwell at the JJWTP with a minimum active storage capacity of 1.0 MG
- Zone 5 Tank: Install a new storage tank with a minimum active storage capacity of 3.2 MG. Sizing of this tank should be confirmed before development of Zone 5 begins

- Zone 6 Tank: Install a new storage tank with a minimum active storage capacity of 1.1 MG. Sizing of this tank should be confirmed before development of Zone 6 begins

8.6.2.2 Groundwater Wells

Planning and design of these new groundwater wells should be phased so that the City's ASR Program can be expanded as needed to meet the City's water supply needs, particularly in dry years. As described in Chapter 5, a feasibility study for the expansion of the City's ASR Program is recommended, and is included above with the recommended 2025 System Improvements, to develop an implementation plan for ASR expansion.

- Westside ASR Well: Install a new ASR well with a minimum firm pumping capacity of 2,500 gpm and equipped with ammonia addition
- Wainwright ASR Well: Install a new ASR well with a minimum firm pumping capacity of 2,500 gpm and equipped with ammonia addition
- Larsen Park ASR Well: Install a new ASR well with a minimum firm pumping capacity of 2,500 gpm and equipped with ammonia addition
- Ellis ASR Well: Install a new ASR well with a minimum firm pumping capacity of 1,000 gpm and equipped with ammonia addition

8.6.2.3 Booster Pumping Facilities

Planning and design of these new booster pumping facilities should be coordinated with the construction of other related facilities (e.g., associated storage tanks) and the timing of new development. As of early 2022, the Zone 5 BPS design is complete.

- JJWTP: Increase the firm treated surface water pumping capacity at the JJWTP to meet buildout maximum day water demands
  - Zone 3 BPS: Install additional Zone 3 booster pumps with a minimum pumping capacity of 1,500 gpm
  - Zone 5 BPS: Install a new Zone 5 booster pump station with a minimum firm pumping capacity of 2,410 gpm
- Zone 6 BPS: Install a new booster pump station with a minimum firm pumping capacity of 550 gpm (sizing of this pump station should be confirmed before development of Zone 6 begins)
- Westside Tank: Install a new Zone 1 booster pump station with a minimum firm pumping capacity of 4,500 gpm
- Westside Tank: Install a new Zone 2 booster pump station with a minimum firm pumping capacity of 2,400 gpm

8.6.2.4 Pipelines

Planning and design of these new pipelines should be coordinated with the timing of new development.

- To serve buildout water demands, install approximately 308,270 linear feet of new pipelines (in addition to the proposed 2025 pipelines) ranging in diameter from 12 to 30 inches as shown on Figure 8-12
- To serve buildout water demands, install additional new pipelines of 10 inches in diameter or less within individual development projects; the length of small diameter pipelines needed to serve buildout water demands is unknown, as most buildout development areas do not have detailed water system infrastructure plans prepared

8.6.2.5 Interconnections

Planning and design of these new interconnections should be coordinated with the timing of new development in the respective pressure zones.

- Install the following interconnections between pressure zones to provide supply during peak demands and/or emergency conditions:
  - Westside PRS (from Zone 2 into Zone 1)
  - Ellis PRV #3 (from Zone 3 into Ellis Reduced Zone)
  - Avenues PRV (from Ellis Reduced Zone into Zone 2)
  - Zone 4 PRV (from Zone 5 into Zone 4)
  - Two (2) Zone 5 PRVs (from Zone 6 into Zone 5)
  - Install six new mainline PRVs before the Plan C area is re-zoned to Zone 3 (to be funded through Plan C funds)
- Install an individual PRV on any water service connection with a static pressure exceeding 80 psi

8.6.2.6 Re-Zoning

Planning and design of this rezoning should be coordinated with the timing of the new Zone 3 pipeline from the JJWTP.

- Re-zone the Plan C area from Zone 2 to Zone 3 (to be funded through Plan C funds)

8.6.2.7 SCADA System/Backup Power

Planning and design of the recommended SCADA system improvements and backup power should be prioritized and completed as soon as possible, as these improvements will improve operational flexibility and reliability.

- Install SCADA system monitoring of flows and pressures at PRS #1-#6 to provide operators with additional understanding and flexibility in system operations

- Add remote operation of Well 8 from the SCADA system to provide additional operational flexibility
- Install SCADA system monitoring of flows and pressures at each new water supply facility to provide operators with real-time system data and flexibility in system operations
- Install on-site backup power to any proposed buildout system pumping facility to improve supply reliability

8.6.2.8 JJWTP Expansion

A future additional 10 mgd expansion of the JJWTP (for a total treatment capacity of 40 mgd) is recommended to provide the City with additional water treatment capacity, as well as operational flexibility and reliability, if the use of groundwater supplies needs to be limited or if there is a supply outage from South County Water Supply Project. It is recommended that the JJWTP expansion be constructed by no later than 2030, in coordination with the new JJWTP Clearwell #3.

8.6.2.9 Participation in Phase 2 Los Vaqueros Reservoir Expansion Project

As described in Chapter 5, the City's participation in the Phase 2 Los Vaqueros Reservoir Expansion Project would increase the City's water supply reliability by providing storage of supplies for use in dry years. The estimated cost for 5,000 acre-feet of storage for the City will be approximately $10 million plus an additional $1.5 million for implementation and will be shared by existing rate payers and new development. In October 2021, the Tracy City Council authorized staff to initiate the process to participate in the project and authorized the City Manager to execute the project activity agreement.

8.6.2.10 Water Master Plan Updates

Regular updates of this Citywide Water System Master Plan are recommended to evaluate potable water and recycled water infrastructure needs to reflect any changes in future development plans, water use trends and patterns, and water supply availability and reliability, as well as new regulations and operational needs as new potable water and recycled water system infrastructure is constructed. It is recommended that updates be prepared at least once every 10 years, or more often if changing conditions warrant more frequent updates. For purposes of this Citywide Water System Master Plan Update, three future updates are planned.

CHAPTER 9
Recycled Water System Evaluation

9.1 OVERVIEW

The purpose of this chapter is to describe the City's existing recycled water system and the recommended future recycled water system at buildout of the City's SOI. The recycled water infrastructure recommended in this chapter is based on the adopted water use and peaking factors described in Chapter 4 and system performance criteria described in Chapter 6 of this Citywide Water System Master Plan Update.

The City's existing WWTP on Holly Drive currently collects and treats wastewater to a Title 22 Disinfected Tertiary standard. The construction of a recycled water system to distribute this water to various non-potable use areas began in 2018; currently the only service connection is for the Legacy Fields sports complex. In the future, the City will extend the recycled water system and use recycled water to meet irrigation and other non-potable demands in existing service areas (thus offsetting some existing potable water use) and future service areas.

The topics discussed in this chapter include:

- Description of Existing Recycled Water System
- Existing Recycled Water System Demands
- Recommended Buildout Recycled Water System
- Recycled Water System Criteria
- Recycled Water System Evaluation Results
- Summary of Recommended Future Recycled Water System Improvements

To assist in the evaluation of the City's overall recycled water system at buildout, the recycled water infrastructure recommended in this chapter includes the infrastructure required to serve the Tracy Hills development and, for consistency, is based on the adopted water use, peaking factors, and system performance criteria described in previous chapters of this Citywide Water System Master Plan. Although the Tracy Hills development is located within separate and distinct recycled water pressures zones from the rest of the City, West Yost has included the Tracy Hills development in the future recycled water system evaluation because it will be served by pipelines, tanks, and booster pump stations in other pressure zones which need to be sized to account for the demands in Tracy Hills. Including the Tracy Hills development in the buildout hydraulic model evaluation ensures that the City's buildout recycled water system is integrated and sufficient to serve the recycled water demands of the entire City (including Tracy Hills). Because planning for future phases of Tracy Hills is subject to change, the sizing of any future water system improvements to serve Tracy Hills should be confirmed based on the latest development plans and associated water demand projections.

9.2 DESCRIPTION OF EXISTING RECYCLED WATER SYSTEM

This section provides a summary of the City's existing recycled water system facilities. Construction of the City's recycled water distribution system began in 2018. Currently, the recycled water distribution system consists of the Zone A booster pump station (Zone A BPS) at the City's Wastewater Treatment Plant, and approximately 7.6 miles of 30-inch diameter and 24-inch diameter transmission mains on the north and west side of the City, as shown on Figure 9-1. Additional details regarding each facility are presented below.

9.2.1 Wastewater Treatment Plant

The City's WWTP is located on Holly Drive, just north of the I-205 freeway as shown on Figure 9-1. The WWTP currently has a permitted average dry weather flow treatment capacity of 10.8 mgd. The WWTP treats domestic and industrial wastewater using a combination of primary clarification, an advanced activated sludge process with anoxic denitrification, tertiary filtration, and chlorination. The chlorinated effluent meets Title 22 requirements for recycled water use for landscape irrigation and other non-potable uses.

9.2.2 Booster Pump Stations

The City currently has one recycled water booster pump station, as shown on Figure 9-1. The Zone A BPS is located at the WWTP, and supplies water from the post-aeration basin to the recycled water distribution system. Table 9-1 presents a summary of the existing recycled water booster pump station with key characteristics such as design capacity and number of booster pumps.

Table 9-1. Existing Recycled Water Booster Pump Station

Booster Pump Station Name	Location	Year Installed	Pump 1, gpm	Pump 2, gpm	Pump 3, gpm	Pump 4, gpm	Pump 5, gpm	Rated Capacity[(a)], gpm	Firm Capacity[(b)], gpm	Firm Capacity[(b)], mgd
Zone A[(c)]	WWTP	2019	1,736	1,736	1,736	1,736	1,736	8,680	6,944	10.0

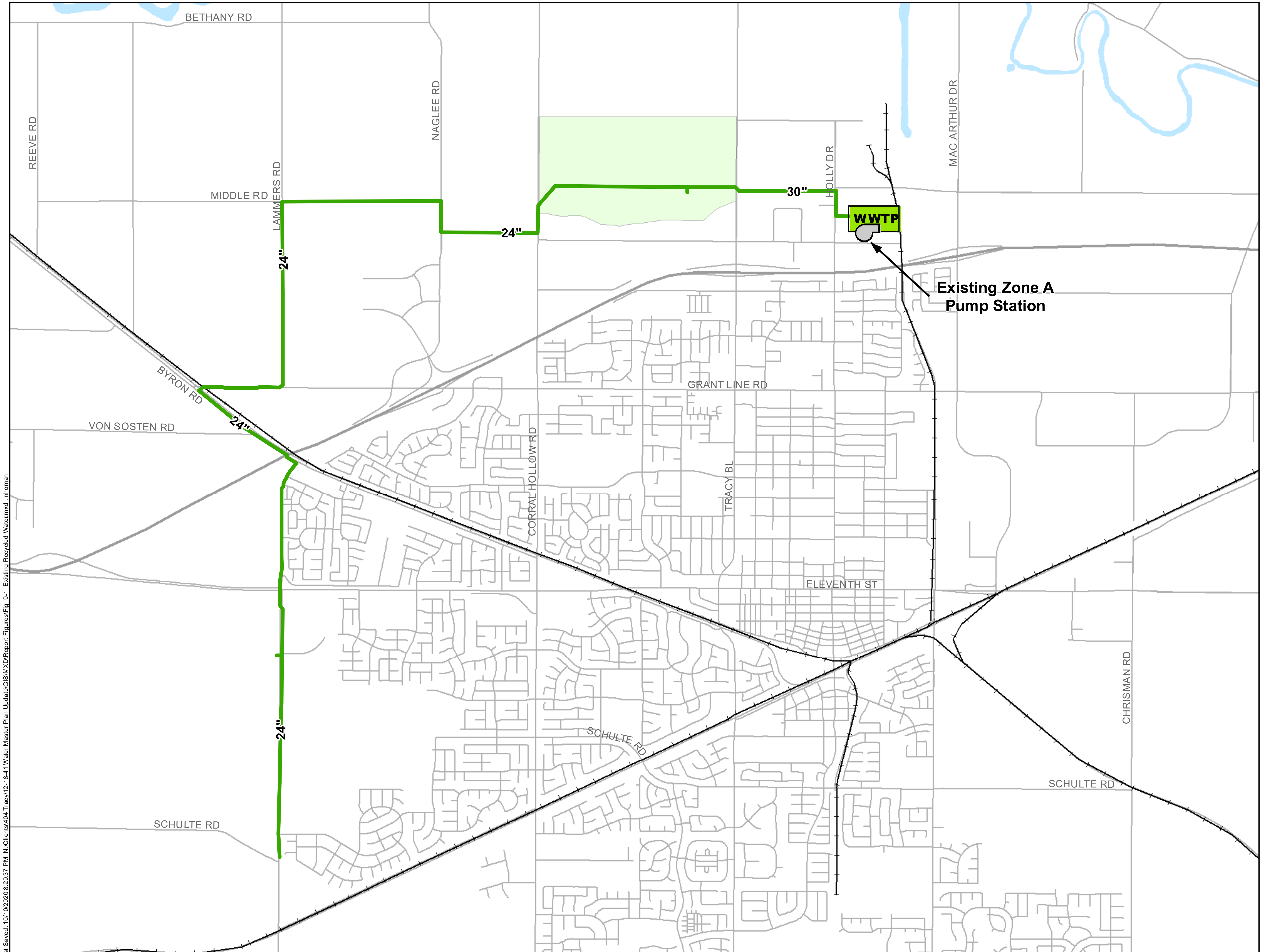
(a) Maximum pumping capacity of entire pump station.
(b) Assumes that the largest booster pump at the pump station is offline.
(c) Pumps are equipped with variable frequency drives.

9.2.3 Pressure Zone Boundaries

The City's existing recycled water system consists of a single pressure zone, Zone A. Pressure zone boundaries at buildout of the recycled water system are discussed in *Section 9.4.2 Pressure Zone Recommendations*.

9.2.4 Transmission and Distribution Pipelines

The City's existing recycled water transmission system pipeline network is shown on Figure 9-1. The only recycled water pipelines currently in service are 7.6 miles of 30-inch diameter and 24-inch diameter transmission mains from the WWTP west to Lammers Road and south to Kimball High School.



Symbology

- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing Transmission Pipeline (Diameter >16 inches)
- Legacy Fields

Notes:
1. The City's recycled water hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
2. Existing recycled water pipelines which are not yet in service are not shown.

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Figure 9-1

Existing Recycled Water System Facilities

City of Tracy
Water System Master Plan Update

Recycled water distribution pipelines have also been installed by developers in several future service areas, including Cordes Ranch, Ellis Specific Plan Phase 1, and Tracy Hills Phase 1. However, because no source of recycled water is currently available in these areas, these pipelines are currently connected to the potable water system via backflow prevention devices and are delivering potable water to serve irrigation demands. Once recycled water service is extended to these areas, the recycled water mains will be connected to the recycled water system and the temporary connections to the potable water system will be removed.

9.2.5 SCADA System

The Zone A BPS is integrated into the City's SCADA (Supervisory Control and Data Acquisition) system for the WWTP. This integration provides for remote operation and monitoring of the Zone A BPS, as well as automated shut down of the pump station if chlorinated effluent from the WWTP does not meet Title 22 standards at a given time.

9.3 EXISTING RECYCLED WATER DEMANDS

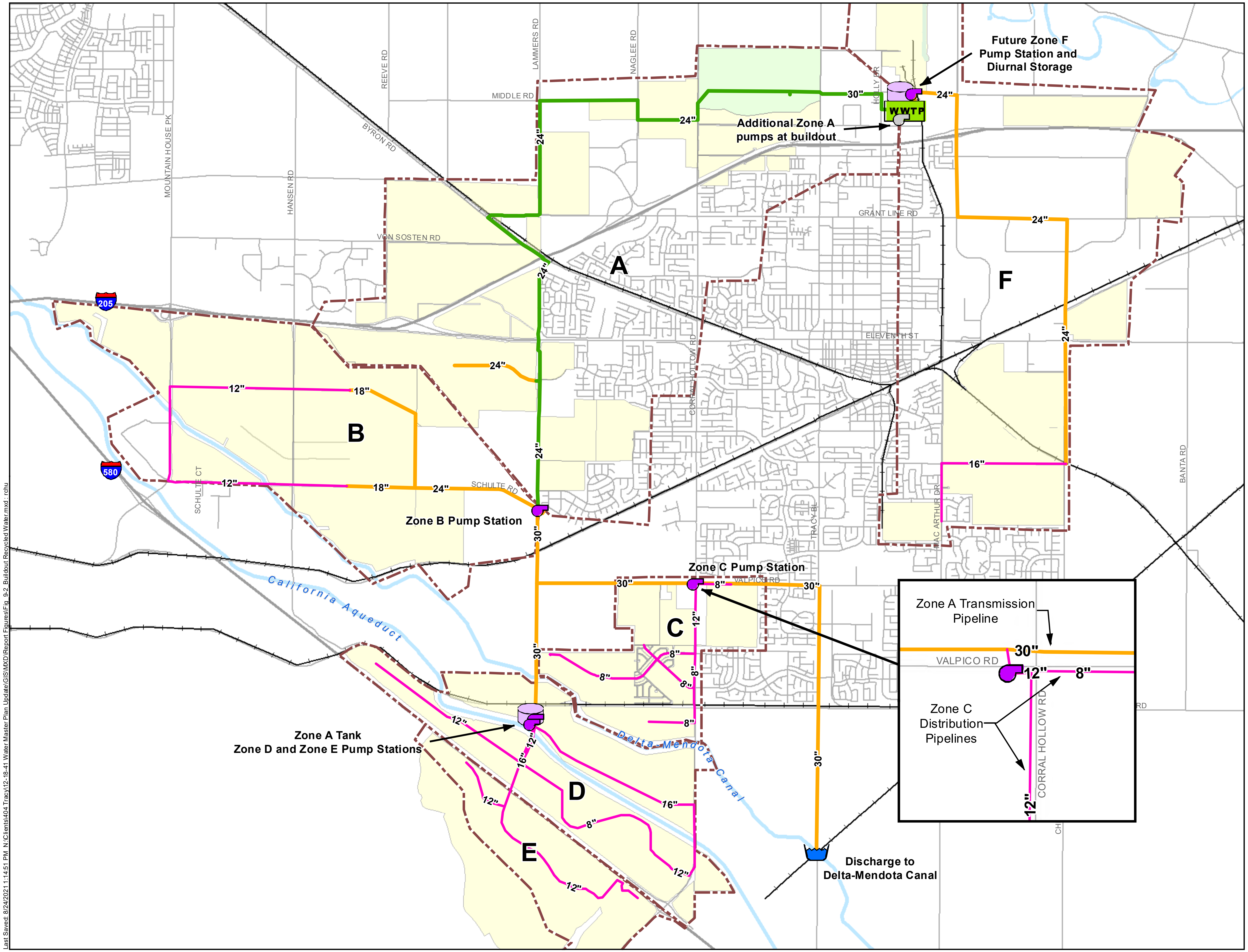
The City's only active recycled water service connection is the Legacy Fields sports complex.

9.4 RECOMMENDED BUILDOUT RECYCLED WATER SYSTEM

The City intends to expand the existing recycled water system to serve non-potable water demands to most future development areas, help offset some existing potable water irrigation demands, and reduce treated effluent discharges to Old River. One integrated recycled water system is proposed and will serve and distribute recycled water throughout the entire SOI.

In addition to serving non-potable water demands, the future recycled water system must also be capable of delivering recycled water to the DMC for the City's proposed Recycled Water Exchange Program with the USBR. As discussed in Chapter 5, this exchange agreement would allow the City's recycled water to be discharged to the DMC and a like amount of raw water to be diverted from the DMC by the City for treatment at the JJWTP for potable use. This exchange agreement is an essential part of the City's projected future water supply portfolio. Future recycled water system infrastructure was sized to account for the additional flow which must be conveyed through the recycled water system from the WWTP to the DMC. It should be noted that the quantity of recycled water required for the exchange agreement is assumed to be up to about 9,000 af/yr. This is higher than the exchange amount assumed in the City's 2020 UWMP and described in Chapter 4 (7,500 af/yr), and reflects an approximate upper bound for the recycled water exchange program. Subsequent revisions to the projected potable water demand and/or the water supply availability and reliability assumptions may change the required quantities and timing of the proposed Recycled Water Exchange Program.

Recommendations for the buildout recycled water system were developed based on previous studies of the recycled water system, projected recycled water demands, the requirements of the planned recycled water exchange program, and the recycled water system performance criteria. A hydraulic model was used to confirm that these recommendations meet the City's recycled water system performance criteria described in Chapter 6. The recommended buildout recycled water system is shown on Figure 9-2.



Scale in Feet: 0, 2,000, 4,000

Symbology

Proposed Future Facilities

- Future Booster Pump Station
- Future Storage Tank
- Delta Mendota Canal Discharge Point
- Future Distribution Pipeline (Diameter ≤ 16 inches)
- Future Transmission Pipeline (Diameter > 16 inches)

Existing System Facilities

- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing Transmission Pipeline (Diameter >16 inches)
- Legacy Fields
- Future Recycled Water Use Area
- Recycled Water Pressure Zone

Notes:
1. Pressure Zones represent approximate boundaries.
2. The City's recycled water hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
3. Existing recycled water pipelines which are not yet in service are shown as future pipelines.

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Figure 9-2

Buildout Recycled Water System Facilities

City of Tracy
Water System Master Plan Update

9.4.1 Future Recycled Water Demand Areas

The demand areas to be served by the future recycled water system are shown on Figure 9-2. For this Citywide WSMP Update, the following assumptions were made regarding the areas served by the recycled water system:

- Most large development projects located on the west side of the City will be served by the recycled water system by 2025, except for Cordes Ranch, West Side Industrial, and Tracy Hills.
- Recycled water service will be extended to Cordes Ranch, West Side Industrial, and Tracy Hills by 2040; it is expected that this will occur after 2025, but much sooner than 2040.
- Future recycled water service areas on the east side of the City (East Side Industrial, Chrisman Road, UR 1, and Rocha), will be served by a separate recycled water transmission main which will not be constructed until after 2040.
- Recycled water service will not be extended to developments in the following areas due to the isolated locations and relatively small individual potential recycled water demands within them:
  - I-205 Corridor Specific Plan
  - Industrial Areas Specific Plan
  - Northeast Industrial Specific Plan
  - Berg Road Subdivision
  - Berg/Byron Remainder
  - Other small, approved projects (refer to Table 3-1, footnote (f) for the full list)
  - Miscellaneous Infill
- Only a small number of existing parks and irrigated areas located close to the recycled water transmission main alignments will be converted to recycled water service; it should be noted that the previously proposed Gateway Exchange Program, under which recycled water service would be extended to most existing parks and large irrigated areas in the City to offset potable water demands from the Gateway development (now called Westside), is no longer being considered.

9.4.2 Pressure Zone Recommendations

The proposed recycled water pressure zones developed in the 2012 WSMP mimicked the potable water distribution system pressure zones. However, the recent Recycled Water Optimization Evaluation[36] (Optimization Study) recommended adjustments to the proposed pressure zones to minimize parallel pipelines and reduce the cost of the system. The recycled water pressure zones proposed in this WSMP Update are generally consistent with those recommended in the Optimization Study:

- Zone A will extend west and south from the City's WWTP to Schulte Road and the western boundary of the Westside Specific Plan. The existing 30-inch diameter and 24-inch diameter transmission main on the north side of the City and in Lammers Road will serve Zone A.
- Zone B will extend west from the western boundary of Zone A, and will include Cordes Ranch, Westside Industrial Area, and portions of the Westside Specific Plan. It will be served by a 24-inch diameter transmission main in Schulte Road.
- Zone C will include the Ellis Specific Plan, Avenues, Tracy Village, UR 10, and SWP & Valpico service areas. Due to the relatively small demands from these areas and the compact nature of this pressure zone, no pipelines greater than 12-inch diameter are recommended to serve it.
- Zones D and E will be located southwest of the DMC and will exclusively serve Tracy Hills. Each pressure zone will be served by dedicated 12-inch and 16-inch diameter distribution mains. Because the elevation and configuration of the Tracy Hills development favors a pressure zone break where Interstate 5 crosses the property, the Tracy Hills pressure zones have not been adjusted from the pressure zones recommended in the 2000 Tracy Hills Master Plan.
- Zone F will extend east and south from the City's WWTP to include the recycled water service areas on the east side of the City. This pressure zone will be served by a 24-inch diameter and 16-inch diameter transmission main. This pressure zone was not included in the Optimization Study, which only considered the recycled water system for the west side of the City. The 2012 WSMP assumed that the east side developments would be served by the same pressure zone(s) as the west side developments. However, because the east side backbone transmission main is no longer planned to connect to the rest of the system, it is recommended that the east side developments be served by a separate pressure zone with a hydraulic grade selected to better serve the specific elevation range of the east side service area. This will require the construction of a separate booster pump station at the WWTP dedicated to serving Zone F.

The proposed ground elevation ranges and the modeled hydraulic grade ranges for each pressure zone are presented in Table 9-2.

[36] "Recycled Water Optimization Evaluation", CH2M Hill Engineers, Inc, January 2017.

Table 9-2. Recycled Water Distribution Pressure Zones

Pressure Zone	Nominal Hydraulic Grade, ft	Expected Range of Service Elevations, ft	Static Pressure Range, psi
A	375	10 - 91	122 - 157
B	410	105 - 230	77 - 131
C	360	100 - 185	75 - 112
D	470	209 - 310	69 - 112
E	550	305 - 400	64 - 105
F	264	19 - 96	72 - 105

psi = pounds per square inch

Ground elevations and hydraulic grades were chosen to provide a system pressure range of 60 psi to 100 psi where possible, as defined in the recycled water system evaluation criteria. The nominal hydraulic grades shown in Table 9-2 are based on the design head of existing pumps (Zone A), planned pumps (Zone B), or on the pump design head necessary to maintain a minimum of 60 psi service pressure within the pressure zone under peak hour conditions (all other zones). Nominal hydraulic grade was calculated at the pump discharge. Because of friction losses in the distribution system during operations, system pressure near the pump stations can exceed 100 psi. The highest expected pressure in the proposed recycled water system is 178 psi on the discharge side of the Zone A BPS.

9.4.3 Allocation of Future Recycled Water Demands

The projected recycled water demands were previously discussed in Chapter 4. The maximum day and peak hour peaking factors were also presented previously in Chapter 4 and are summarized below in Table 9-3.

Table 9-3. Recycled Water Demand Peaking Factors

Parameter	Value
Maximum Month Demand, percent of annual demand[a]	17.6%
Maximum Day Peaking Factor[b]	6.4
Peak Hour Peaking Factor[c]	7.0

(a) Based on 2017 monthly potable water use for dedicated landscape irrigation accounts.
(b) Multiply the average day demand times the peaking factor to obtain maximum day demand. Maximum Day Demand Peaking Factor = Maximum Month Demand (percent) / 30 days x 365 x (24/8).
(c) Multiply the average day demand times the peaking factor to obtain peak hour demand. Assumed to be 110 percent of Maximum Day Demand, refer to Chapter 4.

Projected buildout recycled water average day, maximum day, and peak hour demands (including existing demands) are summarized in Table 9-4. Additional detail of the projected average day recycled water demands at buildout for each future development project by pressure zone (not including existing demands) is provided in Table 9-5.

Table 9-4. Buildout Recycled Water Demands by Pressure Zone

Pressure Zone	Average Day Demand(a)		Maximum Day Demand(b)		Peak Hour Demand(c)	
	gpm	mgd	gpm	mgd	gpm	mgd
Zone A	1,534	2.2	9,818	14.1	10,739	15.5
Zone B	876	1.3	5,605	8.1	6,131	8.8
Zone C	242	0.3	1,547	2.2	1,692	2.4
Zone D	388	0.6	2,484	3.6	2,717	3.9
Zone E	264	0.4	1,690	2.4	1,848	2.7
Zone F	620	0.9	3,968	5.7	4,340	6.2
Total	**3,304**	**4.8**	**21,144**	**30.4**	**23,126**	**33.3**

(a) Equal to existing water demands plus projected buildout water demands presented in Table 4-16.
(b) Maximum day demand is 6.4 times the average day demand.
(c) Peak hour demand is 7.0 times the average day demand.

9.4.4 Recycled Water Exchange Program Seasonality

For purposes of this Citywide Water System Master Plan Update, it has been assumed that the future recycled water system would be designed to deliver up to about 9,000 af/yr of recycled water to the DMC as part of the City's planned recycled water exchange agreement with the USBR. This is more than the 7,500 af//yr assumed in the City's 2020 UWMP and described in Chapter 4 of this Citywide Water System Master Plan Update, but reflects an approximate upper bound for the recycled water exchange program. Because recycled water demands from City customers vary significantly with the season, the time of year in which exchange recycled water is discharged to the DMC has a significant effect on the sizing of recycled water system facilities. For example, the volume of water the system can discharge to the DMC during a maximum day demand condition in the summer will be significantly less than the volume the system can discharge to the DMC in the winter, when recycled water demands are low.

It is assumed that the City will be able to optimize the timing of recycled water discharge to the DMC so that the majority of the exchange takes place in off-peak months. During a maximum day demand condition in a single dry year at buildout, it was assumed that the recycled water system would only have to deliver 4.1 mgd to the DMC. In a single dry year, the recycled water system should be capable of delivering as much as 13.8 mgd to the DMC on a winter day with negligible recycled water demands from City customers.

Table 9-5. Summary of Buildout Average Day Recycled Water Demands by Development Project[a,b]

Project or Development Area	Zone A		Zone B		Zone C		Zone D		Zone E		Zone F		Total	
	gpm	percent of total	gpm	percent of total	gpm	percent of total	gpm	percent of total	gpm	percent of total	gpm	percent of total	gpm	percent of total
UR 5 (Bright)	49.51	3.37%		0.00%		0.00%		0.00%		0.00%		0.00%	49.51	1.28%
UR 7 (Bright/Castro)	44.52	3.03%		0.00%		0.00%		0.00%		0.00%		0.00%	44.52	1.15%
Rocking Horse	6.26	0.43%		0.00%		0.00%		0.00%		0.00%		0.00%	6.26	0.16%
Tracy Village		0.00%		0.00%	98.28	40.67%		0.00%		0.00%		0.00%	98.28	2.55%
UR 1		0.00%		0.00%		0.00%		0.00%		0.00%	263.48	42.47%	263.48	6.83%
Ellis		0.00%		0.00%	66.93	27.70%		0.00%		0.00%		0.00%	66.93	1.74%
Avenues		0.00%		0.00%	12.01	4.97%		0.00%		0.00%		0.00%	12.01	0.31%
UR 10		0.00%		0.00%	45.42	18.80%		0.00%		0.00%		0.00%	45.42	1.18%
Tracy Hills		0.00%		0.00%		0.00%	388.09	100.00%	264.08	100.00%		0.00%	652.18	16.91%
Westside	271.46	18.50%		0.00%		0.00%		0.00%		0.00%		0.00%	271.46	7.04%
Cordes Ranch		0.00%	600.42	68.56%		0.00%		0.00%		0.00%		0.00%	600.42	15.57%
UR 4 (Bright Triangle)	61.87	4.22%		0.00%		0.00%		0.00%		0.00%		0.00%	61.87	1.60%
UR 3 (Sandhu)	254.46	17.34%		0.00%		0.00%		0.00%		0.00%		0.00%	254.46	6.60%
I-205 Expansion	79.63	5.43%		0.00%		0.00%		0.00%		0.00%		0.00%	79.63	2.06%
West Side Industrial		0.00%	254.51	29.06%		0.00%		0.00%		0.00%		0.00%	254.51	6.60%
East Side Industrial		0.00%		0.00%		0.00%		0.00%		0.00%	144.09	23.23%	144.09	3.74%
Larch-Clover	159.91	10.90%		0.00%		0.00%		0.00%		0.00%		0.00%	159.91	4.15%
Chrisman Road		0.00%		0.00%		0.00%		0.00%		0.00%	44.25	7.13%	44.25	1.15%
Rocha		0.00%		0.00%		0.00%		0.00%		0.00%	28.89	4.66%	28.89	0.75%
SWC Valpico & Corral Hollow		0.00%		0.00%	19.00	7.86%		0.00%		0.00%		0.00%	19.00	0.49%
Dobler/Maibes	9.01	0.61%		0.00%		0.00%		0.00%		0.00%		0.00%	9.01	0.23%
Holly Sugar Industrial		0.00%		0.00%		0.00%		0.00%		0.00%	55.99	9.03%	55.99	1.45%
Tracy Combined Cycle Power Plant		0.00%	20.88	2.38%		0.00%		0.00%		0.00%		0.00%	20.88	0.54%
Legacy Fields	246.68	16.81%		0.00%		0.00%		0.00%		0.00%		0.00%	246.68	6.40%
Parks RW Conversion (west side)	283.94	19.35%		0.00%		0.00%		0.00%		0.00%		0.00%	283.94	7.36%
Parks RW Conversion (east side)		0.00%		0.00%		0.00%		0.00%		0.00%	83.69	13.49%	83.69	2.17%
Total	**1,467.24**	**100%**	**875.81**	**100%**	**241.64**	**100%**	**388.09**	**100%**	**264.08**	**100%**	**620.39**	**100%**	**3,857.26**	**100%**

(a) Water demands shown are for new development only and do not include existing recycled water demands. See Appendix A for detailed demand calculations by project or development area.

(b) Water demands shown include UAFW.

9.4.5 Seasonal and Diurnal Storage Facilities

The projected average monthly demands and available flow from the City's WWTP are summarized in Table 9-6. As shown in the table, there will be an excess amount of recycled water available from the Holly Drive WWTP in all months and therefore seasonal storage is not required.

Table 9-6. Projected Buildout Recycled Water Supply and Demand

Month	Available Wastewater Flow[(a)], af	Recycled Water Demand, af[(b)]	Exchange Program Discharge to DMC, af[(c)]	Remaining Amount, af[(d)]
January	1,501	70	1,154	277
February	1,356	44	1,186	127
March	1,501	50	1,074	378
April	1,453	213	886	355
May	1,501	515	776	210
June	1,453	910	519	24
July	1,501	1,103	376	22
August	1,501	935	447	119
September	1,453	1,112	322	19
October	1,501	793	537	171
November	1,453	437	778	238
December	1,501	148	895	458
Total	**17,676**	**6,329**	**8,947**	**2,400**

(a) Based on Average Dry Weather Flow value of 15.78 mgd received from Carollo by e-mail on June 9, 2020.
(b) Monthly recycled water demand distribution based on 2017 City irrigation water use pattern.
(c) Monthly discharge to DMC based on availability of wastewater and the capacity of the proposed recycled water system facilities.
(d) Remaining Amount = Available Wastewater Flow - (Recycled Water Demand + Exchange Program Discharge)

Diurnal storage tanks were sized based on the volume of storage needed to supply peak hour demands and to reduce the required size of recycled water pump stations and pipelines. It is recommended that the City construct a 5.7 MG recycled water storage tank just north of the California Aqueduct on Lammers Road. The location of this tank is consistent with that recommended in the Optimization Study. This tank will supply Zone A via gravity, and Zones D and E via pumping, during the 8-hour irrigation period. It is recommended that the City construct the Zone A Tank before other recycled water storage facilities. The Zone A Tank should meet the City's recycled water storage requirements through 2040.

An additional 2.6 MG of diurnal storage may be needed at the WWTP at buildout. This value may change depending on the actual WWTP effluent diurnal flow. It is recommended that the City re-evaluate the required diurnal storage at the WWTP by performing a diurnal flow study in 2040. Table 9-7 summarizes the recommended distribution of diurnal storage in the buildout recycled water system.

Table 9-7. Diurnal Storage Distribution

Storage Location	Storage Volume, MG
Diurnal Storage at WWTP	2.6[a]
Zone A Tank	5.7
Total	**8.3**

(a) Volume may be reduced depending on Holly Drive WWTP effluent recycled water diurnal flow rate. May go to zero if low flow period exceeds combined Zones A and F maximum pumping rate.

9.4.6 Booster Pump Stations

As the recycled water system develops, additional booster pump stations will be required to move water from Zone A into higher pressure zones, and to pump water from the WWTP into Zone F. With the exception of the Zone C BPS, the locations of the recommended booster pump stations are based on the Optimization Study, which modified the booster pump station recommendations in the 2012 WSMP.

The Zone A BPS will require an additional 3,472 gpm of pumping capacity at buildout. It was assumed that this will be provided by two new pumps with characteristics similar to those of the existing pumps.

The recommended location of the Zone C BPS was moved from Lammers Road to the corner of Valpico Road and Corral Hollow Road. The Zone C BPS cannot be located on the west side of the Ellis Specific Plan, as the headloss through the existing and planned 8-inch diameter pipes in the Ellis would be too great to maintain 60 psi residual pressure in the majority of Zone C. Assuming that the DMC transmission pipeline will be constructed in Valpico Road and Tracy Boulevard (see *9.2.6 Recycled Water Pipeline Alignment* below), it is recommended that the Zone C BPS be located at the corner of Valpico Road and Corral Hollow Road so as to draw water from this transmission pipeline. If the Alternative B alignment is selected for the DMC transmission pipeline, the Zone C BPS could be constructed at the intersection of Corral Hollow Road and Linne Road instead. If the Alternative C alignment is selected for the DMC transmission pipeline, the Zone C BPS could be constructed in several locations, but additional Zone A or Zone C pipelines would need to be constructed to connect Zone C to the rest of the system.

The Tracy Hills Master Plan recommended that both the Zone D and Zone E booster pump stations be constructed adjacent to the Tracy Hills storage tank, instead of having the Zone E BPS constructed as a booster station in Zone D. West Yost concurs with this recommendation, and the logic behind this is three-fold. First, the distribution system is small enough so that the additional pipeline length is not substantial. Second, an emergency pressure reducing valve station was proposed so that some reduced flow could be delivered to Zone D through Zone E, if necessary. Third, having both pump stations at the same location makes it easier for the City to operate and maintain these pump stations.

A summary of the proposed booster pump station design characteristics is shown in Table 9-8.

Table 9-8. Recycled Water Distribution System Pump Station Design Criteria

Pump Station	Design Flow Rate, gpm[a]	Design Total Dynamic Head, feet
Zone A	12,152[b]	362
Zone B	5,780[c]	181
Zone C	1,700[c]	125
Zone D	2,700[c]	225
Zone E	2,000[c]	305
Zone F	4,400[c]	250

(a) Total pump station capacity assumes all pumps at pump station are in service.
(b) Pump station capacity required to fill Zone A Tank and supply exchange water to Delta Mendota Canal during a maximum day. Assumes two new pumps with properties similar to existing pumps are installed by buildout.
(c) Based on peak hour demands.

These proposed booster pump stations should supply a minimum design pressure of 60 psi in all zones to meet the design criteria described in Chapter 6.

9.4.7 Recycled Water Pipeline Alignments

Where possible, future recycled water pipeline alignments were based on existing recycled water pipelines which have been constructed but are not yet in service, or on planned recycled water pipelines for near-term developments. The alignment of the future Zone A transmission pipeline in Lammers Road is consistent with the Optimization Study, as is the alignment of the Zone B transmission pipeline in Schulte Road. It is expected that the alignment of these pipelines when constructed will not differ significantly from Figure 9-2. However, the alignment of the DMC exchange program transmission pipeline and the Zone F transmission pipeline may vary from the alignments shown on Figure 9-2.

Three alignment alternatives were considered for the DMC exchange pipeline, as illustrated on Figure 9-3. It should be noted that all three alignments assume that the discharge of recycled water to the DMC will be required to occur downstream of the City's JJWTP intake per initial discussions with the SWRCB and the USBR. Alternative (shorter) pipeline alignments may be possible if the location for the discharge of recycled water to the DMC can be relocated to a location upstream of the City's JJWTP intake.

The three alignment alternatives are described as follows:

- The Alternative A pipeline would tie into the Zone A transmission pipeline in Lammers Road at the intersection of Lammers Road and Valpico Road. It would consist of approximately 23,700 feet of pipeline constructed in Valpico Road, Corral Hollow Road, Linne Road, and Tracy Boulevard. The Alternative A pipeline would be Zone A. Although Alternative A is the longest of the three alignment alternatives, the entire alignment for Alternative A is within existing streets.

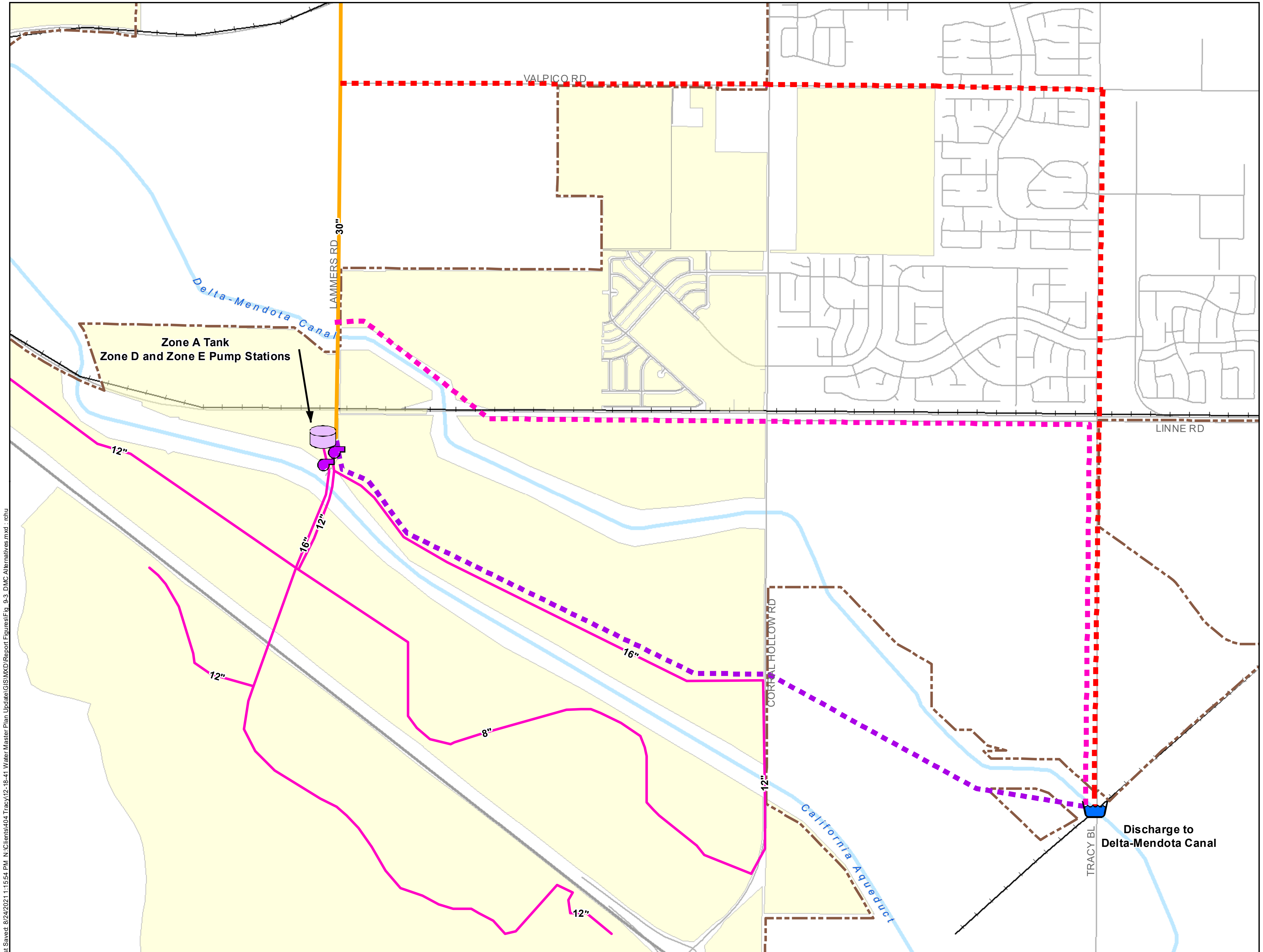
- The Alternative B pipeline would tie into the Zone A transmission pipeline in Lammers Road just north of the DMC, and would consist of approximately 19,100 feet of pipeline running along the south edge of the Ellis Specific Plan, in Linne Road, and in Tracy Boulevard. The Alternative B pipeline would be Zone A. Part of the alignment for Alternative B is along the south edge of the Ellis Specific Plan, not within an established right-of-way, and may require an easement.
- The Alternative C pipeline would be supplied directly from the Zone A reservoir, and would consist of approximately 14,200 feet of pipeline running through Tracy Hills Phase 5 and land currently used for mining. Alternative C may require a dedicated pump station to ensure sufficient head in the exchange pipeline for discharge to the DMC. Part of the alignment for Alternative C is not within an established right-of-way and passes through a quarry, which may require an easement and possibly difficult construction conditions.

For this WSMP Update, it was assumed that Alternative A will be selected as it follows existing street alignments and therefore would likely be the most straight-forward in terms of design and construction, although it is the longest of the three pipeline alignment alternatives. Because it is the longest alignment it is also the most conservative alternative for budgeting purposes.

Similarly, the alignment of the Zone F transmission pipeline depicted on Figure 9-2 was selected to provide a conservative cost estimate. It is recommended that detailed pipeline alignment alternative studies be conducted before either the DMC exchange program transmission pipeline or the Zone F transmission pipeline are constructed.

9.4.8 Recycled Water Pipeline Sizes

The proposed recycled water backbone distribution system pipelines range in size from a minimum of 8-inch diameter to a maximum of 30-inch diameter. A Hazen-Williams friction "C" factor of 130 was used in the hydraulic model. This "C" factor was used for PVC pipelines (16-inch diameter or smaller) and lined ductile iron or steel pipelines (24-inch diameter or larger). Pipeline diameters were based on those recommended in the optimization study, with adjustments to meet the system performance criteria outlined in Chapter 6.



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Scale in Feet

Symbology

- Future Booster Pump Station
- Future Storage Tank
- Delta Mendota Canal Discharge Point
- Future Distribution Pipeline (Diameter ≤ 16 inches)
- Future Transmission Pipeline (Diameter > 16 inches)

Delta Mendota Canal Pipeline Alternatives

- A
- B
- C
- Future Recycled Water Use Area
- Sphere of Influence

Notes:
1. Future facilities for Zone C not shown on this figure, as the configuration of this zone is dependent on the Delta Mendota Canal pipeline alternative selected for construction.

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Figure 9-3

DMC Exchange Pipeline Alternatives

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9.5 RECYCLED WATER SYSTEM CRITERIA

Evaluation of the proposed Citywide recycled water distribution system utilizes criteria that are different from the criteria used to evaluate the potable water system. The proposed evaluation criteria developed for the recycled water system are described in Chapter 6. In summary, because maximum day recycled water demands typically occur during approximately an eight hour per day period between 10:00 pm and 6:00 am (instead of the typical 24-hour period of the potable water system), and peak hour demands are only slightly greater than maximum day demands as described in Chapter 4, recycled water pipeline water velocity must be lower than in potable water systems to help reduce energy/power costs, thus lowering operational costs.

As described in Chapter 6, the desired recycled water system delivery pressure ranges from a minimum of 60 psi to a maximum of 100 psi. Recycled water pipeline water velocity must be less than 10 feet per second (fps) to avoid potential damage to pipelines, and velocity less than 6 fps is preferred. Pipeline velocities greater than 6 feet per second would cause excess friction pressure loss and would require larger pump station power requirements and greater pipeline pressure near the pump stations.

9.6 RECYCLED WATER SYSTEM EVALUATION RESULTS

Typical recycled water systems must deliver the greatest flow during a peak hour demand condition, which coincides with the middle of an assumed 8-hour irrigation period. However, due to the planned recycled water exchange program, in some portions of the City’s planned recycled water system, the flow during the remaining 16 hours of the day (the “fill period”) may exceed that of the peak hour. Therefore, the City’s recycled water hydraulic model was used to evaluate the buildout recycled water system under peak hour demand and fill period conditions.

9.6.1 Peak Hour Demand Scenario

During a peak hour demand scenario, evaluation results indicate that the buildout recycled water system could adequately deliver peak hour demands to meet the City’s minimum pressure criterion of 60 psi at all existing and future recycled water service locations as illustrated on Figure 9-4. It should be noted that many locations in the recycled water system will experience pressures greater than 100 psi during a peak hour demand condition; the pressures at these locations are labeled on Figure 9-4. Some locations in Zone A near the WWTP may experience pressures as high as 153 psi, during a peak hour demand condition and even higher pressures during tank fill periods as described below. Service connections in these areas should be fitted with individual PRVs as needed.

As illustrated on Figure 9-4, some of the existing Zone A transmission pipelines will experience velocities exceeding 6 fps during a peak hour demand condition. However, the velocity in these pipelines is well below the maximum allowable velocity of 10 fps, and therefore no mitigation is recommended.

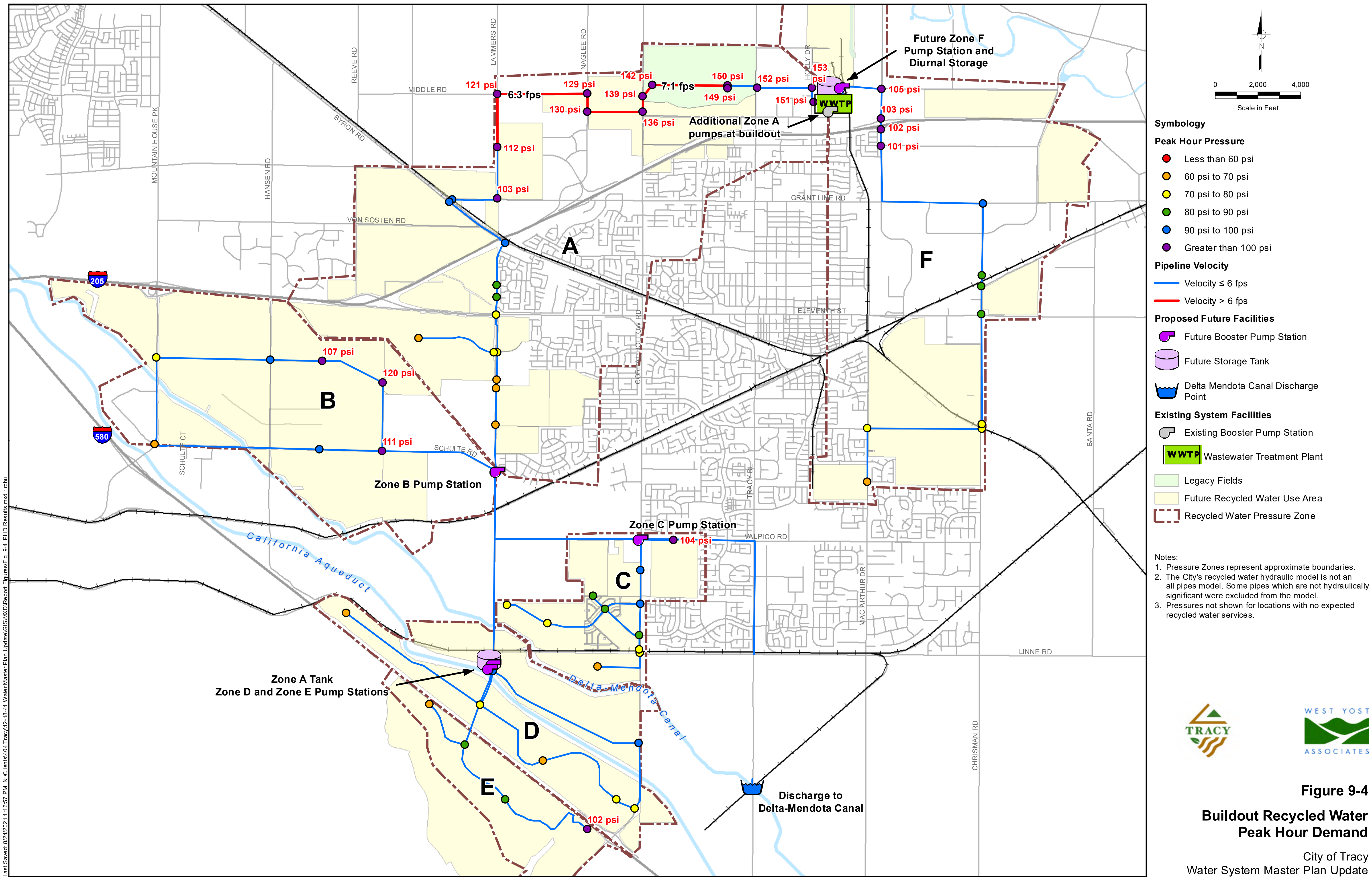

Figure 9-4

Buildout Recycled Water Peak Hour Demand

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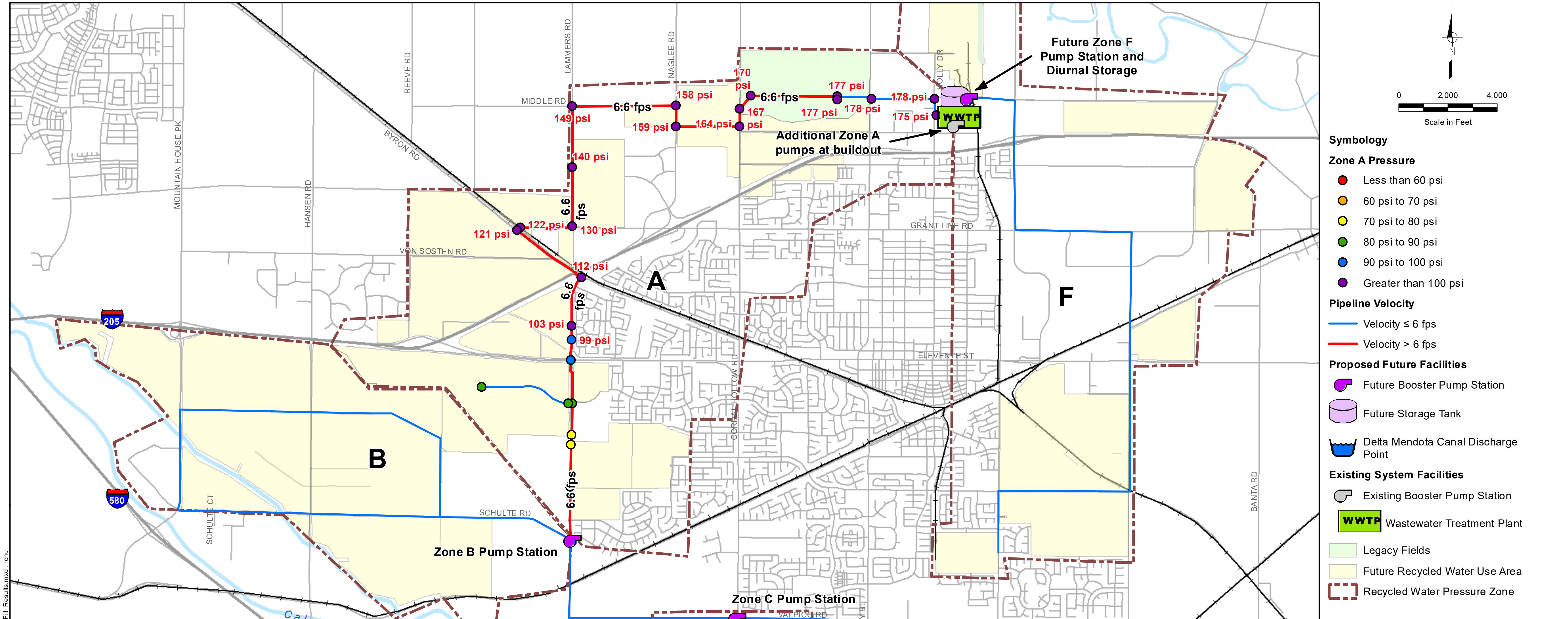
9.6.2 Fill Period Scenario

During a fill period on a maximum demand day, results indicate that the buildout recycled water system could adequately re-fill the Zone A Tank while supplying 4.1 mgd to the DMC for the recycled water exchange program. As shown on Figure 9-5, some locations in the recycled water system will experience pressures greater than 100 psi during a fill period; some locations in Zone A near the WWTP may experience pressures as high as 178 psi. The pressures at these locations are labeled on Figure 9-5. Service connections in these areas should be fitted with individual PRVs as needed.

The feasibility of operating the planned Zone B Pump Station as an in-line booster station to assist in refilling the tank and supplying the DMC during the maximum day fill period was investigated. If feasible, this would reduce the high pressures in Zone A near the WWTP. However, the planned capacity of the Zone B Pump Station is insufficient to supply the required flow and therefore cannot reduce the high pressures in Zone A.

As illustrated on Figure 9-5, some of the existing Zone A transmission pipelines will experience velocities exceeding 6 fps during a fill period. However, the velocity in these pipelines is well below the maximum allowable velocity of 10 fps, and therefore no mitigation is recommended.



Notes:
1. Pressure Zones represent approximate boundaries.
2. The City's recycled water hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
3. Pressures shown for Zone A service locations only.

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Figure 9-5

Buildout Recycled Water Fill Period

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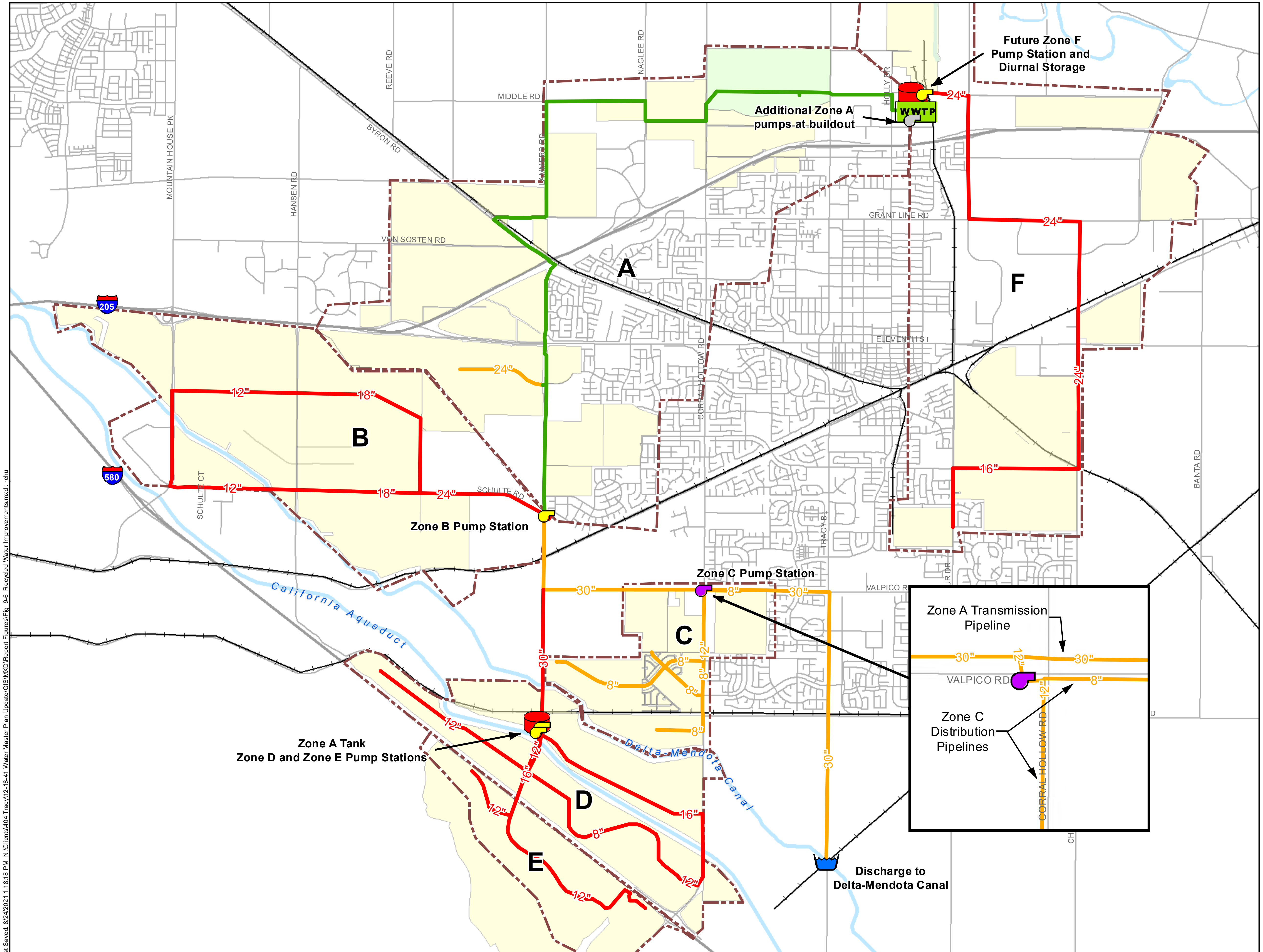
9.7 SUMMARY OF RECOMMENDED FUTURE RECYCLED WATER SYSTEM IMPROVEMENTS

The recommended backbone recycled water system improvements required to serve future recycled water demands and the recycled water exchange program are summarized below and illustrated on Figure 9-6. It should be noted that these recommendations only identify facility improvements at a master plan level and do not necessarily include all required on-site infrastructure nor constitute design of improvements. Subsequent detailed design is required to determine the exact sizes and final locations of these proposed facility improvements.

Because the City's recycled water program is still in its infancy, many planning factors used to size the system were based on industry averages or standard practice, due to the lack of data specific to the City of Tracy. As the recycled water system continues to expand and serve more customers, and as more data becomes available, the recommendations in this chapter should be periodically reviewed and revised to better fit the needs of the City's recycled water use profile.

It should also be noted that the future hydraulic model is not an "all pipes" model (i.e., not all smaller diameter pipelines are included); therefore, the hydraulic simulations performed as discussed above may not identify all necessary water system improvements. Consequently, it is recommended that further hydraulic evaluations be performed as additional details are provided for each future development project.



Last Saved: 8/24/2021 1:18:18 PM N:\Clients\404 Tracy\12-18-41 Water Master Plan Update\GIS\MXD\Report Figures\Fig 9-6 Recycled Water Improvements.mxd : rchu

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Scale in Feet

Symbology

Proposed Buildout Facilities

- Buildout Booster Pump Station
- Future Storage Tank
- Buildout System Pipeline

Proposed 2025 Facilities

- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta Mendota Canal Discharge Point

Existing System Facilities

- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing Transmission Pipeline (Diameter >16 inches)
- Legacy Fields
- Future Recycled Water Use Area
- Recycled Water Pressure Zone

Notes:
1. Install a PRV on any service connection with peak hour or fill period pressures exceeding 100 psi.
2. Install SCADA system monitoring of flows and pressures at each new facility.

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Figure 9-6

Proposed Future Recycled Water System Improvements

City of Tracy
Water System Master Plan Update

9.7.1 2025 System Improvements

The recommended backbone recycled water system improvements required to serve 2025 recycled water demands are summarized below and shown on Figure 9-6. Planning and design for these improvements should be conducted so that these improvements can be constructed and operational by 2025.

9.7.1.1 Booster Pumping Facilities

- Zone C BPS: Install a new booster pump station with a minimum pumping capacity of 1,700 gpm

9.7.1.2 Pipelines

- To serve 2025 recycled water demands, install approximately 33,810 linear feet of new pipelines ranging in diameter from 12 to 30 inches; included in these pipelines is the pipeline needed to discharge recycled water to the DMC as part of the recycled water exchange program (as described above, the exchange program is an essential part of the City's projected future water supply portfolio and should be implemented as soon as possible)
- To serve 2025 recycled water demands, install additional new pipelines of 16 inches in diameter or less within individual development projects; the total length of pipelines needed to serve 2025 recycled water demands is unknown, as not all 2025 development areas have detailed recycled water system infrastructure plans prepared

9.7.1.3 Interconnections

- Install an individual PRV on any recycled water service connection with a peak hour or fill period pressure exceeding 100 psi

9.7.1.4 SCADA System

- Install SCADA system monitoring of flows and pressures at each new water supply facility to provide operators with real-time system data and flexibility in system operations

9.7.2 Buildout System Improvements

The recommended backbone recycled water system improvements required to serve buildout recycled water demands are summarized below and shown on Figure 9-6. Planning and design for these improvements should be conducted so that these improvements can be constructed and operational as soon as possible, as funding is available, so that recycled water supplies can be used to meet landscape irrigation and other non-potable water demands to minimize the use of potable water supplies for these uses.

9.7.2.1 Storage Facilities

Note: Because the actual dimensions of each proposed storage facility have not been determined, the storage facility sizes below do not include dead and freeboard storage requirements, which will be determined during design.

- Zone A Tank: Install a new storage tank with a minimum active storage capacity of 5.7 MG
- WWTP Diurnal Storage: Install a new storage tank with a minimum active storage capacity of 2.3 MG; the need for this storage will depend on WWTP diurnal flow patterns, and it is recommended that the City re-evaluate the required diurnal storage at the WWTP by performing a diurnal flow study in 2040

9.7.2.2 Booster Pumping Facilities

- Zone A BPS Expansion: Install additional Zone A booster pumps with a minimum pumping capacity of 3,472 gpm
- Zone B BPS: Install a new booster pump station with a minimum pumping capacity of 5,780 gpm; note that it is expected this booster pump station will be constructed after 2025, but well before 2040
- Zone D BPS: Install a new booster pump station with a minimum pumping capacity of 2,700 gpm
- Zone E BPS: Install a new booster pump station with a minimum pumping capacity of 2,000 gpm
- Zone F BPS: Install a new booster pump station with a minimum pumping capacity of 4,400 gpm

9.7.2.3 Pipelines

- To serve buildout recycled water demands, install approximately 109,300 linear feet of new pipelines (in addition to the proposed 2025 pipelines) ranging in diameter from 12 to 30 inches
- To serve buildout recycled water demands, install additional new pipelines of 16 inches in diameter or less within individual development projects; the total length of pipelines needed to serve buildout recycled water demands is unknown, as most buildout development areas do not have detailed recycled water system infrastructure plans prepared

9.7.2.4 Interconnections

- Install an individual PRV on any recycled water service connection with a peak hour or fill period pressure exceeding 100 psi

9.7.2.5 SCADA System

- Install SCADA system monitoring of flows and pressures at each new water supply facility to provide operators with real-time system data and flexibility in system operations

CHAPTER 10
Recommended Capital Improvement Program

10.1 OVERVIEW

This chapter presents the recommended capital improvement program (CIP) for the City's existing and future potable water systems and proposed future recycled water system to support the City's projected future potable and recycled water demands, respectively. Recommended improvements to the existing and future potable water systems were described in Chapters 7 and 8, respectively. In addition, infrastructure recommendations for the proposed future recycled water system were described in Chapter 9. It should be noted that the recommended CIP only identifies improvements at a Master Plan level and does not necessarily include all required on-site infrastructure or constitute design of improvements. Subsequent detailed design is required to determine the exact sizes and locations of these proposed improvements.

This chapter provides a summary of the recommended capital improvement projects, along with estimates of probable construction costs. Probable construction cost estimates have been developed for each proposed improvement project, and will then allocated to existing rate payers and new development based on the need for and benefit provided by the proposed improvement. For example, the cost for a pipeline improvement to increase the fire flow availability in the existing potable water system will be allocated to existing rate payers, but a new pipeline required to serve buildout potable water demands will be allocated to new development. An additional analysis to evaluate the potential development impact fees that will be required to fund the buildout potable and recycled water system capital improvement costs will be provided in a separate memorandum.

Construction costs are presented in 2020 dollars and were developed based on bids from other municipal water facility design projects and standard cost estimating guides. Consistent with the 2012 WSMP, the total CIP cost includes mark-ups equal to 40 percent of the estimated base construction costs to allow for general contingency, design and planning, construction management, and program administration as listed below:

- General Contingency: 15 percent
- Design and Planning: 10 percent
- Construction Management: 10 percent
- Program Administration: 5 percent

For this Citywide Water System Master Plan Update, it is assumed that land for buildout potable and recycled water facilities, if required, will be acquired at $190,000 per acre. Costs for land acquisition will only be added to major facilities (e.g., tank sites), where a large parcel is required. Consequently, land acquisition costs do not include right-of-way acquisition costs for transmission and distribution mains. In addition, the proposed construction costs do not include costs for acquisition of additional surface water supplies, supply reliability, or for annual operation and maintenance. A complete description of the assumptions used in the development of the estimated probable construction costs is provided in Appendix E.

This CIP excludes non-backbone facilities that only serve a specific development area, as costs associated with those facilities will be borne solely by the corresponding developers. For example, while facilities to serve specific development areas were evaluated as part of the overall buildout potable and recycled water system operations, costs for facilities recommended for specific development areas are not included in the CIP. Costs for development-specific infrastructure will be evaluated in conjunction with separate planning efforts prepared for those developments.

This Citywide Water System Master Plan Update only includes costs for backbone system facilities with more widespread system benefit, henceforth known as program facilities. Costs for program facilities will be allocated to new developments proportionally based on projected demand. These cost allocations will be evaluated and presented in a separate report.

The following sections of this chapter describe the components of the potable and recycled water system capital improvement program developed for this Citywide Water System Master Plan Update:

- Recommended Potable Water System Capital Improvement Program
- Recommended Recycled Water System Capital Improvement Program
- Capital Improvement Program Implementation

10.2 RECOMMENDED POTABLE WATER SYSTEM CAPITAL IMPROVEMENT PROGRAM

Summaries of the recommended capital improvement projects for the existing, 2025, and buildout potable water systems are presented below in *Section 10.2.1 Existing Potable Water System Improvements*, *Section 10.2.2 2025 Potable Water System Improvements*, and *Section 10.2.3 Buildout Potable Water System Improvements*, respectively. Each section contains a table with preliminary capital cost estimates for the recommended potable water system improvements for the corresponding time horizon. *Section 10.2.4 Water Treatment Plant Expansion Costs* discusses how the costs for the 2008 JJWTP expansion are to be allocated amongst future developments. All potable water system costs are summarized in *Section 10.2.5 Summary of Recommended Potable Water System CIP Costs*, which also discusses the proposed cost allocation between existing rate payers and new development.

10.2.1 Existing Potable Water System Improvements

Chapter 7 evaluated the ability of the City's existing potable water system to meet the recommended water system operational and design criteria described in Chapter 6. Based on the existing potable water system evaluation, improvements were recommended to eliminate existing system hydraulic capacity deficiencies, as listed in the following section. These improvements are recommended based on existing water system demands, and are not triggered by projected future water demands from new development. These improvements should be completed as soon as possible to eliminate existing system deficiencies.

- Pipeline Improvement[37]
  - Replace the existing pipelines in 20th Street between Bessie Avenue and Parker Avenue, Wall Street between Lowell Avenue and 20th Street, Emerson Avenue between Bessie Avenue and Holly Drive, Court Drive between Whittier Avenue and Lowell Avenue, and Lowell Avenue between Parker Avenue and Holly Drive with approximately 6,000 linear feet (lf) of new 8-inch diameter pipelines.
  - Install approximately 515 lf of 12-inch diameter pipeline in Ninth Street between School Street and Tenth Street.
  - Replace approximately 485 lf of existing 4-inch diameter pipeline in Tracy Boulevard north of Mount Diablo Avenue with new 12-inch diameter pipeline. This improvement was previously recommended in the 2012 WSMP.

The locations of the recommended existing potable water system improvement projects are shown on Figure 10-1. Preliminary capital cost estimates for the recommended existing potable water system improvements are presented in Table 10-1.

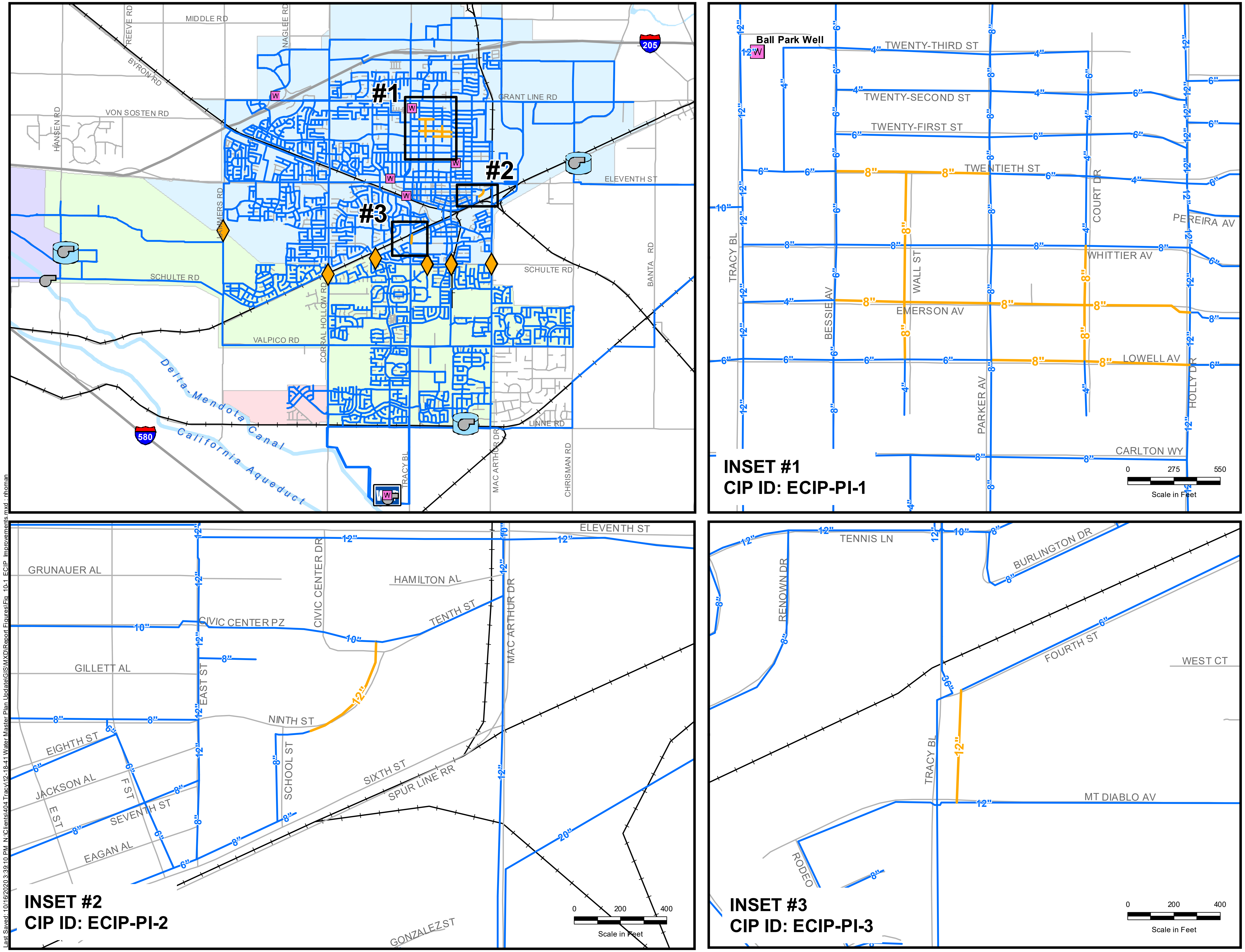
It is also recommended that the City implement a renewal and replacement (R&R) program to proactively replace aging and deteriorating water pipelines before they fail. This Citywide Water System Master Plan Update does not include costs for replacement of aging infrastructure. Therefore, it is recommended that the City perform a separate study which evaluates the condition of existing water system assets and develops a prioritized list and annual budget for asset replacement based on age, material, failure history, and other parameters.

[37] The existing hydraulic model is not an "all pipes" model; therefore, the hydraulic simulations performed may not identify all necessary water system improvements. Consequently, it is recommended that City staff review older parts of the water system, where smaller diameter pipelines are typically found and consider possible upsizing of these pipelines, as the City plans for future pipeline renewal and replacement projects.

Table 10-1. Probable Construction Costs for Recommended Existing Potable Water System CIP[(a)]

Improvement Type	Improvement Description	CIP ID	Quantity		Estimated Construction Cost, dollars[(b)]	CIP Cost, dollars (includes mark-ups)[(c,d)]
Pipeline Improvement	Replace existing pipelines in 20th Street between Bessie Avenue and Parker Avenue, Wall Street between Lowell Avenue and 20th Street, Emerson Avenue between Bessie Avenue and Holly Drive, Court Drive between Whittier Avenue and Lowell Avenue and Lowell Avenue between Parker Avenue and Holly Drive with 8-inch diameter pipe.	ECIP-PI-1	6,000	lf	1,140,000	1,596,000
Pipeline Improvement	Install 12-inch diameter pipe in Ninth Street between School Street and Tenth Street	ECIP-PI-2	515	lf	133,900	187,000
Pipeline Improvement	Replace existing 4-inch diameter pipes on Tracy Boulevard, between Fourth Street and Mt. Diablo Avenue with 12-inch diameter pipes	ECIP-PI-3	485	lf	126,100	177,000
					Total	**$ 1,960,000**

(a) Costs shown are presented in 2020 dollars.
(b) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.
(c) Costs include mark-ups equal to 40 percent (General Contingency: 15 percent; Design and Planning: 10 percent; Construction Management: 10 percent; and Program Administration: 5 percent).
(d) Total rounded to nearest $1,000.



Symbology

- Existing Pipeline
- Pipeline Improvement
- Pressure Regulating Station
- Booster Pump Station
- Groundwater Well
- Storage Tank
- John Jones Water Treatment Plant

Pressure Zone

- Zone 1
- Zone 2
- Zone 3 (IPC/PPBP)
- Ellis Reduced Zone

Notes:
1. The City's existing hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.

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Figure 10-1

Recommended Existing Potable Water System Improvements

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10.2.2 2025 Potable Water System Improvements

Chapter 8 summarized the evaluation of the City's 2025 potable water system and its ability to meet the recommended water system operational and design criteria described in Chapter 6. Based on the 2025 potable water system evaluation, the following backbone water system improvements were recommended to meet projected 2025 potable water demands. **Only program facilities are listed below; the complete list of recommended 2025 potable water system improvements (including non-program facilities) and their recommended timing can be found in Chapter 8.**

- Pipeline Improvements[38]
  - To serve 2025 potable water demands, replace existing pipelines in Sixth Street, Tracy Boulevard, and Eleventh Street with approximately 1,390 linear feet of new 18-inch and 24-inch diameter pipelines.
  - To serve 2025 potable water demands, jack and bore approximately 160 linear feet of new pipelines. This represents one (1) jack and bore installation.
- New Pipelines plus Jack and Bore
  - To serve 2025 potable water demands, install approximately 43,010 linear feet of new pipelines ranging in diameter from 12 to 24 inches.
  - To serve 2025 potable water demands, jack and bore approximately 1,050 linear feet of new pipelines. This represents four (4) distinct jack and bore installations.
- Interconnections
  - Install PRVs at Schulte Road and Bud Lyons Way and at Schulte Road and Pavillion Parkway before the transmission main in Schulte Road is re-zoned to Zone 3.
- Re-zoning
  - Re-zone the existing transmission mains in Lammers Road, Schulte Road, and Hansen Road from Zone 2 to Zone 3 as described in Appendix D. The capital costs of pipelines and other new facilities which need to be constructed prior to re-zoning are included in their respective categories. The capital cost of the re-zoning itself is assumed to be insignificant.
- Groundwater Wells
  - Provide ammonia addition for existing City wells (Lincoln Well, Lewis Manor Well, Park & Ride Well and Ball Park Well) (as noted below under Buildout System Improvements, all future wells are also recommended to be equipped with ammonia addition)
  - A feasibility study is recommended to develop an implementation plan for future ASR expansion (see additional discussion in Chapters 5 and 8)

[38] The buildout hydraulic model was developed as a backbone system and is not an "all pipes" model; therefore, the hydraulic simulations performed may not identify all necessary water system improvements. Consequently, it is recommended that further hydraulic evaluations be performed as additional details are provided for each future development project.

The locations of the recommended 2025 potable water system improvement projects are shown on Figure 10-2. Preliminary capital cost estimates for the recommended 2025 potable water system improvements are presented in Table 10-2. Detailed maps illustrating the proposed pipeline projects for the 2025 potable water system are provided in Appendix F.

10.2.3 Buildout Potable Water System Improvements

Chapter 8 also summarized the evaluation of the City's buildout potable water system and its ability to meet the recommended water system operational and design criteria described in Chapter 6. Based on the buildout potable water system evaluation, the following backbone water system improvements were recommended to meet projected buildout potable water demands. **Only program facilities are listed below; the complete list of recommended buildout potable water system improvements (including non-program facilities) and their recommended timing can be found in Chapter 8.**

- Land Acquisition
  - To account for land acquisition costs, it was assumed that 1.5 acres will be required for each tank site
  - To account for land acquisition costs, it was assumed that 0.25 acres will be required for each ASR well site

- Storage Reservoir

  Note: Because the actual dimensions of each proposed storage tank have not been determined, the recommended storage facility sizes do not include dead and freeboard storage requirements, which will be determined during design.

  - To provide buildout water storage capacity, installation of the following storage facilities is recommended:
    - Westside Tank - 1.0 MG
    - Install a new clearwell at the JJWTP with a minimum active storage capacity of 1.0 MG to provide storage for Zone 3. It is assumed that the existing JJWTP site can accommodate this new clearwell (i.e., land acquisition is not necessary).

- Groundwater Well
  - To provide emergency and dry year water supply, installation of the following groundwater wells is recommended:
    - Westside - ASR well with a minimum firm pumping capacity of 2,500 gpm
    - Wainwright - ASR well with a minimum firm pumping capacity of 2,500 gpm
    - Larsen Park - ASR well with a minimum firm pumping capacity of 2,500 gpm
    - Ellis - ASR well with a minimum firm pumping capacity of 1,000 gpm
    - All new groundwater wells should be equipped with ammonia addition and backup power

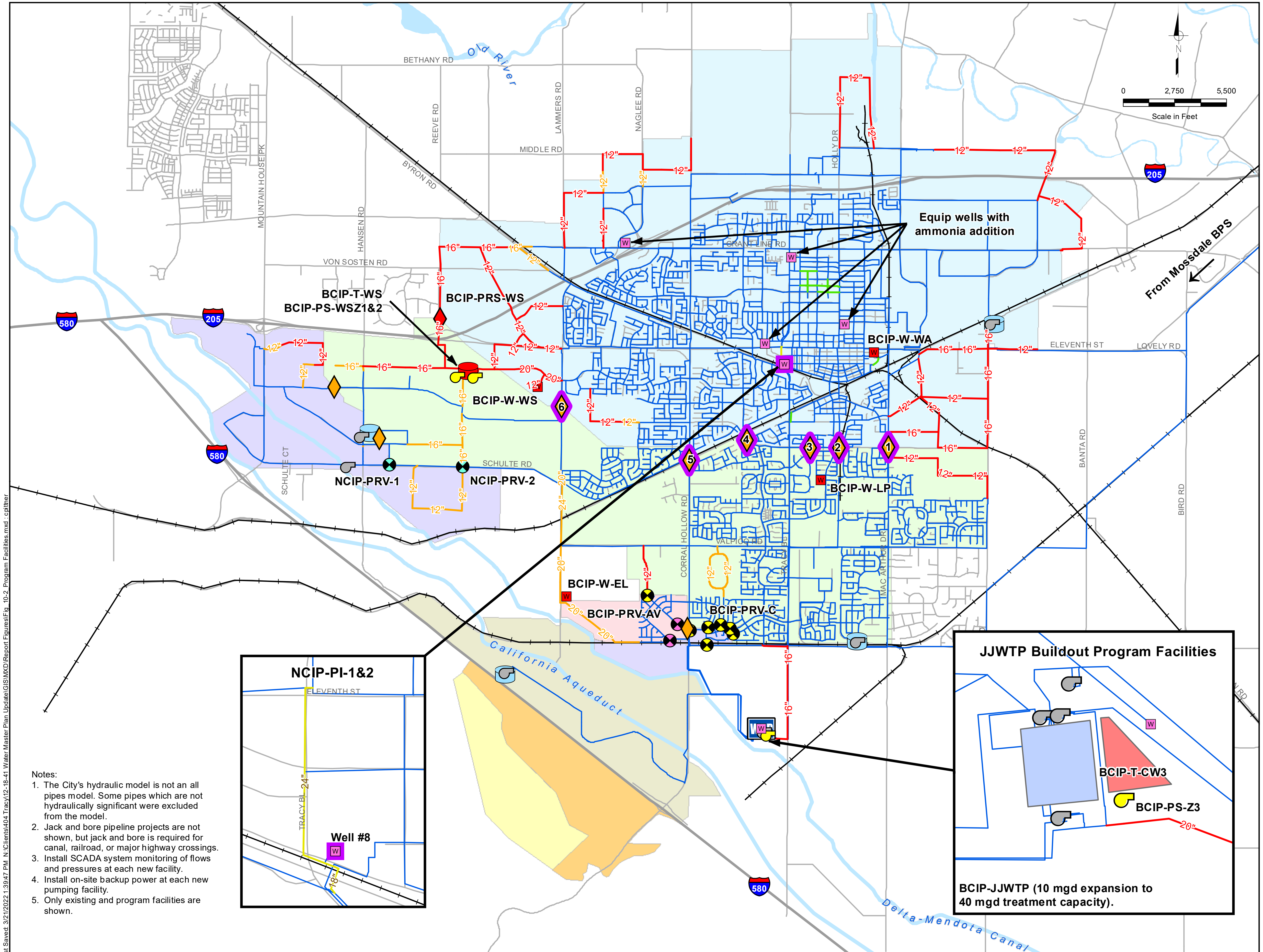

Figure 10-2

Recommended Future Potable Water System Program Improvements

City of Tracy
Water System Master Plan Update

Table 10-2. Probable Construction Costs for Recommended 2025 Potable Water System CIP[(a)]

Improvement Type	Improvement Description	CIP ID	Quantity		Estimated Construction Cost, dollars[(b)]	CIP Cost, dollars (includes mark-ups)[(c,d)]
Shared City-side Facilities						
Pipeline Improvement	Replace existing 12-inch diameter pipeline crossing railroad track with 18-inch diameter pipe. Replace existing 12-inch diameter pipelines in Sixth Street, Tracy Boulevard, and Eleventh Street with 24-inch diameter pipe.	NCIP-PI-1	1,389	lf	627,574	879,000
Jack and Bore Improvement	18-inch diameter (24-inch casing)	NCIP-PI-2	159	lf	109,451	153,000
New Pipeline (Developed Area)	8-inch diameter	NCIP-PD-8	-	lf	-	-
New Pipeline (Developed Area)	10-inch diameter	NCIP-PD-10	-	lf	-	-
New Pipeline (Developed Area)	12-inch diameter	NCIP-PD-12	2,013	lf	523,453	733,000
New Pipeline (Developed Area)	14-inch diameter	NCIP-PD-14	-	lf	-	-
New Pipeline (Developed Area)	16-inch diameter	NCIP-PD-16	1,051	lf	351,924	493,000
New Pipeline (Developed Area)	18-inch diameter	NCIP-PD-18	-	lf	-	-
New Pipeline (Developed Area)	20-inch diameter	NCIP-PD-20	609	lf	243,594	341,000
New Pipeline (Developed Area)	24-inch diameter	NCIP-PD-24	3,426	lf	1,593,146	2,230,000
New Pipeline (Undeveloped Area)	8-inch diameter	NCIP-PU-8	-	lf	-	-
New Pipeline (Undeveloped Area)	10-inch diameter	NCIP-PU-10	-	lf	-	-
New Pipeline (Undeveloped Area)	12-inch diameter	NCIP-PU-12	18,666	lf	4,199,794	5,880,000
New Pipeline (Undeveloped Area)	14-inch diameter	NCIP-PU-14	-	lf	-	-
New Pipeline (Undeveloped Area)	16-inch diameter	NCIP-PU-16	9,270	lf	2,642,003	3,699,000
New Pipeline (Undeveloped Area)	18-inch diameter	NCIP-PU-18	-	lf	-	-
New Pipeline (Undeveloped Area)	20-inch diameter	NCIP-PU-20	7,975	lf	2,711,517	3,796,000
New Pipeline (Undeveloped Area)	24-inch diameter	NCIP-PU-24	-	lf	-	-
Jack and Bore	Boring and Receiving Pits	NCIP-JB-PIT	5	each	200,000	280,000
Jack and Bore	8-inch diameter (16-inch casing)	NCIP-JB-8	-	lf	-	-
Jack and Bore	12-inch diameter (21-inch casing)	NCIP-JB-12	-	lf	-	-
Jack and Bore	16-inch diameter (24-inch casing)	NCIP-JB-16	374	lf	258,046	361,000
Jack and Bore	18-inch diameter (24-inch casing)	NCIP-JB-18	-	lf	-	-
Jack and Bore	20-inch diameter (30-inch casing)	NCIP-JB-20	-	lf	-	-
Jack and Bore	24-inch diameter (36-inch casing)	NCIP-JB-24	677	lf	673,911	943,000
Interconnection	PRV at Schulte Road and Bud Lyons Way	NCIP-PRV-1	1	L.S.	125,000	175,000
Interconnection	PRV at Schulte Road and Pavillion Prkway	NCIP-PRV-2	1	L.S.	125,000	175,000
Groundwater Wells	Equip Lincoln Well, Park & Ride Well, Ball Park Well and Lewis Manor Well with ammonia addition	NCIP-GW-1	1	L.S.	-	1,500,000
ASR Expansion Study	Evaluate future ASR well sites and operational scenarios	NCIP-ASR	1	L.S.	-	350,000
					Total	**$ 21,988,000**

(a) Costs shown are presented in 2020 dollars.
(b) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.
(c) Costs include mark-ups equal to 40 percent (General Contingency: 15 percent; Design and Planning: 10 percent; Construction Management: 10 percent; and Program Administration: 5 percent).
(d) Total rounded to nearest $1,000.

- Booster Pump Station[39]
  - To provide buildout water pumping capacity and to convey water from proposed partially buried storage reservoirs, installation of the following pumping facilities is recommended:
    - Zone 3 BPS (JJWTP) – Install additional Zone 3 booster pumps at the JJWTP with a minimum firm pumping capacity of 1,500 gpm
    - Westside Zone 1 Tank - Booster pump station with a minimum firm pumping capacity of 4,500 gpm
    - Westside Zone 2 Tank - Booster pump station with a minimum firm pumping capacity of 2,400 gpm
- New Pipeline plus Jack and Bore[40]
  - To serve buildout potable water demands, install approximately 131,280 linear feet of new pipelines (in addition to the proposed 2025 pipelines) ranging in diameter from 12 to 20 inches
  - To serve buildout potable water demands, jack and bore approximately 2,750 linear feet of new pipelines. This represents eleven (11) distinct jack and bore installations
- Interconnection
  - To provide supply during peak demands and/or emergency conditions between pressure zones, installation of the following pressure zone interconnections is recommended:
    - Westside PRS (from Zone 2 into Zone 1)
    - Avenues PRV (from Ellis Reduced Zone into Zone 2)
  - To provide adequate pressure to the Plan C area and prevent the accumulation of stagnant water in dead-end mains, installation of six (6) PRVs is recommended before the Plan C re-zoning occurs (to be funded with Plan C funding)

    Note: The estimated probable construction costs do not include installation of individual PRVs on water service connections with static pressures exceeding 80 psi, as these will be the responsibility of individual developer(s).
- Re-zoning
  - Re-zone the Plan C area from Zone 2 to Zone 3. The capital costs of pipelines and other new facilities which need to be constructed prior to re-zoning are included in their respective categories. The capital cost of the re-zoning itself is assumed to be insignificant

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[39] Cost based on the firm pumping capacity required.

[40] The buildout hydraulic model was developed as a backbone system and is not an "all pipes" model; therefore, the hydraulic simulations performed may not identify all necessary water system improvements. Consequently, it is recommended that further hydraulic evaluations be performed as additional details are provided for each future development project.

- SCADA System and Backup Power
  - Install SCADA system monitoring of flows and pressures at PRS #1-#6 to provide operators with additional understanding and flexibility in system operations
  - Add remote operation of Well 8 from the SCADA system to provide additional operational flexibility
  - Install SCADA system monitoring of flows and pressures at each new water supply facility to provide operators with real-time system data and flexibility in system operations. The capital cost for SCADA system installation is included in the cost for these facilities
  - Install on-site backup power to any proposed buildout system pumping facility to improve supply reliability. The capital cost for backup power is included in the cost for new pump stations
- JJWTP Expansion
  - A future additional 10 mgd expansion of the JJWTP (for a total treatment capacity of 40 mgd) is recommended to provide the City with additional water treatment capacity, as well as operational flexibility and reliability.
- Participation in Phase 2 Los Vaqueros Reservoir Expansion Project
  - The City's participation in the Phase 2 Los Vaqueros Reservoir Expansion Project would increase the City's water supply reliability by providing storage of supplies for use in dry years
  - The estimated cost for 5,000 acre-feet of storage for the City will be approximately $10 million plus an additional $1.5 million for implementation and will be shared by existing rate payers and new development
- Water Master Plan Updates
  - Regular updates of this Citywide Water System Master Plan are recommended to evaluate potable water and recycled water infrastructure needs to reflect any changes in future development plans, water use trends and patterns, and water supply availability and reliability, as well as new regulations and operational needs as new potable water and recycled water system infrastructure is constructed. It is recommended that updates be prepared at least once every 10 years, or more often if changing conditions warrant more frequent updates. For purposes of this Citywide Water System Master Plan Update, three future updates are planned.

The locations of the recommended buildout program facility improvements are shown on Figure 10-2. Preliminary capital cost estimates for the recommended buildout potable water system improvements are presented in Table 10-3. Detailed maps illustrating the proposed pipeline projects for the buildout potable water system are provided in Appendix F.

Table 10-3. Probable Construction Costs for Recommended Buildout Potable Water System CIP[a]						
Improvement Type	Improvement Description	CIP ID	Quantity		Estimated Construction Cost, dollars[b]	CIP Cost, dollars (includes mark-ups)[c,d]
Shared City-side Facilities						
Land Acquisition[e]	Tank Sites	BCIP-LA-T	1	sites	-	285,000
Land Acquisition[f]	ASR Well Sites	BCIP-LA-W	4	sites	-	190,000
Storage Reservoir[g]	1.0 MG Clearwell No. 3 at JJWTP	BCIP-T-CW3	1	L.S.	3,008,250	4,212,000
Storage Reservoir[g]	1.0 MG Westside Tank	BCIP-T-WS	1	L.S.	3,008,250	4,212,000
Groundwater Well	2,500 gpm ASR Well in Westside	BCIP-W-WS	1	L.S.	3,900,000	5,460,000
Groundwater Well	2,500 gpm ASR Well in Wainwright	BCIP-W-WA	1	L.S.	3,900,000	5,460,000
Groundwater Well	2,500 gpm ASR Well in Larsen Park	BCIP-W-LP	1	L.S.	3,900,000	5,460,000
Groundwater Well	1,000 gpm ASR Well in Ellis	BCIP-W-EL	1	L.S.	2,500,000	3,500,000
Booster Pump Station[h]	2.16 mgd at Zone 3 Clearwell (JJWTP)	BCIP-PS-Z3	1	L.S.	1,554,755	2,177,000
Booster Pump Station[h]	6.48 mgd at Westside Zone 1 Tank	BCIP-PS-WSZ1	1	L.S.	2,263,735	3,169,000
Booster Pump Station[h]	3.46 mgd at Westside Zone 2 Tank	BCIP-PS-WSZ2	1	L.S.	1,767,450	2,474,000
New Pipeline (Developed Area)	8-inch diameter	BCIP-PD-8	11	lf	2,090	3,000
New Pipeline (Developed Area)	10-inch diameter	BCIP-PD-10	-	lf	-	-
New Pipeline (Developed Area)	12-inch diameter	BCIP-PD-12	-	lf	-	-
New Pipeline (Developed Area)	14-inch diameter	BCIP-PD-14	-	lf	-	-
New Pipeline (Developed Area)	16-inch diameter	BCIP-PD-16	11,349	lf	3,801,881	5,323,000
New Pipeline (Developed Area)	18-inch diameter	BCIP-PD-18	-	lf	-	-
New Pipeline (Developed Area)	20-inch diameter	BCIP-PD-20	1,132	lf	452,853	634,000
New Pipeline (Developed Area)	24-inch diameter	BCIP-PD-24	-	lf	-	-
New Pipeline (Undeveloped Area)	8-inch diameter	BCIP-PU-8	-	lf	-	-
New Pipeline (Undeveloped Area)	10-inch diameter	BCIP-PU-10	-	lf	-	-
New Pipeline (Undeveloped Area)	12-inch diameter	BCIP-PU-12	84,957	lf	19,115,431	26,762,000
New Pipeline (Undeveloped Area)	14-inch diameter	BCIP-PU-14	-	lf	-	-
New Pipeline (Undeveloped Area)	16-inch diameter	BCIP-PU-16	27,691	lf	7,891,999	11,049,000
New Pipeline (Undeveloped Area)	18-inch diameter	BCIP-PU-18	-	lf	-	-
New Pipeline (Undeveloped Area)	20-inch diameter	BCIP-PU-20	6,148	lf	2,090,151	2,926,000
New Pipeline (Undeveloped Area)	24-inch diameter	BCIP-PU-24	-	lf	-	-
Jack and Bore	Boring and Receiving Pits	BCIP-JB-PIT	11	each	440,000	616,000
Jack and Bore	8-inch diameter (16-inch casing)	BCIP-JB-8	-	lf	-	-
Jack and Bore	12-inch diameter (21-inch casing)	BCIP-JB-12	1,489	lf	885,921	1,240,000
Jack and Bore	16-inch diameter (24-inch casing)	BCIP-JB-16	1,257	lf	867,182	1,214,000
Jack and Bore	18-inch diameter (24-inch casing)	BCIP-JB-18	-	lf	-	-
Jack and Bore	20-inch diameter (30-inch casing)	BCIP-JB-20	-	lf	-	-
Jack and Bore	24-inch diameter (36-inch casing)	BCIP-JB-24	-	lf	-	-
Interconnection	Westside PRS (12-inch)	BCIP-PRS-WS	1	L.S.	250,000	350,000
Interconnection	Avenues PRV (12-inch)	BCIP-PRV-AV	1	L.S.	125,000	175,000
SCADA	Well No. 8	BCIP-S-W8	1	L.S.	125,000	175,000
SCADA	Pressure Regulating Station No. 1	BCIP-S-1	1	L.S.	125,000	175,000
SCADA	Pressure Regulating Station No. 2	BCIP-S-2	1	L.S.	125,000	175,000
SCADA	Pressure Regulating Station No. 3	BCIP-S-3	1	L.S.	125,000	175,000
SCADA	Pressure Regulating Station No. 4	BCIP-S-4	1	L.S.	125,000	175,000
SCADA	Pressure Regulating Station No. 5	BCIP-S-5	1	L.S.	125,000	175,000
SCADA	Pressure Regulating Station No. 6	BCIP-S-6	1	L.S.	125,000	175,000
JJWTP Expansion	Expand JJWTP from 30 mgd to 40 mgd	BCIP-JJWTP	1	L.S.	40,000,000	56,000,000
Participation in Phase 2 Los Vaqueros Reservoir Expansion Project[i]	5,000 acre-feet of storage for dry year use	BCIP-LVE	1	L.S.	11,500,000	11,500,000
Water Master Plan Updates	Future updates to Water Master Plan (three updates assumed @ $500,000 per update)	BCIP-WMP	3	each		1,500,000
					Total	$ 157,116,000

(a) Costs shown are presented in 2020 dollars.
(b) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.
(c) Costs include mark-ups equal to 40 percent (General Contingency: 15 percent; Design and Planning: 10 percent; Construction Management: 10 percent; and Program Administration: 5 percent).
(d) Total rounded to nearest $1,000.
(e) Assumes each tank site is 1.5 acres. Cost includes Westside Tank site.
(f) Assumes each ASR well site is 0.25 acres. Cost includes Westside, Wainwright, Larsen Park, and Ellis ASR Well sites.
(g) Recommended volume based on active volume. Cost assumes the construction of a partially buried prestressed concrete tank.
(h) Recommended capacity based on firm pumping capacity.
(i) Cost for participation in Phase 2 Los Vaqueros Reservoir Expansion Project to be shared by existing rate payers and new development.

10.2.4 Water Treatment Plant Expansion Costs

In 2008, the JJWTP was expanded by 15 mgd to provide additional treatment capacity for future development. While some of this capacity is now utilized by the City's existing water users, it is estimated that 9 mgd of the expansion capacity is still available for future developments to use. To recoup the costs of constructing this remaining 9 mgd of treatment capacity, the City will include a charge for the JJWTP expansion capacity in the developer impact fees. The cost of the 2008 expansion was $45 million, or $3 million per mgd of capacity. Therefore, the remaining JJWTP expansion cost to be allocated amongst future developments is $27 million.

In addition, as discussed in Chapter 8, a future additional 10 mgd expansion of the JJWTP is recommended. The estimated construction cost is $4 million per mgd, or $40 million for the recommended 10 mgd expansion.

10.2.5 Summary of Recommended Potable Water System CIP Costs

Preliminary capital cost estimates for the recommended existing, 2025, and buildout potable water system improvements are presented in Tables 10-1, 10-2, and 10-3, respectively.

The total existing potable water system CIP cost estimate is $2.0 million, while the total 2025 and buildout potable water system CIP cost estimates (which include only program facilities) are $22.0 million and $157.1 million, respectively. The estimated probable construction costs do not include installation of individual PRVs on potable water service connections with static pressures exceeding 80 psi, as these will be the responsibility of individual developer. The remaining previous JJWTP expansion buy-in cost is $27.0 million.

The total CIP costs from Table 10-1 should be allocated to existing rate payers, while the total CIP costs from Table 10-2 and Table 10-3 and the previous JJWTP expansion buy-in cost should be allocated to new development; with the exception of the costs for the participation in the Phase 2 Los Vaqueros Reservoir Expansion Project which should be shared between existing rate payers and future development.

10.3 RECOMMENDED RECYCLED WATER SYSTEM CAPITAL IMPROVEMENT PROGRAM

A summary of the recommended capital improvement projects for the recycled water system is presented below in *Section 10.3.1 2025 Recycled Water System Improvements* and *Section 10.3.2 Buildout Recycled Water System Improvements*. Each section contains a table with preliminary capital cost estimates for the recommended recycled water system improvements. These costs are summarized in *Section 10.3.3 Summary of Recommended Recycled Water System CIP Costs*.

10.3.1 2025 Recycled Water System Improvements

Based on the recycled water system evaluation, the following backbone improvements were recommended to meet projected 2025 recycled water demands. **Only program facilities are listed below; the complete list of recommended 2025 recycled water system improvements (including non-program facilities) and their recommended timing can be found in Chapter 9.**

- Booster Pump Station[41]
  - To provide 2025 recycled water pumping capacity, installation of the following pumping facilities is recommended:
    - Zone C BPS - Booster pump station with a minimum pumping capacity of 1,700 gpm.
- New Pipeline plus Jack and Bore[42]
  - To serve 2025 recycled water demands, install approximately 11,370 linear feet of new pipelines ranging in diameter from 8 to 30 inches
  - To serve 2025 recycled water demands, jack and bore approximately 590 linear feet of new pipelines. This represents 2 distinct jack and bore installations.
  - To deliver recycled water to the DMC as part of the City's planned recycled water exchange agreement with the USBR, install approximately 23,680 linear feet and jack and bore approximately 180 linear feet (in 1 installation) of new, 30-inch diameter pipeline. This assumes Alignment A as depicted on Figure 9-3 is constructed. A detailed alignment study should be conducted to determine the final alignment of the recycled water exchange pipeline. Actual length of the recycled water exchange pipeline may change considerably if a different alignment is selected. A separate line item for program implementation is also included for the City's planned recycled water exchange agreement to account for coordination and negotiations with the USBR and SWRCB which may require additional studies, legal review and assistance and staff and consultant time.

    Note: Within individual developments, additional new pipelines of 16-inch diameter and less will be required. The total length of pipelines needed to serve 2025 recycled water demands is unknown, as some development areas are still preparing recycled water system plans.

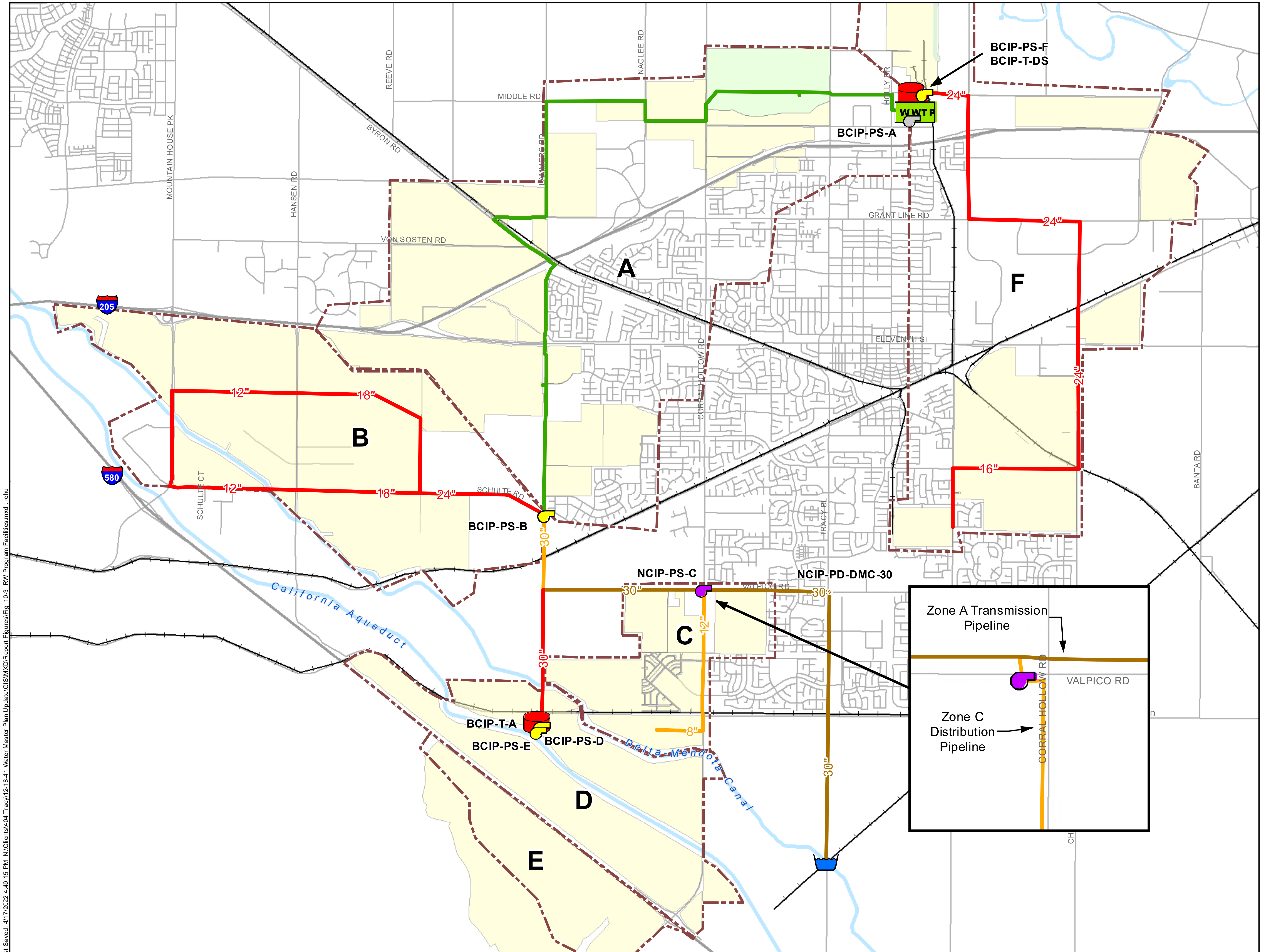
The locations of the recommended 2025 recycled water program facility improvements are shown on Figure 10-3. Preliminary capital cost estimates for the recommended 2025 recycled water system improvements are presented in Table 10-4. Detailed maps illustrating the proposed pipeline projects for the 2025 potable water system are provided in Appendix G.

[41] Cost based on the firm pumping capacity required.

[42] The buildout hydraulic model was developed as a backbone system and is not an "all pipes" model; therefore, the hydraulic simulations performed may not identify all necessary recycled water system improvements. Consequently, it is recommended that further hydraulic evaluations be performed as additional details are provided for each future development project.

Table 10-4. Probable Construction Costs for the Recommended 2025 Recycled Water System CIP[(a)]						
Improvement Type	Improvement Description	CIP ID	Quantity		Estimated Construction Cost, dollars[(b)]	CIP Cost, dollars (includes mark-ups)[(c,d)]
Shared City-side Facilities						
Booster Pump Station	2.45 mgd for Zone C	NCIP-PS-C	1	L.S.	1,441,820	2,019,000
New Pipeline (Developed Area)	8-inch diameter	NCIP-PD-8	4,962	lf	868,372	1,216,000
New Pipeline (Developed Area)	10-inch diameter	NCIP-PD-10	-	lf	-	-
New Pipeline (Developed Area)	12-inch diameter	NCIP-PD-12	3,055	lf	778,900	1,090,000
New Pipeline (Developed Area)	14-inch diameter	NCIP-PD-14	-	lf	-	-
New Pipeline (Developed Area)	16-inch diameter	NCIP-PD-16	-	lf	-	-
New Pipeline (Developed Area)	18-inch diameter	NCIP-PD-18	-	lf	-	-
New Pipeline (Developed Area)	20-inch diameter	NCIP-PD-20	-	lf	-	-
New Pipeline (Developed Area)	24-inch diameter	NCIP-PD-24	131	lf	60,939	85,000
New Pipeline (Developed Area)	30-inch diameter	NCIP-PD-30	3,218	lf	1,818,131	2,545,000
New DMC Pipeline (Developed Area)	30-inch diameter	NCIP-PD-DMC-30	23,683	lf	13,380,877	18,733,000
New Pipeline (Undeveloped Area)	8-inch diameter	NCIP-PU-8	-	lf	-	-
New Pipeline (Undeveloped Area)	10-inch diameter	NCIP-PU-10	-	lf	-	-
New Pipeline (Undeveloped Area)	12-inch diameter	NCIP-PU-12	-	lf	-	-
New Pipeline (Undeveloped Area)	14-inch diameter	NCIP-PU-14	-	lf	-	-
New Pipeline (Undeveloped Area)	16-inch diameter	NCIP-PU-16	-	lf	-	-
New Pipeline (Undeveloped Area)	18-inch diameter	NCIP-PU-18	-	lf	-	-
New Pipeline (Undeveloped Area)	20-inch diameter	NCIP-PU-20	-	lf	-	-
New Pipeline (Undeveloped Area)	24-inch diameter	NCIP-PU-24	-	lf	-	-
New Pipeline (Undeveloped Area)	30-inch diameter	NCIP-PU-30	-	lf	-	-
Jack and Bore	Boring and Receiving Pits	NCIP-JB-PIT	2	each	80,000	112,000
Jack and Bore	8-inch diameter (16-inch casing)	NCIP-JB-8	154	lf	79,907	112,000
Jack and Bore	12-inch diameter (21-inch casing)	NCIP-JB-12	-	lf	-	-
Jack and Bore	16-inch diameter (24-inch casing)	NCIP-JB-16	-	lf	-	-
Jack and Bore	18-inch diameter (24-inch casing)	NCIP-JB-18	-	lf	-	-
Jack and Bore	20-inch diameter (30-inch casing)	NCIP-JB-20	-	lf	-	-
Jack and Bore	24-inch diameter (36-inch casing)	NCIP-JB-24	-	lf	-	-
Jack and Bore	30-inch diameter (42-inch casing)	NCIP-JB-30	434	lf	483,956	678,000
Jack and Bore (DMC Pipeline)	Boring and Receiving Pits	NCIP-JB-DMC-PIT	1	each	40,000	56,000
Jack and Bore (DMC Pipeline)	30-inch diameter (42-inch casing)	NCIP-JB-DMC-30	178	lf	198,418	278,000
Recycled Water Exchange Program Implementation	Additional studies, legal review and assistance, City staff and consultant time	NCIP-DMC	1	L.S.	1,000,000	1,000,000
					Total	**$ 27,924,000**

(a) Costs shown are presented in 2020 dollars.
(b) Estimated construction costs do not yet reflect an adjustment to account for the current economic bidding climate.
(c) Costs include mark-ups equal to 40 percent (General Contingency: 15 percent; Design and Planning: 10 percent; Construction Management: 10 percent; and Program Administration: 5 percent).
(d) Total rounded to nearest $1,000.



0 2,000 4,000
Scale in Feet

Symbology

Proposed Buildout Program Facilities

- Buildout Booster Pump Station
- Buidlout Storage Tank
- Buildout System Pipeline

Proposed 2025 Program Facilities

- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta-Mendota Canal Pipeline
- Delta-Mendota Canal Discharge Point

Existing System Facilities

- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing System Pipeline
- Legacy Fields
- Future Recycled Water Use
- Recycled Water Pressure Zone

Notes:

1. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
2. Jack and bore pipeline projects are not shown, but jack and bore is required for canal, railroad, or major highway crossings.
3. Install SCADA system monitoring of flows and pressures at each new facility.
4. Only existing and program facilities are shown.

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WEST YOST ASSOCIATES

Figure 10-3

Recommended Future Recycled Water System Program Improvements

City of Tracy
Water System Master Plan Update

10.3.2 Buildout Recycled Water System Improvements

As discussed in Chapter 9, the buildout recycled water system is expected to consist of one system that encompasses the entire SOI. Based on the buildout recycled water system evaluation, the following backbone recycled water system improvements were recommended to meet projected buildout recycled water demands. **Only program facilities are listed below; the complete list of recommended buildout recycled water system improvements (including non-program facilities) and their recommended timing can be found in Chapter 9.**

- Land Acquisition
  - — To account for land acquisition costs, assume 1.5 acres will be required for each tank site
- Storage Reservoir

  Note: Because the actual dimensions of each proposed storage tank have not been determined, the recommended storage facility sizes do not include dead and freeboard storage requirements, which will be determined during design.

  - — To provide buildout recycled water storage capacity, installation of the following storage facilities is recommended:
    - Zone A Tank – install an above ground, welded steel storage tank with a minimum active storage capacity of 5.7 MG
    - Install a diurnal storage tank at the WWTP with a minimum active storage capacity of 2.3 MG. It is assumed that the existing WWTP site can accommodate this new tank (i.e., land acquisition is not necessary). The need for this storage will depend on WWTP diurnal flow patterns, and it is recommended that the City re-evaluate the required diurnal storage at the WWTP by performing a diurnal flow study in 2040.
- Booster Pump Station
  - — To provide buildout recycled water pumping capacity and to convey water from proposed partially buried storage reservoirs, installation of the following pumping facilities is recommended:
  - — Zone A BPS Expansion – install additional booster pumps with a minimum pumping capacity of 3,472 gpm
  - — Zone B BPS – Booster pump station with a minimum pumping capacity of 5,780 gpm
  - — Zone D BPS – Booster pump station with a minimum pumping capacity of 2,700 gpm
  - — Zone E BPS – Booster pump station with a minimum pumping capacity of 2,000 gpm
  - — Zone F BPS – Booster pump station with a minimum pumping capacity of 4,400 gpm

- New Pipeline plus Jack and Bore[43]
  - To serve buildout recycled water demands, install approximately 71,550 linear feet of new pipelines (in addition to the proposed 2025 pipelines) ranging in diameter from 12 to 30 inches
  - To serve buildout potable water demands, jack and bore approximately 1,590 linear feet of new pipelines. This represents 5 distinct jack and bore installations.

    Note: Within individual developments, additional new pipelines of 16-inch diameter and less will be required. The total length of pipelines needed to serve buildout recycled water demands is unknown, as some development areas are still preparing recycled water system plans.

- SCADA System
  - Install SCADA system monitoring of flows and pressures at each new water supply facility to provide operators with real-time system data and flexibility in system operations. The capital cost for SCADA system installation is included in the cost for these facilities.

The locations of these recommended buildout recycled water program facility improvements are shown on Figure 10-3. Preliminary capital cost estimates for the recommended buildout recycled water system improvements are presented in Table 10-5. Detailed maps illustrating the proposed pipeline projects for the buildout recycled water system are provided in Appendix G.

10.3.3 Summary of Recommended Recycled Water System CIP Costs

As discussed in Appendix E, unit construction costs for pipelines, booster pump stations, and storage tanks are essentially the same as for the potable water system. However, unit construction costs for recycled water system pipelines 8 inches and 12 inches in diameter are slightly less than for potable water pipelines, because the 8-inch and 12-inch diameter recycled water pipelines are assumed to be constructed from PVC instead of ductile iron.

Preliminary capital cost estimates for the recommended 2025 and buildout recycled water system are presented in Table 10-4 and Table 10-5, respectively. The estimated probable construction costs do not include installation of individual PRVs on recycled water service connections with peak hour or fill period pressures exceeding 100 psi, as these will be the responsibility of individual developer.

The total 2025 recycled water system CIP cost estimate is $27.9 million, while the total buildout recycled water system CIP cost estimate is $65.5 million. The total recommended recycled water system CIP cost estimate is $93.4 million. These costs only include program facilities.

[43] The buildout hydraulic model was developed as a backbone system and is not an "all pipes" model; therefore, the hydraulic simulations performed may not identify all necessary water system improvements. Consequently, it is recommended that further hydraulic evaluations be performed as additional details are provided for each future development project.

Table 10-5. Probable Construction Costs for the Recommended Buildout Recycled Water System CIP[a]						
Improvement Type	Improvement Description	CIP ID	Quantity		Estimated Construction Cost, dollars[b]	CIP Cost, dollars (includes mark-ups)[c,d]
Shared City-side Facilities						
Land Acquisition[e]	Tank Sites	BCIP-LA-T	1	sites	-	285,000
Storage Reservoir[f]	5.7 MG Zone A Tank	BCIP-T-A	1	L.S.	5,809,500	8,133,000
Storage Reservoir[f]	2.3 MG WWTP Diurnal Storage Tank	BCIP-T-DS	1	L.S.	4,262,640	5,968,000
Booster Pump Station	5.00 mgd Zone A Expansion	BCIP-PS-A	1	L.S.	1,818,715	2,546,000
Booster Pump Station	6.34 mgd for Zone F	BCIP-PS-F	1	L.S.	2,016,095	2,823,000
Booster Pump Station	8.32 mgd for Zone B	BCIP-PS-B	1	L.S.	2,309,610	3,233,000
Booster Pump Station	3.89 mgd for Zone D	BCIP-PS-D	1	L.S.	1,654,515	2,316,000
Booster Pump Station	2.88 mgd for Zone E	BCIP-PS-E	1	L.S.	1,505,630	2,108,000
New Pipeline (Developed Area)	8-inch diameter	BCIP-PD-8	-	lf	-	-
New Pipeline (Developed Area)	10-inch diameter	BCIP-PD-10	-	lf	-	-
New Pipeline (Developed Area)	12-inch diameter	BCIP-PD-12	-	lf	-	-
New Pipeline (Developed Area)	14-inch diameter	BCIP-PD-14	-	lf	-	-
New Pipeline (Developed Area)	16-inch diameter	BCIP-PD-16	2,499	lf	837,072	1,172,000
New Pipeline (Developed Area)	18-inch diameter	BCIP-PD-18	-	lf	-	-
New Pipeline (Developed Area)	20-inch diameter	BCIP-PD-20	-	lf	-	-
New Pipeline (Developed Area)	24-inch diameter	BCIP-PD-24	21,852	lf	10,161,175	14,226,000
New Pipeline (Developed Area)	30-inch diameter	BCIP-PD-30	-	lf	-	-
New Pipeline (Undeveloped Area)	8-inch diameter	BCIP-PU-8	-	lf	-	-
New Pipeline (Undeveloped Area)	10-inch diameter	BCIP-PU-10	-	lf	-	-
New Pipeline (Undeveloped Area)	12-inch diameter	BCIP-PU-12	19,557	lf	4,302,643	6,024,000
New Pipeline (Undeveloped Area)	14-inch diameter	BCIP-PU-14	-	lf	-	-
New Pipeline (Undeveloped Area)	16-inch diameter	BCIP-PU-16	5,343	lf	1,522,836	2,132,000
New Pipeline (Undeveloped Area)	18-inch diameter	BCIP-PU-18	9,202	lf	2,898,523	4,058,000
New Pipeline (Undeveloped Area)	20-inch diameter	BCIP-PU-20	-	lf	-	-
New Pipeline (Undeveloped Area)	24-inch diameter	BCIP-PU-24	7,219	lf	2,851,449	3,992,000
New Pipeline (Undeveloped Area)	30-inch diameter	BCIP-PU-30	5,882	lf	2,823,234	3,953,000
Jack and Bore	Boring and Receiving Pits	BCIP-JB-PIT	5	each	200,000	280,000
Jack and Bore	8-inch diameter (16-inch casing)	BCIP-JB-8	-	lf	-	-
Jack and Bore	12-inch diameter (21-inch casing)	BCIP-JB-12	-	lf	-	-
Jack and Bore	16-inch diameter (24-inch casing)	BCIP-JB-16	-	lf	-	-
Jack and Bore	18-inch diameter (24-inch casing)	BCIP-JB-18	-	lf	-	-
Jack and Bore	20-inch diameter (30-inch casing)	BCIP-JB-20	-	lf	-	-
Jack and Bore	24-inch diameter (36-inch casing)	BCIP-JB-24	1,234	lf	1,227,805	1,719,000
Jack and Bore	30-inch diameter (42-inch casing)	BCIP-JB-30	359	lf	400,168	560,000
					Total	$ 65,528,000

(a) Costs shown are presented in 2020 dollars.
(b) Estimated construction costs do not yet reflect an adjustment to account for the current economic bidding climate.
(c) Costs include mark-ups equal to 40 percent (General Contingency: 15 percent; Design and Planning: 10 percent; Construction Management: 10 percent; and Program Administration: 5 percent).
(d) Total rounded to nearest $1,000.
(e) Assumes each tank site is 1.5 acres. Cost includes Zone A Tank site.
(f) Recommended volume based on active volume. Cost assumes the Zone A tank will be an aboveground welded steel tank, and the WWTP tank will be a partially buried prestressed concrete tank.

10.4 CAPITAL IMPROVEMENT PROGRAM TIMING AND TRIGGERS

As described in Chapters 7 and 8 for the potable water system and Chapter 9 for the recycled water system, the construction of the capital improvements for the future potable and recycled water systems should be coordinated with the proposed schedules of new development and/or other system needs to ensure that the required infrastructure will be in place to serve future customers when needed.

Triggers for capital improvements vary depending on the improvement type and the location of the specific improvement project. General guidelines are summarized as follows:

- Existing system pipeline improvements are triggered by existing fire flow deficiencies and should be addressed as soon as funding is available.
- Improvements that improve system operational flexibility and reliability should be prioritized. Examples of such improvements include the equipping of the City's existing wells with ammonia addition, the JJWTP expansion and construction of Clearwell #3 at the JJWTP, and implementation of SCADA system improvements and backup power provisions.
- Pipelines which extend potable water service to currently undeveloped areas are generally triggered by development of those areas. Hydraulic evaluations for specific developments should be conducted to confirm that the proposed pipelines to serve each development are adequate.
- The NCIP-PI-1 and NCIP-PI-2 projects are triggered by new development, which is expected to occur by 2025, and should be in service before 2025. Similarly, the infrastructure needed to re-zone the existing transmission mains in Lammers Road, Schulte Road, and Hansen Road from Zone 2 to Zone 3 should be constructed before 2025.
- New valve interconnections between pressure zones are triggered when the pipelines requiring the valve connections are constructed.
- Pump stations and tanks which serve a new pressure zone with no existing facilities, such as Zones 5 and 6 in the potable water system or Zones B through F in the recycled water system, are triggered when development of the new pressure zone begins.
- New pump stations and tanks which serve an existing pressure zone are triggered when total demands within that pressure zone nearly exceeds the capacity of existing facilities. The City should continue to monitor demands within the existing pressure zones and begin design and construction of new facilities in advance of demands exceeding existing capacity.

APPENDIX A

Land Use Assumptions and Projected Water Demands for New Developments

Table A-1. Land Uses with TAZ Estimates provided by City Planning Division

General Plan Planning Area/Common Name	TAZ	Total Acres	Adjusted Total Acres	Overall Density (Units per Gross Acre)	TAZ 2025 SFDU	TAZ 2025 MFDU	TAZ 2025 Retail/Office Acres	TAZ 2025 Ind Acres	TAZ 2025 Institutional Acres	TAZ 2025 Sr Assist Liv Acres	TAZ 2040 SFDU	TAZ 2040 MFDU	TAZ 2040 Retail/Office Acres	TAZ 2040 Ind Acres	TAZ 2040 Institutional Acres	Taz 2040 Sr Assist Liv Acres	TAZ 2040 to Buildout SFDU	TAZ 2040 to Buildout MFDU	TAZ Buildout Retail/Office Acres	TAZ Buildout Ind Acres	TAZ Buildout Institutional Acres	TAZ Buildout Sr. Assist Liv Acres	Very Low Density (1.5 DU per acre typical) acres	Low Density (4.35 DU per acre typical) acres	Medium Density (9 DU per acre typical) acres	High Density SFD (13 DU per acre typical) acres	High Density Multi-Family (24 DU per acre typical) acres	Total Resid SF DU	Total Resid MF DU	Senior /Assisted Living units	Senior /Assisted Living acres	Institutional (Hospital and Medical Office) square footage	Institutional (Hospital and Medical Office) acres	Industrial Acres (0.5 FAR)	Retail/Commercial/Office Acres
UR 5 (Bright) (1)	527	170	108	8.2							546								10					40	38	10	10	546	0		0		0	0	10
	789										100	240																100	240		0		0	0	0
UR 7 (Bright/Castro) (2)	792	112	107	5.7	150						456													40	48			606	0		0		0	0	0
Rocking Horse (3)	788	58	55	4.5	250																			55				250	0		0		0	0	0
Tracy Village (4)	535	135	130	4.6	400						200													130				600	0		0		0	0	0
UR1 (5)	515	780	780	3.8	50	50					200							169	20				380	300	65		25	250	219		0		0	0	20
	517																400											400	0		0		0	0	0
	613										200						260											460	0		0		0	0	0
	616																300											300	0		0		0	0	0
	617												10				200	200										200	200		0		0	0	10
	618				50	50					200	50					300											550	100		0		0	0	0
	659																200											200	0		0		0	0	0
Ellis (6)	529	321	185	4.1	43						132													178	7			175	0		0		0	0	0
	661											60																0	60		0		0	0	0
	662				43						132																	175	0		0		0	0	0
	663				43						132																	175	0		0		0	0	0
	664										176																	176	0		0		0	0	0
Avenues (8)	670	96	96	4.7							350													96				350	0		0		0	0	0
	599										103																	103	0		0		0	0	0
UR10 (9)	660	116	116	N/A																116								0	0		0		0	116	0
Tracy Hills (10)	573	2732	1845	3.3	200						100		7										81	876	342	8		300	0		0		0	0	9
	574																			27								0	0		0		0	27	0
	601																700			85								700	0		0		0	85	0
	682										600																	600	0		0		0	0	0
	683				200						150						100											450	0		0		0	0	0
	684										300																	300	0		0		0	0	0
	685										908						200											1,108	0		0		0	0	0
	686										500						500											1,000	0		0		0	0	0
	687										320																	320	0		0		0	0	0
	688										450																	450	0		0		0	0	0
	689				200						600																	800	0		0		0	0	0
	690				200						100																	300	0		0		0	0	0
	691													196														0	0		0		0	196	0
	692																500											500	0		0		0	0	0
	693				200						185		30															385	0		0		0	0	30
	1044										50																	50	0		0		0	0	0
Gateway (11)	794	535	454			75	8.5					302	34						34						50		17	0	377	1,557	0	688,000	0	0	120
	839									17						69												0	0		86		0	0	0
	840																											0	0		0		0	0	0
	843									12.5						50												0	0		63		0	0	0
	844						8				50		33						34									50	0		0		0	0	75
	845								20						60						50							0	0		0		130	0	0
	847				160						325																	485	0		0		0	0	0
	848				18					5	75					20												93	0		25		0	0	0
UR6 (Cordes Ranch) (12)	829	1730	971	N/A			5						40	150																	0		0	150	171
	830						5						20																		0		0	0	25
	831													50																	0		0	50	0
	832							50					54	50																	0		0	100	54
	833													110																	0		0	110	0
	834							20						20																	0		0	40	0
	835																		57												0		0	0	57

Table A-1. Land Uses with TAZ Estimates provided by City Planning Division																																			
General Plan Planning Area/Common Name	TAZ	Total Acres	Adjusted Total Acres	Overall Density (Units per Gross Acre)	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2040	TAZ 2040	TAZ 2040	TAZ 2040	TAZ 2040	Taz 2040	TAZ 2040 to Buildout	TAZ 2040 to Buildout	TAZ Buildout	TAZ Buildout	TAZ Buildout	TAZ Buildout	Very Low Density (1.5 DU per acre typical)	Low Density (4.35 DU per acre typical)	Medium Density (9 DU per acre typical)	High Density SFD (13 DU per acre typical)	High Density Multi-Family (24 DU per acre typical)	Total Resid SF DU	Total Resid MF DU	Senior /Assisted Living		Institutional (Hospital and Medical Office)		Industrial Acres (0.5 FAR)	Retail/Commercial/ Office Acres
					SFDU	MFDU	Retail/Office Acres	Ind Acres	Institutional Acres	Sr Assist Liv Acres	SFDU	MFDU	Retail/Office Acres	Ind Acres	Institutional Acres	Sr Assist Liv Acres	SFDU	MFDU	Retail/Office Acres	Ind Acres	Institutional Acres	Sr. Assist Liv Acres	acres	acres	acres	acres	acres			units	acres	square footage	acres		
	836																														0		0	0	0
	837													50																	0		0	50	0
	838													74																	0		0	74	0
	840													143																	0		0	143	0
	841							50						143																	0		0	193	0
UR4 (Bright Triangle) (13)	795	190	162	5														816									34	0	816		0		0	0	43
	817																		22									0	0		0		0	0	22
	818																		22									0	0		0		0	0	22
	828																		80									0	0		0		0	0	80
UR3 (Catellus) (14)	819	700	700	0.1																66			40					0	0		0		0	66	40
	820																		40	66								0	0		0		0	66	40
	821																60			66								60	0		0		0	66	0
	822																			67								0	0		0		0	67	0
	823																			67								0	0		0		0	67	0
	824																		45	67								0	0		0		0	67	45
	825																			67								0	0		0		0	67	0
	1039																			69								0	0		0		0	69	0
I-205 Expansion (15)	525	172	172	10.2							257	180	50				257	180							42	50	30	514	360		0		0	0	50
	641										257	180					257	180										514	360		0		0	0	0
West Side Industrial (16)	528	487	485	N/A				120						240																	0		0	360	0
	842													200																	0		0	200	0
	851							45						45																	0		0	90	0
East Side Industrial (17)	510	370	368	N/A										220																	0		0	220	0
	511												5	69																	0		0	69	5
	627													74																	0		0	74	0
Larch Clover (18)	521	442	100	2.7																			250	40	40		12	0	0		0		0	0	0
	530																549											549	0		0		0	0	0
	554																											0	0		0		0	0	0
	638						10												80									0	0		0		0	0	90
	641																											0	0		0		0	0	0
	642																360	288	20									360	288		0		0	0	20
	656																											0	0		0		0	0	0
Chrisman Road (19)	647	116	113	N/A															13	100											0		0	100	13
Rocha (20)	810	91	91	8													296	431						68			23	296	431		0		0	0	0
Berg/Byron remainder (21)	796	56	44	9.3													26								39		5	26	0		0		0	0	0
	1040					72											275	60										275	132		0		0	0	0
	625																50											50	0		0		0	0	0
Berg Road Subdivision (22)	1040	10	10	7.1	71																				10			71	0		0		0	0	0
SWC Valpico and Corral Hollow (23)	671	65	65	4.3													282							65				282	0		0		0	0	0
Kagehiro (24)	534	47	10	5	62																			10				62	0		0		0	0	0
Dobler/ Maibes (25)	644	23	23	N/A									23																		0		0	0	23
Holly Sugar Industrial	518	160	143	N/A									18	125																	0		0	125	18
Between Holly Sugar and Arbor	636	111	100											50						50											0		0	100	0
Gabriel Estates	653																																		
San Marco	622																																		
	654																																		
Sterling Park	624																																		
Alden Meadows	791																																		
Presidio	623																																		
Placencia Fields/CalTrans	793																	30	1									0	30		0		0	0	1
Belconte	797																																		
Lyon Crossroads	625																																		

General Plan Planning Area/Common Name	TAZ	Total Acres	Adjusted Total Acres	Overall Density (Units per Gross Acre)	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2040	TAZ 2040	TAZ 2040	TAZ 2040	TAZ 2040	Taz 2040	TAZ 2040 to Buildout	TAZ 2040 to Buildout	TAZ Buildout	TAZ Buildout	TAZ Buildout	TAZ Buildout	Very Low Density (1.5 DU per acre typical)	Low Density (4.35 DU per acre typical)	Medium Density (9 DU per acre typical)	High Density SFD (13 DU per acre typical)	High Density Multi-Family (24 DU per acre typical)	Total Resid SF DU	Total Resid MF DU	Senior /Assisted Living		Institutional (Hospital and Medical Office)		Industrial Acres (0.5 FAR)	Retail/Commercial/ Office Acres
					SFDU	MFDU	Retail/Office Acres	Ind Acres	Institutional Acres	Sr Assist Liv Acres	SFDU	MFDU	Retail/Office Acres	Ind Acres	Institutional Acres	Sr Assist Liv Acres	SFDU	MFDU	Retail/Office Acres	Ind Acres	Institutional Acres	Sr. Assist Liv Acres	acres	acres	acres	acres	acres			units	acres	square footage	acres		
Cintra Park	640																																		
Woodfield Estates	1042																																		
SWC Grant Line and Corral Hollow	639						1.06			2.73																					3		0	0	1
Bridle Creek, Laurelbrook	526																																		
Heartland / Chesapeake Bay	798																																		
West HS / Alegre Commons	556																																		
Summergate	555																																		
Arnaudo Village, Rebeiro	657																																		
East of Tracy Blvd, between I-205 & Grant Line (La Quinta)	553						87-room hotel																								0		0	0	0
The Classics, California Espirit, Mobile Home Park	537																																		
Garden Square + Shamrock	699																			4											0		0	4	0
Garden Square+ Brookview	1041																																		
Garden Square	696																																		
Mars Ct, Gandy Dancer area	816							4.8												18											0		0	23	0
Jim Tracey (vacant)	815												29																		0		0	0	29
N. Side Valpico, inc. Tar pit	811																	442											442		0		0	0	0
NEI Amazon + Crate & Barrel North bldg.	649													15																	0		0	15	0
US Cold, other Ind.	650																																		
Crate & Barrel South, Amazon Pkng	680													5																	0		0	5	0
OSH, Seagate, United Grocers	635																																		
Various M-1 and M-2, SEC MacArthur and Grant Line	509																																		
Red Maple Village (west half)	814																																		
ISP (So. Side Valpico, b/t RR spur & Glenbriar)	589																																		
Heinz	694													11						11								0	0		0		0	22	0
Mission Court	612											200						210										0	410		0		0	0	0
Red Maple remainder	813												3					78										0	78		0		0	0	3
Sycamore Village (apts +SFDs)	652																																		
LDR	610																																		
Corral Hollow Estates (county)	603																																		
old residential	541																																		
old residential (Clover+more)	538																																		
South side GL, west of MA (GHC + res)	540																																		
LDR, Dr. Powers Park	557																																		
Old Res., Millenium	544																																		
Old Res, Lincoln Park-mostly built but includes NEC 11th & Central	545											12																0	12		0		0	0	0
S. Side old downtown, MDR, LDR, PUD	567																	20										0	20		0		0	0	0
Edgewood	597																																		
Edgewood	785																																		
Edgewood-res plus commercial site	784						2.4						8.5																		0		0	0	11
Edgewood, Brookview West	786																																		
Edgewood	787																																		
Edgewood	598																																		
Fairhaven, Victoria Greens, Harvest Glen, Glen Creek	596																																		
Murifield 8 & 9	607																																		
Murifield	608																																		
Parkside Estates, California Parkside, California Marquis	609																																		

General Plan Planning Area/Common Name	TAZ	Total Acres	Adjusted Total Acres	Overall Density (Units per Gross Acre)	TAZ 2025 SFDU	TAZ 2025 MFDU	TAZ 2025 Retail/Office Acres	TAZ 2025 Ind Acres	TAZ 2025 Institutional Acres	TAZ 2025 Sr Assist Liv Acres	TAZ 2040 SFDU	TAZ 2040 MFDU	TAZ 2040 Retail/Office Acres	TAZ 2040 Ind Acres	TAZ 2040 Institutional Acres	Taz 2040 Sr Assist Liv Acres	TAZ 2040 to Buildout SFDU	TAZ 2040 to Buildout MFDU	TAZ Buildout Retail/Office Acres	TAZ Buildout Ind Acres	TAZ Buildout Institutional Acres	TAZ Buildout Sr. Assist Liv Acres	Very Low Density (1.5 DU per acre typical) acres	Low Density (4.35 DU per acre typical) acres	Medium Density (9 DU per acre typical) acres	High Density SFD (13 DU per acre typical) acres	High Density Multi-Family (24 DU per acre typical) acres	Total Resid SF DU	Total Resid MF DU	Senior /Assisted Living units	Senior /Assisted Living acres	Institutional (Hospital and Medical Office) square footage	Institutional (Hospital and Medical Office) acres	Industrial Acres (0.5 FAR)	Retail/Commercial/ Office Acres
Glenbriar, Pebblebrook	590																																		
County Residential	591																																		
Tiburon Village, Katerra Apts	812					264																						0			0		0	0	0
Larkspur Estates-14 units remaining	536				14																							14			0		0	0	0
Eastlake	614																																		
Elissagaray Ranch	615																																		
Country Vista (Yosemite Vista)	695																																		
Victoria Park	611																																		
Santana, Centennial	651																																		
Schulte Ranch, Quail Glen, Countrywood, Vintage Estates, Mt Oso	568																	50											50		0		0	0	0
Forest Glen, Mt. Diablo Estates	566																																		
Bowtie East, Quail Run, Pheasant Crossing 2, CA Cameo, CA Collections	565											See TOD/Valley Link Plan						See TOD/Valley Link Plan													0		0	0	0
Bowtie West, Ryland Junction	564											See TOD/Valley Link Plan						See TOD/Valley Link Plan													0		0	0	0
Tennis Vista, RR property	621																			9											0		0	9	0
Tennis Village, Harvest Ridge	620																																		
Westchester Green, Rancho Pacific, Alden Glen, Fox Hollow	560																																		
Harvest Landing, Quail Meadows, Corral Hollow Estates	619																																		
CBD	561																																		
N. side 11th, b/t Parker & Central	550																																		
City Hall, Creamery, downtown	559																																		
S. sidw GL, west of MA, Light Industrial, PUD	542												1.75																		0		0	0	2
Tracy High, GHC, Res	587																																		
West of Downtown	562																																		
GHC, MDC, MDR (N. of 11th, b/t Tracy & Parker)	551																																		
Commercial, MDR (99 cent store, affordable hsg.)	563																																		
LDR, MDR, GHC (N. of 11th, b/t Lincoln & Tracy)	558																																		
LDR (East, Acacia)	543																																		
HDR	549																																		
(Hospital) MDR, MDC, MO	548						5						5															0	0		0		0	0	10
HDR, PUD, GHC, MDR, MDC (E. of Holly, N. of G.L.)	539																	65										0	65		0		0	0	0
LDR, MDR, MDC (El Pescadero Park, S. side Clover)	552					20						20						60										0	100		0		0	0	0
s. side GL, b/t Parker &East	546											22																0	22		0		0	0	0
GHC, HDR, LDR, POM, MDR	547																																		
Highway Service, GHC (Kaiser, Arco)	655						5						5																		0		0	0	10
M-1, PUD, HS (N. of I-205, b/t Tracy & Holly)	637																			2											0		0	2	0
M-2	700																																		
Airport	593																		?	?											0		0	0	0
Redbridge	602																																		
I-205 Specific Plan (N. part of Harvest)	799												1																		0		0	0	1
I-205-Auto Plaza	808												3.7																		0		0	0	4
I-205-Auto Plaza	806																																		
I-205 CC-West Valley Mall+	643												20																		0		0	0	20

Table A-1. Land Uses with TAZ Estimates provided by City Planning Division

Table A-1. Land Uses with TAZ Estimates provided by City Planning Division

General Plan Planning Area/Common Name	TAZ	Total Acres	Adjusted Total Acres	Overall Density (Units per Gross Acre)	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2025	TAZ 2040	TAZ 2040	TAZ 2040	TAZ 2040	TAZ 2040	Taz 2040	TAZ 2040 to Buildout	TAZ 2040 to Buildout	TAZ Buildout	TAZ Buildout	TAZ Buildout	TAZ Buildout	Very Low Density (1.5 DU per acre typical)	Low Density (4.35 DU per acre typical)	Medium Density (9 DU per acre typical)	High Density SFD (13 DU per acre typical)	High Density Multi-Family (24 DU per acre typical)	Total Resid SF DU	Total Resid MF DU	Senior /Assisted Living		Institutional (Hospital and Medical Office)		Industrial Acres (0.5 FAR)	Retail/Commercial/ Office Acres
					SFDU	MFDU	Retail/Office Acres	Ind Acres	Institutional Acres	Sr Assist Liv Acres	SFDU	MFDU	Retail/Office Acres	Ind Acres	Institutional Acres	Sr Assist Liv Acres	SFDU	MFDU	Retail/Office Acres	Ind Acres	Institutional Acres	Sr. Assist Liv Acres	acres	acres	acres	acres	acres			units	acres	square footage	acres		
I-205-Home Depot, Winco	803																																		
I-205-NEC Naglee & GL	809																																		
I-205 Outlets & Surrounding	634						5 acre office +107 room hotel						13																		0		0	0	13
NEI-Yellow freight & IPT 1	632																																		
NEI-Rados Haley	628													52																	0		0	52	0
NEI-Home Depot, Ridgeline +	633							26																							0		0	26	0
NEI-IPT 2, FEMA +	631							75																							0		0	75	0
NEI-Seefried	629							71																							0		0	71	0
NEI Prologis, basin (NWC GL & Paradise)	677							12																							0		0	12	0
NEI-Majestic	648							75																							0		0	75	0
NEI-Barbosa, Animal Shelter, part of PacMed, Katerra	678													20																	0		0	20	0
NEI-Kellogg, part of Katerra	514																																		
NEI-SSI, Best Buy, Prologis (Chabot Ct)	679																																		
Totals		**9825**	**7333**		**2354**	**531**					**8154**	**1266**	**413.95**	**2112**	**60**	**139**	**6072**	**3279**	**478**	**957**	**50**		**751**	**1,898**	**681**	**68**	**156**	**16,580**	**4,812**	**1,557**	**176**	**688,000**	**130**	**3,618**	**1,196**

Does not include units/acreage already built

Does not include schools

Gateway office and industrial is really called "business commercial" in the draft Specific Plan

Cordes Ranch has built 7.7 million square feet of industrial, and about 14-16 million square feet to go

* Tracy Hills MUBP is 50 acres retail, 50 acres office, 80 acres medium density residential

**Pursuant to Ellis DA Ellis receives 2,250 RGAs above the GMO Guidelines Category of F3, which are not yet assigned a location

Larch Clover Planning Ares is largely built out-only assuming 100 acres of land use change (to retail)

Office FAR is assumed at .45, and Retail is .30

Industrial FAR is assumed at .45

Purple=Built Out TAZ

Table A-2. 2025 Time Frame - Land Use Assumptions and Projected Water Demands for New Developments

Project or Development Area	Data Source(s)[a]	Parks Area Assumption[b]	Assumed Recycled Water Availability	Residential – Very Low Density						Residential – Low Density						Residential – Medium Density						
				Dwelling Units	*Total Acres*	Residential Acres	Assumed Park Acres	PW Demand, af/yr[c]	RW Demand, af/yr[d]	Dwelling Units	*Total Acres*	Residential Acres	Assumed Park Acres	PW Demand, af/yr[c]	RW Demand, af/yr[d]	Dwelling Units	*Total Acres*	Residential Acres	Assumed Park Acres	Assumed Other Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]
UR 5 (Bright)	TAZ Spreadsheet	✓	✓																			
UR 7 (Bright/Castro)	TAZ Spreadsheet	✓	✓							150	34.5	30.6	3.9	67.8	16.3							
Rocking Horse	Hydraulic Analysis TM		✓							226	56.7	56.7		102.2								
Tracy Village[f]	Hydraulic Analysis TM		✓							400	64.1	64.1		180.9								
UR 1	TAZ Spreadsheet	✓								50	11.5	10.2	1.3	28.3		50	5.6	4.1	0.6	0.8	21.3	
Ellis[g,h]	Hydraulic Analysis TM		✓							664	150.5	150.5		300.3								
Avenues	Hydraulic Analysis TM		✓																			
UR 10	TAZ Spreadsheet	✓	✓																			
Tracy Hills[i]	Hydraulic Analysis TM, TAZ Spreadsheet	✓								1,073	269.8	269.8		485.3		132	33.2	28.2		5.0	56.4	
Westside Ranch	Westside Draft Specific Plan	✓	✓																			
Cordes Ranch	Hydraulic Analysis TM, TAZ Spreadsheet	✓																				
UR 4 (Bright Triangle)	TAZ Spreadsheet	✓	✓																			
UR 3 (Catellus)	TAZ Spreadsheet	✓	✓																			
I-205 Expansion	TAZ Spreadsheet	✓	✓																			
West Side Industrial	TAZ Spreadsheet	✓																				
East Side Industrial	TAZ Spreadsheet	✓																				
Larch-Clover	TAZ Spreadsheet	✓	✓																			
Chrisman Road	TAZ Spreadsheet	✓																				
Rocha	TAZ Spreadsheet	✓																				
Berg/Byron Remainder	TAZ Spreadsheet	✓																				
Berg Road Subdivision	Hydraulic Analysis TM															71	9.9	8.4		1.5	27.2	
SWC Valpico & Corral Hollow	TAZ Spreadsheet	✓	✓																			
Kagehiro[g,j]	Email from City Planning Division									252	47.0	47.0		114.0								
Dobler/Maibes	TAZ Spreadsheet	✓	✓																			
Holly Sugar Industrial	TAZ Spreadsheet	✓	✓																			
Northeast Industrial Area	Hydraulic Analysis TM																					
Industrial Areas Specific Plan	TAZ Spreadsheet																					
I-205 Corridor Specific Plan	TAZ Spreadsheet																					
Home 2 Suites	Hydraulic Analysis TM																					
Sierra Hills	Hydraulic Analysis TM																					
Grant Line Road Apartments	Hydraulic Analysis TM																					
Aspire II	Hydraulic Analysis TM																					
Harvest	Hydraulic Analysis TM																					
321 E. Grant Line Rd Apartments	Hydraulic Analysis TM																					
Barcelona Infill	Hydraulic Analysis TM									51	10.2	10.2		23.1								
Mountain View	Tracy Municipal Services Review, June 2019																					
Tracy Combined Cycle Power Plant RW Conversion[k]	Hydraulic Analysis TM		✓																			
Legacy Fields[l]	Hydraulic Analysis TM		✓																			
Parks RW Conversion[m]	2017 Irrigation Meters		✓																			
Infill (misc.)	TAZ Spreadsheet									14	3.2	3.2		6.3								
			Total							**2,880**	**647**	**642**	**5**	**1,308**	**16**	**253**	**49**	**41**	**1**	**7**	**105**	

(a) Data Source abbreviations:
TAZ Spreadsheet - data from Land Uses with TAZ Estimates_06_23_2021_2025_2040_BU_Independent.xlsx spreadsheet received from the City Planning Division in June 2021 (Table A-1).
Hydraulic Analysis TM - data from a previously prepared hydraulic analysis technical memorandum prepared by either West Yost Associates or Blackwater Consulting Engineers, Inc.

(b) For selected projects and development areas, it was assumed that 11.2% of the total acres in very low, low, and medium density residential land uses will be developed as parks. These park acres are in addition to the identified parks in the Rocking Horse, Ellis, Avenues, Tracy Hills Phase 1, and Legacy Fields developments. If available, recycled water was used to meet park demands.

(c) Includes 9.6% Unaccounted-for Water (UAFW).

(d) Includes 5.0% UAFW.

(e) Assumes that 15 percent of total gross acres will be landscaped and irrigated. If available, recycled water was used to meet irrigated area demands.

(f) Miscellaneous potable water demands for Tracy Village are from existing residential units to be annexed as part of the Project. Miscellaneous recycled water demand for Tracy Village is to fill the lakes which will be constructed as part of the project.

(g) Projected land use data includes dwelling units and acreage developed by 2017.

(h) Land use data for Ellis includes dwelling units constructed by 2017. Miscellaneous potable water demand for Ellis represents projected demands for the Aquatic Center minus 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.

(i) Land use data from hydraulic analysis TMs was used for Tracy Hills Phase 1. The parks acreage assumption was not applied to Tracy Hills Phase 1 because the available land use data specifically identified parks. The parks acreage assumption was applied to the remaining phases of Tracy Hills, which used land use data from the TAZ spreadsheet.

(j) Land use data for Kagehiro includes dwelling units constructed by 2017. Miscellaneous potable water demand for Kagehiro represents 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.

(k) Demands for the Tracy Combined Cycle Power Plant Recycled Water Conversion are from City of Tracy Recycled Water Project - Projected Recycled Water Demands TM, West Yost Associates, October 11, 2016.

(l) It was assumed that 50 percent of the remaining Legacy Fields acreage (from City of Tracy Parks Master Plan, Table A-1, April 2013) will be developed by 2025. Projected near term demands for Legacy Fields are equal to 50 percent of projected Legacy Fields demands for the 2040 and buildout time frames.

(m) Represents the transfer of 2017 metered potable demands for selected existing parks and irrigated areas to recycled water demands. Projected recycled water demands for these areas are larger than existing potable water demands due to current potable water conservation practices. Refer to Chapter 9 for a full list of irrigated areas projected to be converted to recycled water use.

Table A-2. 2025 Time Frame - Land Use Assumptions and Projected Water Demands for New Developments

Project or Development Area	Residential – High Density						Residential – Very High Density						Commercial					Office				
	Dwelling Units	*Total Acres*	Residential Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	Dwelling Units	*Total Acres*	Residential Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	*Total Acres*	Commercial Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	*Total Acres*	Office Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]
UR 5 (Bright)																						
UR 7 (Bright/Castro)																						
Rocking Horse																						
Tracy Village[f]													2.7	2.3	0.4	4.5	1.7					
UR 1	100	7.7	6.5	1.2	26.2																	
Ellis[g,h]																						
Avenues																						
UR 10																						
Tracy Hills[i]																						
Westside Ranch																						
Cordes Ranch													10.0	8.5	1.5	20.1						
UR 4 (Bright Triangle)																						
UR 3 (Catellus)																						
I-205 Expansion																						
West Side Industrial																						
East Side Industrial																						
Larch-Clover													10.0	8.5	1.5	16.9	6.3					
Chrisman Road																						
Rocha																						
Berg/Byron Remainder	72	5.0	4.3	0.8	18.7																	
Berg Road Subdivision																						
SWC Valpico & Corral Hollow																						
Kagehiro[g,j]																						
Dobler/Maibes																						
Holly Sugar Industrial																						
Northeast Industrial Area																						
Industrial Areas Specific Plan																						
I-205 Corridor Specific Plan																						
Home 2 Suites							110	2.6	2.2	0.4	18.5							0.6	0.5	0.1	1.1	
Sierra Hills	300	11.6	9.9	1.7	74.1																	
Grant Line Road Apartments	448	20.0	17.0	3.0	111.8																	
Aspire II	47	2.3	2.0	0.3	11.8																	
Harvest	300	17.9	15.2	2.7	76.6																	
321 E. Grant Line Rd Apartments	40	1.7	1.4	0.3	9.9																	
Barcelona Infill																						
Mountain View																						
Tracy Combined Cycle Power Plant RW Conversion[k]																						
Legacy Fields[l]																						
Parks RW Conversion[m]																						
Infill (misc.)	284	15.1	12.9	2.3	71.8								22.5	19.1	3.4	45.1						
Total	**1,591**	**81**	**69**	**12**	**401**		**110**	**3**	**2**	**0**	**18**		**45**	**38**	**7**	**87**	**8**	**1**	**1**	**0**	**1**	

(a) Data Source abbreviations:
TAZ Spreadsheet - data from Land Uses with TAZ Estimates_06_23_2021_2025_2040_BU_Independent.xlsx spreadsheet received from the City Planning Division in June 2021 (Table A-1).
Hydraulic Analysis TM - data from a previously prepared hydraulic analysis technical memorandum prepared by either West Yost Associates or Blackwater Consulting Engineers, Inc.

(b) For selected projects and development areas, it was assumed that 11.2% of the total acres in very low, low, and medium density residential land uses will be developed as parks. These park acres are in addition to the identified parks in the Rocking Horse, Ellis, Avenues, Tracy Hills Phase 1, and Legacy Fields developments. If available, recycled water was used to meet park demands.

(c) Includes 9.6% Unaccounted-for Water (UAFW).

(d) Includes 5.0% UAFW.

(e) Assumes that 15 percent of total gross acres will be landscaped and irrigated. If available, recycled water was used to meet irrigated area demands.

(f) Miscellaneous potable water demands for Tracy Village are from existing residential units to be annexed as part of the Project. Miscellaneous recycled water demand for Tracy Village is to fill the lakes which will be constructed as part of the project.

(g) Projected land use data includes dwelling units and acreage developed by 2017.

(h) Land use data for Ellis includes dwelling units constructed by 2017. Miscellaneous potable water demand for Ellis represents projected demands for the Aquatic Center minus 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.

(i) Land use data from hydraulic analysis TMs was used for Tracy Hills Phase 1. The parks acreage assumption was not applied to Tracy Hills Phase 1 because the available land use data specifically identified parks. The parks acreage assumption was applied to the remaining phases of Tracy Hills, which used land use data from the TAZ spreadsheet.

(j) Land use data for Kagehiro includes dwelling units constructed by 2017. Miscellaneous potable water demand for Kagehiro represents 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.

(k) Demands for the Tracy Combined Cycle Power Plant Recycled Water Conversion are from City of Tracy Recycled Water Project - Projected Recycled Water Demands TM, West Yost Associates, October 11, 2016.

(l) It was assumed that 50 percent of the remaining Legacy Fields acreage (from City of Tracy Parks Master Plan, Table A-1, April 2013) will be developed by 2025. Projected near term demands for Legacy Fields are equal to 50 percent of projected Legacy Fields demands for the 2040 and buildout time frames.

(m) Represents the transfer of 2017 metered potable demands for selected existing parks and irrigated areas to recycled water demands. Projected recycled water demands for these areas are larger than existing potable water demands due to current potable water conservation practices. Refer to Chapter 9 for a full list of irrigated areas projected to be converted to recycled water use.

Table A-2. 2025 Time Frame - Land Use Assumptions and Projected Water Demands for New Developments

Project or Development Area	Industrial					Institutional					Identified Parks			Misc. Water Demands		Total Dwelling Units	Total Area, acres	Total Potable Water Demand, af/yr	Total Recycled Water Demand, af/yr
	Total Acres	Industrial Acres	Assumed Irrigated Acres[(e)]	PW Demand, af/yr[(c)]	RW Demand, af/yr[(d)]	*Total Acres*	Institutional Acres	Assumed Irrigated Acres[(e)]	PW Demand, af/yr[(c)]	RW Demand, af/yr[(d)]	*Total Acres*	PW Demand, af/yr[(c)]	RW Demand, af/yr[(d)]	PW Demand, af/yr[(c)]	RW Demand, af/yr[(d)]				
UR 5 (Bright)																			
UR 7 (Bright/Castro)																150	34.5	67.8	16.3
Rocking Horse											2.4		10.1			226	59.1	102.2	10.1
Tracy Village[(f)]														17.7	126.1	400	66.8	203.1	127.8
UR 1																200	24.7	75.9	
Ellis[(g,h)]											11.2		47.2	-29		664	161.7	270.9	47.2
Avenues																			
UR 10																			
Tracy Hills[(i)]											11.4	50.4				1,205	314.3	592.1	
Westside Ranch																			
Cordes Ranch	429.7	365.2	64.5	660.7													439.7	680.8	
UR 4 (Bright Triangle)																			
UR 3 (Catellus)																			
I-205 Expansion																			
West Side Industrial	165.0	140.3	24.8	253.7													165.0	253.7	
East Side Industrial																			
Larch-Clover																	10.0	16.9	6.3
Chrisman Road																			
Rocha																			
Berg/Byron Remainder																72	5.0	18.7	
Berg Road Subdivision																71	9.9	27.2	
SWC Valpico & Corral Hollow																			
Kagehiro[(g,j)]														-24		252	47.0	89.8	
Dobler/Maibes																			
Holly Sugar Industrial																			
Northeast Industrial Area	259.0	220.2	38.9	398.2													259.0	398.2	
Industrial Areas Specific Plan	4.8	4.1	0.7	7.4													4.8	7.4	
I-205 Corridor Specific Plan																			
Home 2 Suites																110	3.2	19.6	
Sierra Hills																300	11.6	74.1	
Grant Line Road Apartments																448	20.0	111.8	
Aspire II																47	2.3	11.8	
Harvest																300	17.9	76.6	
321 E. Grant Line Rd Apartments																40	1.7	9.9	
Barcelona Infill																51	10.2	23.1	
Mountain View																			
Tracy Combined Cycle Power Plant RW Conversion[(k)]															33.7				33.7
Legacy Fields[(l)]											114.3	26.2	198.9				114.3	26.2	198.9
Parks RW Conversion[(m)]														-318	458.1			-318	458.1
Infill (misc.)						2.7	2.3	0.4	4.7							298	43.6	128.0	
Total	**859**	**730**	**129**	**1,320**		**3**	**2**	**0**	**5**		**139**	**77**	**256**	**-354**	**618**	**4,834**	**1,826**	**2,968**	**898**

(a) Data Source abbreviations:
TAZ Spreadsheet - data from Land Uses with TAZ Estimates_06_23_2021_2025_2040_BU_Independent.xlsx spreadsheet received from the City Planning Division in June 2021 (Table A-1).
Hydraulic Analysis TM - data from a previously prepared hydraulic analysis technical memorandum prepared by either West Yost Associates or Blackwater Consulting Engineers, Inc.

(b) For selected projects and development areas, it was assumed that 11.2% of the total acres in very low, low, and medium density residential land uses will be developed as parks. These park acres are in addition to the identified parks in the Rocking Horse, Ellis, Avenues, Tracy Hills Phase 1, and Legacy Fields developments. If available, recycled water was used to meet park demands.

(c) Includes 9.6% Unaccounted-for Water (UAFW).

(d) Includes 5.0% UAFW.

(e) Assumes that 15 percent of total gross acres will be landscaped and irrigated. If available, recycled water was used to meet irrigated area demands.

(f) Miscellaneous potable water demands for Tracy Village are from existing residential units to be annexed as part of the Project. Miscellaneous recycled water demand for Tracy Village is to fill the lakes which will be constructed as part of the project.

(g) Projected land use data includes dwelling units and acreage developed by 2017.

(h) Land use data for Ellis includes dwelling units constructed by 2017. Miscellaneous potable water demand for Ellis represents projected demands for the Aquatic Center minus 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.

(i) Land use data from hydraulic analysis TMs was used for Tracy Hills Phase 1. The parks acreage assumption was not applied to Tracy Hills Phase 1 because the available land use data specifically identified parks. The parks acreage assumption was applied to the remaining phases of Tracy Hills, which used land use data from the TAZ spreadsheet.

(j) Land use data for Kagehiro includes dwelling units constructed by 2017. Miscellaneous potable water demand for Kagehiro represents 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.

(k) Demands for the Tracy Combined Cycle Power Plant Recycled Water Conversion are from City of Tracy Recycled Water Project - Projected Recycled Water Demands TM, West Yost Associates, October 11, 2016.

(l) It was assumed that 50 percent of the remaining Legacy Fields acreage (from City of Tracy Parks Master Plan, Table A-1, April 2013) will be developed by 2025. Projected near term demands for Legacy Fields are equal to 50 percent of projected Legacy Fields demands for the 2040 and buildout time frames.

(m) Represents the transfer of 2017 metered potable demands for selected existing parks and irrigated areas to recycled water demands. Projected recycled water demands for these areas are larger than existing potable water demands due to current potable water conservation practices. Refer to Chapter 9 for a full list of irrigated areas projected to be converted to recycled water use.

Table A-3. 2040 Time Frame - Land Use Assumptions and Projected Water Demands for New Developments

				Residential – Very Low Density						Residential – Low Density						Residential – Medium Density						
Project or Development Area	Data Source(s)[a]	Parks Area Assumption[b]	Assumed Recycled Water Availability	Dwelling Units	*Total Acres*	Residential Acres	Assumed Park Acres	PW Demand, af/yr[c]	RW Demand, af/yr[d]	Dwelling Units	*Total Acres*	Residential Acres	Assumed Park Acres	PW Demand, af/yr[c]	RW Demand, af/yr[d]	Dwelling Units	*Total Acres*	Residential Acres	Assumed Park Acres	Assumed Other Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]
UR 5 (Bright)	TAZ Spreadsheet	✓	✓							174	40.0	35.5	4.5	78.7	18.9	342	38.1	28.1	4.3	5.7	111.9	42.0
UR 7 (Bright/Castro)	TAZ Spreadsheet	✓	✓							174	40.0	35.5	4.5	78.7	18.9	432	48.0	35.4	5.4	7.2	141.3	53.0
Rocking Horse	Hydraulic Analysis TM		✓							226	56.7	56.7		102.2								
Tracy Village[f]	Hydraulic Analysis TM		✓							600	96.2	96.2		271.4								
UR 1	TAZ Spreadsheet	✓								450	103.4	91.9	11.6	254.8		250	27.8	20.5	3.1	4.2	106.6	
Ellis[g,h]	Hydraulic Analysis TM		✓							958	213.5	213.5		433.3								
Avenues	Hydraulic Analysis TM		✓							480	90.4	90.4		217.1								
UR 10	TAZ Spreadsheet	✓	✓																			
Tracy Hills[i]	Hydraulic Analysis TM, TAZ Spreadsheet	✓	✓	100	66.7	59.2	7.5	53.2	31.4	3,111	737.1	695.7	41.4	1,407.0	174.3	1,841	232.4	180.3	17.2	34.9	602.2	219.3
Westside Ranch	Westside Draft Specific Plan	✓	✓													2,130	210.0	155.0	23.5	31.5	696.8	231.7
Cordes Ranch[j]	Hydraulic Analysis TM, TAZ Spreadsheet	✓	✓																			
UR 4 (Bright Triangle)	TAZ Spreadsheet	✓	✓																			
UR 3 (Catellus)	TAZ Spreadsheet	✓	✓																			
I-205 Expansion	TAZ Spreadsheet	✓	✓													378	42.0	31.0	4.7	6.3	123.7	46.3
West Side Industrial	TAZ Spreadsheet	✓	✓																			
East Side Industrial	TAZ Spreadsheet	✓																				
Larch-Clover	TAZ Spreadsheet	✓	✓																			
Chrisman Road	TAZ Spreadsheet	✓																				
Rocha	TAZ Spreadsheet	✓																				
Berg/Byron Remainder	TAZ Spreadsheet	✓																				
Berg Road Subdivision	Hydraulic Analysis TM															71	9.9	8.4		1.5	27.2	
SWC Valpico & Corral Hollow	TAZ Spreadsheet	✓	✓																			
Kagehiro[g,k]	Email from City Planning Division									252	47.0	47.0		114.0								
Dobler/Maibes	TAZ Spreadsheet	✓	✓																			
Holly Sugar Industrial	TAZ Spreadsheet	✓	✓																			
Northeast Industrial Area	Hydraulic Analysis TM																					
Industrial Areas Specific Plan	TAZ Spreadsheet																					
I-205 Corridor Specific Plan	TAZ Spreadsheet																					
Home 2 Suites	Hydraulic Analysis TM																					
Sierra Hills	Hydraulic Analysis TM																					
Grant Line Road Apartments	Hydraulic Analysis TM																					
Aspire II	Hydraulic Analysis TM																					
Harvest	Hydraulic Analysis TM																					
321 E. Grant Line Rd Apartments	Hydraulic Analysis TM																					
Barcelona Infill	Hydraulic Analysis TM									51	10.2	10.2		23.1								
Mountain View	Tracy Municipal Services Review, June 2019			165	156.0	156.0		87.7														
Tracy Combined Cycle Power Plant RW Conversion[l]	Hydraulic Analysis TM		✓																			
Legacy Fields[m]	Hydraulic Analysis TM		✓																			
Parks RW Conversion[n]	2017 Irrigation Meters		✓																			
Infill (misc.)	TAZ Spreadsheet									14	3.2	3.2		6.3								
			Total	**265**	**223**	**215**	**7**	**141**	**31**	**6,490**	**1,438**	**1,376**	**62**	**2,987**	**212**	**5,444**	**608**	**459**	**58**	**91**	**1,810**	**592**

(a) Data Source abbreviations:
TAZ Spreadsheet - data from Land Uses with TAZ Estimates_06_23_2021_2025_2040_BU_Independent.xlsx spreadsheet received from the City Planning Division in June 2021 (Table A-1).
Hydraulic Analysis TM - data from a previously prepared hydraulic analysis technical memorandum prepared by either West Yost Associates or Blackwater Consulting Engineers, Inc.

(b) For selected projects and development areas, it was assumed that 11.2% of the total acres in very low, low, and medium density residential land uses will be developed as parks. These park acres are in addition to the identified parks in the Rocking Horse, Ellis, Avenues, Tracy Hills Phase 1, and Legacy Fields developments. If available, recycled water was used to meet park demands.

(c) Includes 9.6% Unaccounted-for Water (UAFW).

(d) Includes 5.0% UAFW.

(e) Assumes that 15 percent of total gross acres will be landscaped and irrigated. If available, recycled water was used to meet irrigated area demands.

(f) Miscellaneous potable water demands for Tracy Village are from existing residential units to be annexed as part of the Project. Miscellaneous recycled water demand for Tracy Village is to fill the lakes which will be constructed as part of the project.

(g) Projected land use data includes dwelling units and acreage developed by 2017.

(h) Land use data for Ellis includes dwelling units constructed by 2017. Miscellaneous potable water demand for Ellis represents projected demands for the Aquatic Center minus 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.

(i) Land use data from hydraulic analysis TMs was used for Tracy Hills Phase 1. The parks acreage assumption was not applied to Tracy Hills Phase 1 because the available land use data specifically identified parks. The parks acreage assumption was applied to the remaining phases of Tracy Hills, which used land use data from the TAZ spreadsheet.

(j) Miscellaneous water use for Cordes Ranch represents the transfer of 2017 metered potable irrigation demands to recycled water demands once recycled water service is extended to Cordes Ranch.

(k) Land use data for Kagehiro includes dwelling units constructed by 2017. Miscellaneous potable water demand for Kagehiro represents 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.

(l) Demands for the Tracy Combined Cycle Power Plant Recycled Water Conversion are from City of Tracy Recycled Water Project - Projected Recycled Water Demands TM, West Yost Associates, October 11, 2016.

(m) Remaining Legacy Fields acreage to be developed is from the City of Tracy Parks Master Plan, Table A-1, April 2013. Projected demands for Legacy Fields are equal to total demands projected in the Water Supply Assessment for the Holly Sugar Sports Park (West Yost Associates, June 2009) minus the existing recycled water demand for Legacy Fields.

(n) Represents the transfer of 2017 metered potable demands for selected existing parks and irrigated areas to recycled water demands. Projected recycled water demands for these areas are larger than existing potable water demands due to current potable water conservation practices. Refer to Chapter 9 for a full list of irrigated areas projected to be converted to recycled water use.

Table A-3. 2040 Time Frame - Land Use Assumptions and Projected Water Demands for New Developments

Project or Development Area	Residential – High Density						Residential – Very High Density						Commercial					Office				
	Dwelling Units	*Total Acres*	Residential Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	Dwelling Units	*Total Acres*	Residential Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	*Total Acres*	Commercial Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	*Total Acres*	Office Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]
UR 5 (Bright)	370	20.0	17.0	3.0	85.7	12.6																
UR 7 (Bright/Castro)																						
Rocking Horse																						
Tracy Village[f]													4.0	3.4	0.6	6.8	2.5					
UR 1	150	11.5	9.8	1.7	39.4								10.0	8.5	1.5	20.1						
Ellis[g,h]													14.8	12.6	2.2	25.0	9.3					
Avenues																						
UR 10																						
Tracy Hills[i]	125	7.0	6.0	1.1	29.0	4.4							40.6	34.5	6.1	68.7	25.6	45.5	38.7	6.8	64.2	28.7
Westside Ranch	414	26.0	22.1	3.9	95.9	16.4							149.0	126.7	22.4	252.2	94.1					
Cordes Ranch[j]													55.0	46.8	8.3	93.1	34.7	69.0	58.7	10.4	97.3	43.6
UR 4 (Bright Triangle)																						
UR 3 (Catellus)																						
I-205 Expansion	496	29.0	24.6	4.3	114.9	18.3							50.0	42.5	7.5	84.6	31.6					
West Side Industrial																						
East Side Industrial													5.0	4.3	0.8	10.0						
Larch-Clover													10.0	8.5	1.5	16.9	6.3					
Chrisman Road																						
Rocha																						
Berg/Byron Remainder	72	5.0	4.3	0.8	18.7																	
Berg Road Subdivision																						
SWC Valpico & Corral Hollow																						
Kagehiro[g,k]																						
Dobler/Maibes													23.0	19.6	3.5	38.9	14.5					
Holly Sugar Industrial													18.0	15.3	2.7	30.5	11.4					
Northeast Industrial Area																						
Industrial Areas Specific Plan													32.0	27.2	4.8	64.2						
I-205 Corridor Specific Plan													37.7	32.0	5.7	75.7						
Home 2 Suites							110	2.6	2.2	0.4	18.5							0.6	0.5	0.1	1.1	
Sierra Hills	300	11.6	9.9	1.7	74.1																	
Grant Line Road Apartments	448	20.0	17.0	3.0	111.8																	
Aspire II	47	2.3	2.0	0.3	11.8																	
Harvest	300	17.9	15.2	2.7	76.6																	
321 E. Grant Line Rd Apartments	40	1.7	1.4	0.3	9.9																	
Barcelona Infill																						
Mountain View																						
Tracy Combined Cycle Power Plant RW Conversion[l]																						
Legacy Fields[m]																						
Parks RW Conversion[n]																						
Infill (misc.)	538	28.7	24.4	4.3	136.1								99.4	84.5	14.9	199.6						
Total	**3,300**	**181**	**154**	**27**	**804**	**52**	**110**	**3**	**2**	**0**	**18**		**549**	**466**	**82**	**986**	**230**	**115**	**98**	**17**	**163**	**72**

(a) Data Source abbreviations:
TAZ Spreadsheet - data from Land Uses with TAZ Estimates_06_23_2021_2025_2040_BU_Independent.xlsx spreadsheet received from the City Planning Division in June 2021 (Table A-1).
Hydraulic Analysis TM - data from a previously prepared hydraulic analysis technical memorandum prepared by either West Yost Associates or Blackwater Consulting Engineers, Inc.

(b) For selected projects and development areas, it was assumed that 11.2% of the total acres in very low, low, and medium density residential land uses will be developed as parks. These park acres are in addition to the identified parks in the Rocking Horse, Ellis, Avenues, Tracy Hills Phase 1, and Legacy Fields developments. If available, recycled water was used to meet park demands.
(c) Includes 9.6% Unaccounted-for Water (UAFW).
(d) Includes 5.0% UAFW.
(e) Assumes that 15 percent of total gross acres will be landscaped and irrigated. If available, recycled water was used to meet irrigated area demands.
(f) Miscellaneous potable water demands for Tracy Village are from existing residential units to be annexed as part of the Project. Miscellaneous recycled water demand for Tracy Village is to fill the lakes which will be constructed as part of the project.
(g) Projected land use data includes dwelling units and acreage developed by 2017.
(h) Land use data for Ellis includes dwelling units constructed by 2017. Miscellaneous potable water demand for Ellis represents projected demands for the Aquatic Center minus 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.
(i) Land use data from hydraulic analysis TMs was used for Tracy Hills Phase 1. The parks acreage assumption was not applied to Tracy Hills Phase 1 because the available land use data specifically identified parks. The parks acreage assumption was applied to the remaining phases of Tracy Hills, which used land use data from the TAZ spreadsheet.
(j) Miscellaneous water use for Cordes Ranch represents the transfer of 2017 metered potable irrigation demands to recycled water demands once recycled water service is extended to Cordes Ranch.
(k) Land use data for Kagehiro includes dwelling units constructed by 2017. Miscellaneous potable water demand for Kagehiro represents 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.
(l) Demands for the Tracy Combined Cycle Power Plant Recycled Water Conversion are from City of Tracy Recycled Water Project - Projected Recycled Water Demands TM, West Yost Associates, October 11, 2016.
(m) Remaining Legacy Fields acreage to be developed is from the City of Tracy Parks Master Plan, Table A-1, April 2013. Projected demands for Legacy Fields are equal to total demands projected in the Water Supply Assessment for the Holly Sugar Sports Park (West Yost Associates, June 2009) minus the existing recycled water demand for Legacy Fields.
(n) Represents the transfer of 2017 metered potable demands for selected existing parks and irrigated areas to recycled water demands. Projected recycled water demands for these areas are larger than existing potable water demands due to current potable water conservation practices. Refer to Chapter 9 for a full list of irrigated areas projected to be converted to recycled water use.

Table A-3. 2040 Time Frame - Land Use Assumptions and Projected Water Demands for New Developments

Project or Development Area	Industrial					Institutional					Identified Parks			Misc. Water Demands		Total Dwelling Units	Total Area, acres	Total Potable Water Demand, af/yr	Total Recycled Water Demand, af/yr
	Total Acres	Industrial Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	*Total Acres*	Institutional Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	*Total Acres*	PW Demand, af/yr[c]	RW Demand, af/yr[d]	PW Demand, af/yr[c]	RW Demand, af/yr[d]				
UR 5 (Bright)																886	98.1	276.3	73.5
UR 7 (Bright/Castro)																606	88.0	220.0	71.8
Rocking Horse											2.4		10.1			226	59.1	102.2	10.1
Tracy Village[f]														17.7	156.0	600	100.2	295.8	158.5
UR 1																850	152.8	420.8	
Ellis[g,h]	28.8	24.5	4.3	35.2	18.2	16.0	13.6	2.4	22.6	10.1	16.7		70.3	-29		958	289.8	486.7	108.0
Avenues											4.6		19.4			480	95.0	217.1	19.4
UR 10																			
Tracy Hills[i]	196.0	166.6	29.4	239.6	123.8	18.6	15.8	2.8	26.2	11.7	27.9		117.5			5,177	1,371.7	2,490.1	736.9
Westside Ranch						150.0	127.5	22.5	211.6	94.7						2,544	535.0	1,256.4	436.9
Cordes Ranch[j]	1,219.7	1,036.7	183.0	1,490.9	770.3									-84	83.8		1,343.7	1,597.5	932.5
UR 4 (Bright Triangle)																			
UR 3 (Catellus)																			
I-205 Expansion																874	121.0	323.2	96.2
West Side Industrial	650.0	552.5	97.5	794.5	410.5												650.0	794.5	410.5
East Side Industrial	363.0	308.6	54.5	558.2													368.0	568.2	
Larch-Clover																	10.0	16.9	6.3
Chrisman Road																			
Rocha																			
Berg/Byron Remainder																72	5.0	18.7	
Berg Road Subdivision																71	9.9	27.2	
SWC Valpico & Corral Hollow																			
Kagehiro[g,k]														-24		252	47.0	89.8	
Dobler/Maibes																	23.0	38.9	14.5
Holly Sugar Industrial	125.0	106.3	18.8	152.8	78.9												143.0	183.3	90.3
Northeast Industrial Area	468.0	397.8	70.2	719.6													468.0	719.6	
Industrial Areas Specific Plan	4.8	4.1	0.7	7.4													36.8	71.6	
I-205 Corridor Specific Plan																	37.7	75.7	
Home 2 Suites																110	3.2	19.6	
Sierra Hills																300	11.6	74.1	
Grant Line Road Apartments																448	20.0	111.8	
Aspire II																47	2.3	11.8	
Harvest																300	17.9	76.6	
321 E. Grant Line Rd Apartments																40	1.7	9.9	
Barcelona Infill																51	10.2	23.1	
Mountain View																165	156.0	87.7	
Tracy Combined Cycle Power Plant RW Conversion[l]															33.7				33.7
Legacy Fields[m]											228.5	52.3	397.9				228.5	52.3	397.9
Parks RW Conversion[n]														-318	458.1			-318	458.1
Infill (misc.)	81.0	68.9	12.2	124.5		2.7	2.3	0.4	4.7							552	215.1	471.3	
Total	**3,136**	**2,666**	**470**	**4,123**	**1,402**	**187**	**159**	**28**	**265**	**117**	**280**	**52**	**615**	**-438**	**732**	**15,609**	**6,719**	**10,911**	**4,055**

(a) Data Source abbreviations:
TAZ Spreadsheet - data from Land Uses with TAZ Estimates_06_23_2021_2025_2040_BU_Independent.xlsx spreadsheet received from the City Planning Division in June 2021 (Table A-1).
Hydraulic Analysis TM - data from a previously prepared hydraulic analysis technical memorandum prepared by either West Yost Associates or Blackwater Consulting Engineers, Inc.

(b) For selected projects and development areas, it was assumed that 11.2% of the total acres in very low, low, and medium density residential land uses will be developed as parks. These park acres are in addition to the identified parks in the Rocking Horse, Ellis, Avenues, Tracy Hills Phase 1, and Legacy Fields developments. If available, recycled water was used to meet park demands.
(c) Includes 9.6% Unaccounted-for Water (UAFW).
(d) Includes 5.0% UAFW.
(e) Assumes that 15 percent of total gross acres will be landscaped and irrigated. If available, recycled water was used to meet irrigated area demands.
(f) Miscellaneous potable water demands for Tracy Village are from existing residential units to be annexed as part of the Project. Miscellaneous recycled water demand for Tracy Village is to fill the lakes which will be constructed as part of the project.
(g) Projected land use data includes dwelling units and acreage developed by 2017.
(h) Land use data for Ellis includes dwelling units constructed by 2017. Miscellaneous potable water demand for Ellis represents projected demands for the Aquatic Center minus 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.
(i) Land use data from hydraulic analysis TMs was used for Tracy Hills Phase 1. The parks acreage assumption was not applied to Tracy Hills Phase 1 because the available land use data specifically identified parks. The parks acreage assumption was applied to the remaining phases of Tracy Hills, which used land use data from the TAZ spreadsheet.
(j) Miscellaneous water use for Cordes Ranch represents the transfer of 2017 metered potable irrigation demands to recycled water demands once recycled water service is extended to Cordes Ranch.
(k) Land use data for Kagehiro includes dwelling units constructed by 2017. Miscellaneous potable water demand for Kagehiro represents 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.
(l) Demands for the Tracy Combined Cycle Power Plant Recycled Water Conversion are from City of Tracy Recycled Water Project - Projected Recycled Water Demands TM, West Yost Associates, October 11, 2016.
(m) Remaining Legacy Fields acreage to be developed is from the City of Tracy Parks Master Plan, Table A-1, April 2013. Projected demands for Legacy Fields are equal to total demands projected in the Water Supply Assessment for the Holly Sugar Sports Park (West Yost Associates, June 2009) minus the existing recycled water demand for Legacy Fields.
(n) Represents the transfer of 2017 metered potable demands for selected existing parks and irrigated areas to recycled water demands. Projected recycled water demands for these areas are larger than existing potable water demands due to current potable water conservation practices. Refer to Chapter 9 for a full list of irrigated areas projected to be converted to recycled water use.

Table A-4. Buildout Time Frame - Land Use Assumptions and Projected Water Demands for New Developments

Project or Development Area	Data Source(s)[(a)]	Parks Area Assumption[(b)]	Assumed Recycled Water Availability	Residential – Very Low Density						Residential – Low Density						Residential – Medium Density						
				Dwelling Units	*Total Acres*	Residential Acres	Assumed Park Acres	PW Demand, af/yr[(c)]	RW Demand, af/yr[(d)]	Dwelling Units	*Total Acres*	Residential Acres	Assumed Park Acres	PW Demand, af/yr[(c)]	RW Demand, af/yr[(d)]	Dwelling Units	*Total Acres*	Residential Acres	Assumed Park Acres	Assumed Other Irrigated Acres[(e)]	PW Demand, af/yr[(c)]	RW Demand, af/yr[(d)]
UR 5 (Bright)	TAZ Spreadsheet	✓	✓							174	40.0	35.5	4.5	78.7	18.9	342	38.1	28.1	4.3	5.7	111.9	42.0
UR 7 (Bright/Castro)	TAZ Spreadsheet	✓	✓							174	40.0	35.5	4.5	78.7	18.9	432	48.0	35.4	5.4	7.2	141.3	53.0
Rocking Horse	Hydraulic Analysis TM		✓							226	56.7	56.7		102.2								
Tracy Village[(f)]	Hydraulic Analysis TM		✓							600	96.2	96.2		271.4								
UR 1	TAZ Spreadsheet	✓	✓	570	380.0	337.4	42.6	303.0	179.2	1,255	288.5	256.2	32.3	567.6	136.1	535	59.4	43.9	6.7	8.9	175.0	65.6
Ellis[(g,h)]	Hydraulic Analysis TM		✓							958	213.5	213.5		433.3								
Avenues	Hydraulic Analysis TM		✓							480	90.4	90.4		217.1								
UR 10	TAZ Spreadsheet	✓	✓																			
Tracy Hills[(i)]	Hydraulic Analysis TM, TAZ Spreadsheet	✓	✓	122	81.3	72.2	9.1	64.9	38.4	3,439	812.5	762.7	49.8	1,555.4	209.9	3,491	415.7	315.6	37.8	62.4	1,142.0	421.6
Westside	Westside Draft Specific Plan	✓	✓													2,130	210.0	155.0	23.5	31.5	696.8	231.7
Cordes Ranch[(j)]	Hydraulic Analysis TM, TAZ Spreadsheet	✓	✓																			
UR 4 (Bright Triangle)	TAZ Spreadsheet	✓	✓																			
UR 3 (Sandhu)	TAZ Spreadsheet	✓	✓	60	40.0	35.5	4.5	31.9	18.9													
I-205 Expansion	TAZ Spreadsheet	✓	✓													378	42.0	31.0	4.7	6.3	123.7	46.3
West Side Industrial	TAZ Spreadsheet	✓	✓																			
East Side Industrial	TAZ Spreadsheet	✓	✓																			
Larch-Clover	TAZ Spreadsheet	✓	✓	375	250.0	222.0	28.0	199.3	117.9	174	40.0	35.5	4.5	78.7	18.9	360	40.0	29.5	4.5	6.0	117.8	44.1
Chrisman Road	TAZ Spreadsheet	✓	✓																			
Rocha	TAZ Spreadsheet	✓	✓							296	68.0	60.4	7.6	133.9	32.1							
Berg/Byron Remainder	TAZ Spreadsheet	✓														411	39.0	28.8	4.4	5.9	169.3	
Berg Road Subdivision	Hydraulic Analysis TM															71	9.9	8.4		1.5	27.2	
SWC Valpico & Corral Hollow	TAZ Spreadsheet	✓	✓							282	65.0	57.7	7.3	127.5	30.7							
Kagehiro[(g,k)]	Email from City Planning Division									252	47.0	47.0		114.0								
Dobler/Maibes	TAZ Spreadsheet	✓	✓																			
Holly Sugar Industrial	TAZ Spreadsheet	✓	✓																			
Northeast Industrial Area	Hydraulic Analysis TM																					
Industrial Areas Specific Plan	TAZ Spreadsheet																					
I-205 Corridor Specific Plan	TAZ Spreadsheet																					
Home 2 Suites	Hydraulic Analysis TM																					
Sierra Hills	Hydraulic Analysis TM																					
Grant Line Road Apartments	Hydraulic Analysis TM																					
Aspire II	Hydraulic Analysis TM																					
Harvest	Hydraulic Analysis TM																					
321 E. Grant Line Rd Apartments	Hydraulic Analysis TM																					
Barcelona Infill	Hydraulic Analysis TM									51	10.2	10.2		23.1								
Mountain View	Tracy Municipal Services Review, June 2019			165	156.0	156.0		87.7														
Tracy Combined Cycle Power Plant RW Conversion[(l)]	Hydraulic Analysis TM		✓																			
Legacy Fields[(m)]	Hydraulic Analysis TM		✓																			
Parks RW Conversion[(n)]	2017 Irrigation Meters		✓																			
Infill (misc.)	TAZ Spreadsheet									14	3.2	3.2		6.3								
			Total	**1,292**	**907**	**823**	**84**	**687**	**354**	**8,375**	**1,871**	**1,761**	**110**	**3,788**	**465**	**8,150**	**902**	**676**	**91**	**135**	**2,705**	**904**

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(b) For selected projects and development areas, it was assumed that 11.2% of the total acres in very low, low, and medium density residential land uses will be developed as parks. These park acres are in addition to the identified parks in the Rocking Horse, Ellis, Avenues, Tracy Hills Phase 1, and Legacy Fields developments. If available, recycled water was used to meet park demands.
(c) Includes 9.6% Unaccounted-for Water (UAFW).
(d) Includes 5.0% UAFW.
(e) Assumes that 15 percent of total gross acres will be landscaped and irrigated. If available, recycled water was used to meet irrigated area demands.
(f) Miscellaneous potable water demands for Tracy Village are from existing residential units to be annexed as part of the Project. Miscellaneous recycled water demand for Tracy Village is to fill the lakes which will be constructed as part of the project.
(g) Projected land use data includes dwelling units and acreage developed by 2017.
(h) Land use data for Ellis includes dwelling units constructed by 2017. Miscellaneous potable water demand for Ellis represents projected demands for the Aquatic Center minus 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.
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(j) Miscellaneous water use for Cordes Ranch represents the transfer of 2017 metered potable irrigation demands to recycled water demands once recycled water service is extended to Cordes Ranch.
(k) Land use data for Kagehiro includes dwelling units constructed by 2017. Miscellaneous potable water demand for Kagehiro represents 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.
(l) Demands for the Tracy Combined Cycle Power Plant Recycled Water Conversion are from City of Tracy Recycled Water Project - Projected Recycled Water Demands TM, West Yost Associates, October 11, 2016.
(m) Remaining Legacy Fields acreage to be developed is from the City of Tracy Parks Master Plan, Table A-1, April 2013. Projected demands for Legacy Fields are equal to total demands projected in the Water Supply Assessment for the Holly Sugar Sports Park (West Yost Associates, June 2009) minus the existing recycled water demand for Legacy Fields.
(n) Represents the transfer of 2017 metered potable demands for selected existing parks and irrigated areas to recycled water demands. Projected recycled water demands for these areas are larger than existing potable water demands due to current potable water conservation practices. Refer to Chapter 9 for a full list of irrigated areas projected to be converted to recycled water use.

Table A-4. Buildout Time Frame - Land Use Assumptions and Projected Water Demands for New Developments

Project or Development Area	Residential – High Density						Residential – Very High Density						Commercial					Office				
	Dwelling Units	*Total Acres*	Residential Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	Dwelling Units	*Total Acres*	Residential Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	*Total Acres*	Commercial Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	*Total Acres*	Office Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]
UR 5 (Bright)	370	20.0	17.0	3.0	85.7	12.6							10.0	8.5	1.5	16.9	6.3					
UR 7 (Bright/Castro)																						
Rocking Horse																						
Tracy Village[f]													4.0	3.4	0.6	6.8	2.5					
UR 1	519	39.9	33.9	6.0	120.3	25.2							30.0	25.5	4.5	50.8	18.9					
Ellis[g,h]													14.8	12.6	2.2	25.0	9.3					
Avenues																						
UR 10																						
Tracy Hills[i]	125	7.0	6.0	1.1	29.0	4.4							40.6	34.5	6.1	68.7	25.6	45.5	38.7	6.8	64.2	28.7
Westside	414	26.0	22.1	3.9	95.9	16.4							149.0	126.7	22.4	252.2	94.1					
Cordes Ranch[j]													55.0	46.8	8.3	93.1	34.7	126.0	107.1	18.9	177.7	79.6
UR 4 (Bright Triangle)	816	34.0	28.9	5.1	189.1	21.5							80.0	68.0	12.0	135.4	50.5	44.0	37.4	6.6	62.1	27.8
UR 3 (Sandhu)													45.0	38.3	6.8	76.2	28.4	40.0	34.0	6.0	56.4	25.3
I-205 Expansion	1,370	80.0	68.0	12.0	317.4	50.5							50.0	42.5	7.5	84.6	31.6					
West Side Industrial																						
East Side Industrial													5.0	4.3	0.8	8.5	3.2					
Larch-Clover	288	12.0	10.2	1.8	66.7	7.6							110.0	93.5	16.5	186.2	69.5					
Chrisman Road													13.0	11.1	2.0	22.0	8.2					
Rocha	431	23.0	19.6	3.5	99.9	14.5																
Berg/Byron Remainder	72	5.0	4.3	0.8	18.7																	
Berg Road Subdivision																						
SWC Valpico & Corral Hollow																						
Kagehiro[g,k]																						
Dobler/Maibes													23.0	19.6	3.5	38.9	14.5					
Holly Sugar Industrial													18.0	15.3	2.7	30.5	11.4					
Northeast Industrial Area																						
Industrial Areas Specific Plan	520	27.7	23.6	4.2	131.5								32.0	27.2	4.8	64.2						
I-205 Corridor Specific Plan													37.7	32.0	5.7	75.7						
Home 2 Suites							110	2.6	2.2	0.4	18.5							0.6	0.5	0.1	1.1	
Sierra Hills	300	11.6	9.9	1.7	74.1																	
Grant Line Road Apartments	448	20.0	17.0	3.0	111.8																	
Aspire II	47	2.3	2.0	0.3	11.8																	
Harvest	300	17.9	15.2	2.7	76.6																	
321 E. Grant Line Rd Apartments	40	1.7	1.4	0.3	9.9																	
Barcelona Infill																						
Mountain View																						
Tracy Combined Cycle Power Plant RW Conversion[l]																						
Legacy Fields[m]																						
Parks RW Conversion[n]																						
Infill (misc.)	973	51.9	44.1	7.8	246.1								100.4	85.3	15.1	201.6						
Total	**7,033**	**380**	**323**	**57**	**1,685**	**153**	**110**	**3**	**2**	**0**	**18**		**818**	**695**	**123**	**1,437**	**409**	**256**	**218**	**38**	**361**	**161**

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(b) For selected projects and development areas, it was assumed that 11.2% of the total acres in very low, low, and medium density residential land uses will be developed as parks. These park acres are in addition to the identified parks in the Rocking Horse, Ellis, Avenues, Tracy Hills Phase 1, and Legacy Fields developments. If available, recycled water was used to meet park demands.
(c) Includes 9.6% Unaccounted-for Water (UAFW).
(d) Includes 5.0% UAFW.
(e) Assumes that 15 percent of total gross acres will be landscaped and irrigated. If available, recycled water was used to meet irrigated area demands.
(f) Miscellaneous potable water demands for Tracy Village are from existing residential units to be annexed as part of the Project. Miscellaneous recycled water demand for Tracy Village is to fill the lakes which will be constructed as part of the project.
(g) Projected land use data includes dwelling units and acreage developed by 2017.
(h) Land use data for Ellis includes dwelling units constructed by 2017. Miscellaneous potable water demand for Ellis represents projected demands for the Aquatic Center minus 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.
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(j) Miscellaneous water use for Cordes Ranch represents the transfer of 2017 metered potable irrigation demands to recycled water demands once recycled water service is extended to Cordes Ranch.
(k) Land use data for Kagehiro includes dwelling units constructed by 2017. Miscellaneous potable water demand for Kagehiro represents 2017 metered water use. The 2017 metered use was subtracted from the calculated water demands for the entire development to account for the portion of the development constructed by 2017.
(l) Demands for the Tracy Combined Cycle Power Plant Recycled Water Conversion are from City of Tracy Recycled Water Project - Projected Recycled Water Demands TM, West Yost Associates, October 11, 2016.
(m) Remaining Legacy Fields acreage to be developed is from the City of Tracy Parks Master Plan, Table A-1, April 2013. Projected demands for Legacy Fields are equal to total demands projected in the Water Supply Assessment for the Holly Sugar Sports Park (West Yost Associates, June 2009) minus the existing recycled water demand for Legacy Fields.
(n) Represents the transfer of 2017 metered potable demands for selected existing parks and irrigated areas to recycled water demands. Projected recycled water demands for these areas are larger than existing potable water demands due to current potable water conservation practices. Refer to Chapter 9 for a full list of irrigated areas projected to be converted to recycled water use.

Table A-4. Buildout Time Frame - Land Use Assumptions and Projected Water Demands for New Developments

Project or Development Area	Industrial					Institutional					Identified Parks			Misc. Water Demands		Total Dwelling Units	Total Area, acres	Total Potable Water Demand, af/yr	Total Recycled Water Demand, af/yr
	Total Acres	Industrial Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	*Total Acres*	Institutional Acres	Assumed Irrigated Acres[e]	PW Demand, af/yr[c]	RW Demand, af/yr[d]	*Total Acres*	PW Demand, af/yr[c]	RW Demand, af/yr[d]	PW Demand, af/yr[c]	RW Demand, af/yr[d]				
UR 5 (Bright)																886	108.1	293.2	79.9
UR 7 (Bright/Castro)																606	88.0	220.0	71.8
Rocking Horse											2.4		10.1			226	59.1	102.2	10.1
Tracy Village[f]														17.7	156.0	600	100.2	295.8	158.5
UR 1																2,879	797.9	1,216.6	425.0
Ellis[g,h]	28.8	24.5	4.3	35.2	18.2	16.0	13.6	2.4	22.6	10.1	16.7		70.3	7.1		958	289.8	523.2	108.0
Avenues											4.6		19.4			480	95.0	217.1	19.4
UR 10	116.0	98.6	17.4	141.8	73.3												116.0	141.8	73.3
Tracy Hills[i]	308.0	261.8	46.2	376.5	194.5	18.6	15.8	2.8	26.2	11.7	27.9		117.5			7,177	1,757.2	3,326.8	1,052.4
Westside						150.0	127.5	22.5	211.6	94.7						2,544	535.0	1,256.4	436.9
Cordes Ranch[j]	1,219.7	1,036.7	183.0	1,490.9	770.3									-84	83.8		1,400.7	1,677.9	968.5
UR 4 (Bright Triangle)																816	158.0	386.5	99.8
UR 3 (Sandhu)	535.0	454.8	80.3	654.0	337.9											60	660.0	818.4	410.4
I-205 Expansion																1,748	172.0	525.7	128.4
West Side Industrial	650.0	552.5	97.5	794.5	410.5												650.0	794.5	410.5
East Side Industrial	363.0	308.6	54.5	443.7	229.3												368.0	452.2	232.4
Larch-Clover																1,197	452.0	648.7	257.9
Chrisman Road	100.0	85.0	15.0	122.2	63.2												113.0	144.2	71.4
Rocha																727	91.0	233.7	46.6
Berg/Byron Remainder																483	44.0	188.0	
Berg Road Subdivision																71	9.9	27.2	
SWC Valpico & Corral Hollow																282	65.0	127.5	30.7
Kagehiro[g,k]														-24		252	47.0	89.8	
Dobler/Maibes																	23.0	38.9	14.5
Holly Sugar Industrial	125.0	106.3	18.8	152.8	78.9												143.0	183.3	90.3
Northeast Industrial Area	468.0	397.8	70.2	719.6													468.0	719.6	
Industrial Areas Specific Plan	26.8	22.8	4.0	41.2												520	86.5	237.0	
I-205 Corridor Specific Plan																	37.7	75.7	
Home 2 Suites																110	3.2	19.6	
Sierra Hills																300	11.6	74.1	
Grant Line Road Apartments																448	20.0	111.8	
Aspire II																47	2.3	11.8	
Harvest																300	17.9	76.6	
321 E. Grant Line Rd Apartments																40	1.7	9.9	
Barcelona Infill																51	10.2	23.1	
Mountain View																165	156.0	87.7	
Tracy Combined Cycle Power Plant RW Conversion[l]															33.7				33.7
Legacy Fields[m]											228.5	52.3	397.9				228.5	52.3	397.9
Parks RW Conversion[n]														-432	593.5			-432	593.5
Infill (misc.)	153.0	130.1	23.0	235.3		2.7	2.3	0.4	4.7							987	311.3	694.0	
Total	**4,093**	**3,479**	**614**	**5,208**	**2,176**	**187**	**159**	**28**	**265**	**117**	**280**	**52**	**615**	**-516**	**867**	**24,960**	**9,698**	**15,691**	**6,222**

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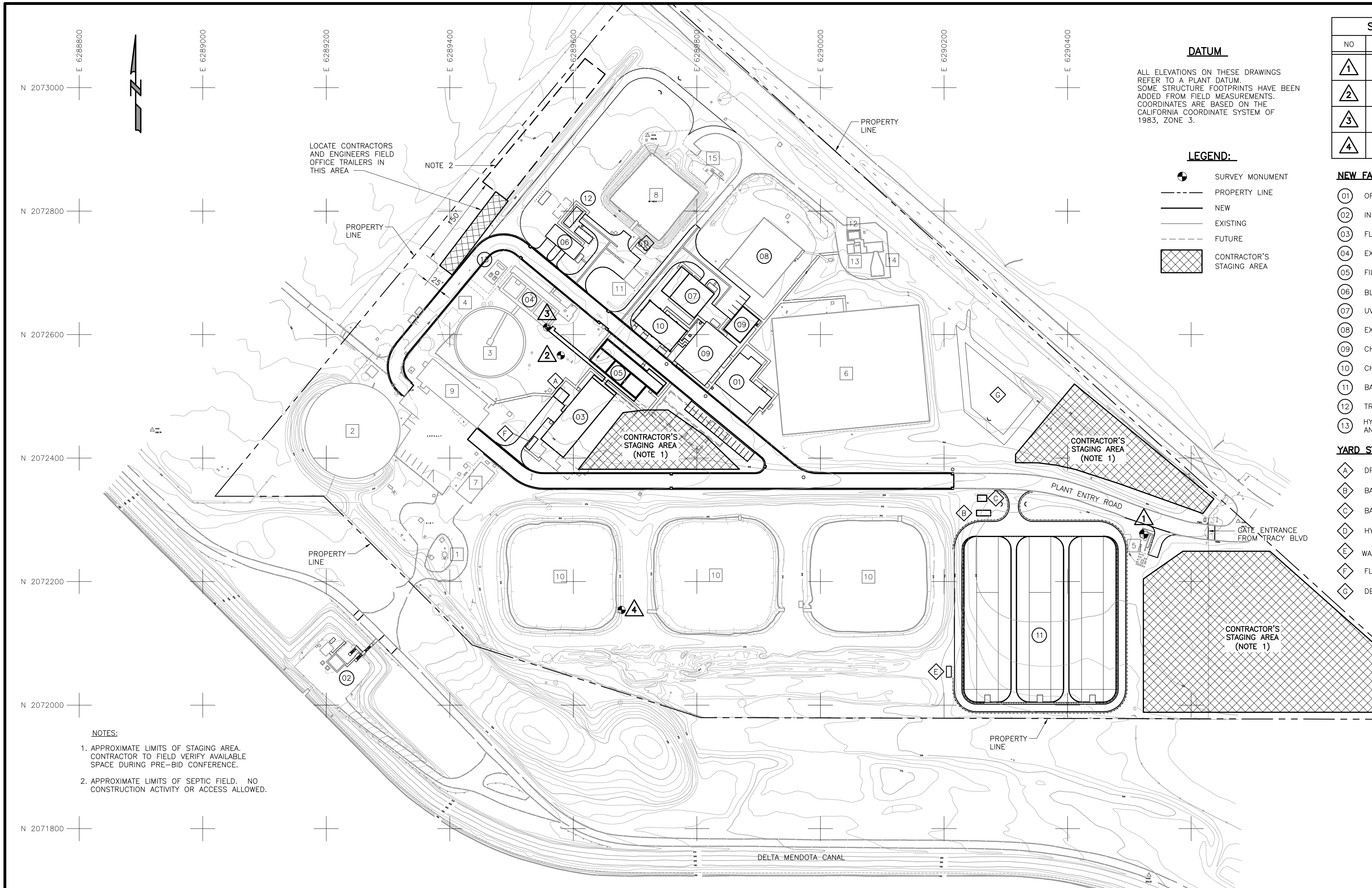
APPENDIX B

JJWTP Expansion Project

Site Plan, Process Schematic, and Hydraulic Profile



A GENERAL SITE PLAN
SCALE: 1"= 80'
FILE: 00G011

DATUM

ALL ELEVATIONS ON THESE DRAWINGS REFER TO A PLANT DATUM. SOME STRUCTURE FOOTPRINTS HAVE BEEN ADDED FROM FIELD MEASUREMENTS. COORDINATES ARE BASED ON THE CALIFORNIA COORDINATE SYSTEM OF 1983, ZONE 3.

LEGEND:

- SURVEY MONUMENT
- PROPERTY LINE
- NEW
- EXISTING
- FUTURE
- CONTRACTOR'S STAGING AREA

SURVEY GRID MONUMENT DATA

NO	DESCRIPTION	COORDINATES	ELEVATION
1	BRASS DISK IN CONC SLAB	N 2072277.29 E 6290523.62	200.76
2	BRASS DISK IN CONC VAULT	N 2072566.47 E 6289579.75	204.54
3	BRASS DISK IN CONC SLAB	N 2072611.76 E 6289557.30	216.52
4	BRASS DISK IN CONC HEADWALL	N 2072154.17 E 6289678.10	211.72

NEW FACILITIES/MODIFICATIONS

- 01 OPERATIONS/CONTROL BUILDING
- 02 INFLUENT PUMP STATION MODIFICATIONS
- 03 FLOCCULATION / SEDIMENTATION SYSTEM
- 04 EXISTING FILTER NO.S 1 – 3 MODIFICATIONS
- 05 FILTERS NO.S 4 – 6
- 06 BLOWER AND ELECTRICAL DISTRIBUTION BUILDING
- 07 UV FACILITY / FILTER OVERFLOW STRUCTURE
- 08 EXISTING CLEARWELL NO.1 MODIFICATIONS
- 09 CHEMICAL BUILDING / CHLORINE SCRUBBER
- 10 CHEMICAL TANK FARM
- 11 BACKWASH WATER RECOVERY BASIN NO.1 – 3
- 12 TRANSFORMER/GENERATOR/FUEL TANK
- 13 HYDROPNEUMATIC TANK, AIR RECEIVER AND AIR BLOWER

YARD STRUCTURE

- A DRAIN PUMP STATION
- B BACKWASH WATER RECOVERY BASIN VALVE VAULT
- C BACKWASH WATER RECOVERY BASIN METER
- D HYDROPNEUMATIC TANK PAD
- E WASTE STREAM TREATMENT MCC PAD
- F FLOCCULATION / SEDIMENTATION MCC PAD
- G DETENTION POND

EXISTING FACILITIES

- 1 SURGE TOWER
- 2 EQUALIZATION TANK
- 3 REACTOR CLARIFIER
- 4 CONTROL METER VAULT
- 5 WELL NO.2
- 6 CLEARWELL NO.2
- 7 CHEMICAL FEED BUILDING
- 8 FTW RECOVERY POND *
- 9 CONTROL BUILDING
- 10 SLUDGE DRYING BED NO.1 – 3
- 11 SWITCHGEAR BUILDING
- 12 ZONE 1 BPS ELECTRICAL BUILDING
- 13 METER VAULT
- 14 ZONE 1 PUMP STATION
- 15 WELL NO.1

* FACILITY RENAMED AFTER IMPROVEMENTS

NOTES:

1. APPROXIMATE LIMITS OF STAGING AREA. CONTRACTOR TO FIELD VERIFY AVAILABLE SPACE DURING PRE-BID CONFERENCE.
2. APPROXIMATE LIMITS OF SEPTIC FIELD. NO CONSTRUCTION ACTIVITY OR ACCESS ALLOWED.

REV	DATE	BY	DESCRIPTION
			CONFORMED DOCUMENTS FOR CONSTRUCTION

DESIGNED MAL
DRAWN DST
CHECKED WCL
DATE MAR 2005

DISCIPLINE ENGINEER: ** ORIGINAL STAMPED BY MATHEW AXEL LARSON **
PROJECT ENGINEER: ** ORIGINAL STAMPED BY SUZAN K. ENGLAND **
PARTNER: ** ORIGINAL STAMPED BY KENNETH WILKINS **

carollo engineers

CITY OF TRACY
JOHN JONES WTP – EXPANSION PROJECT
GENERAL
SITE PLAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

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DRAWING NO. G-12
SHEET NO. 12 OF 573

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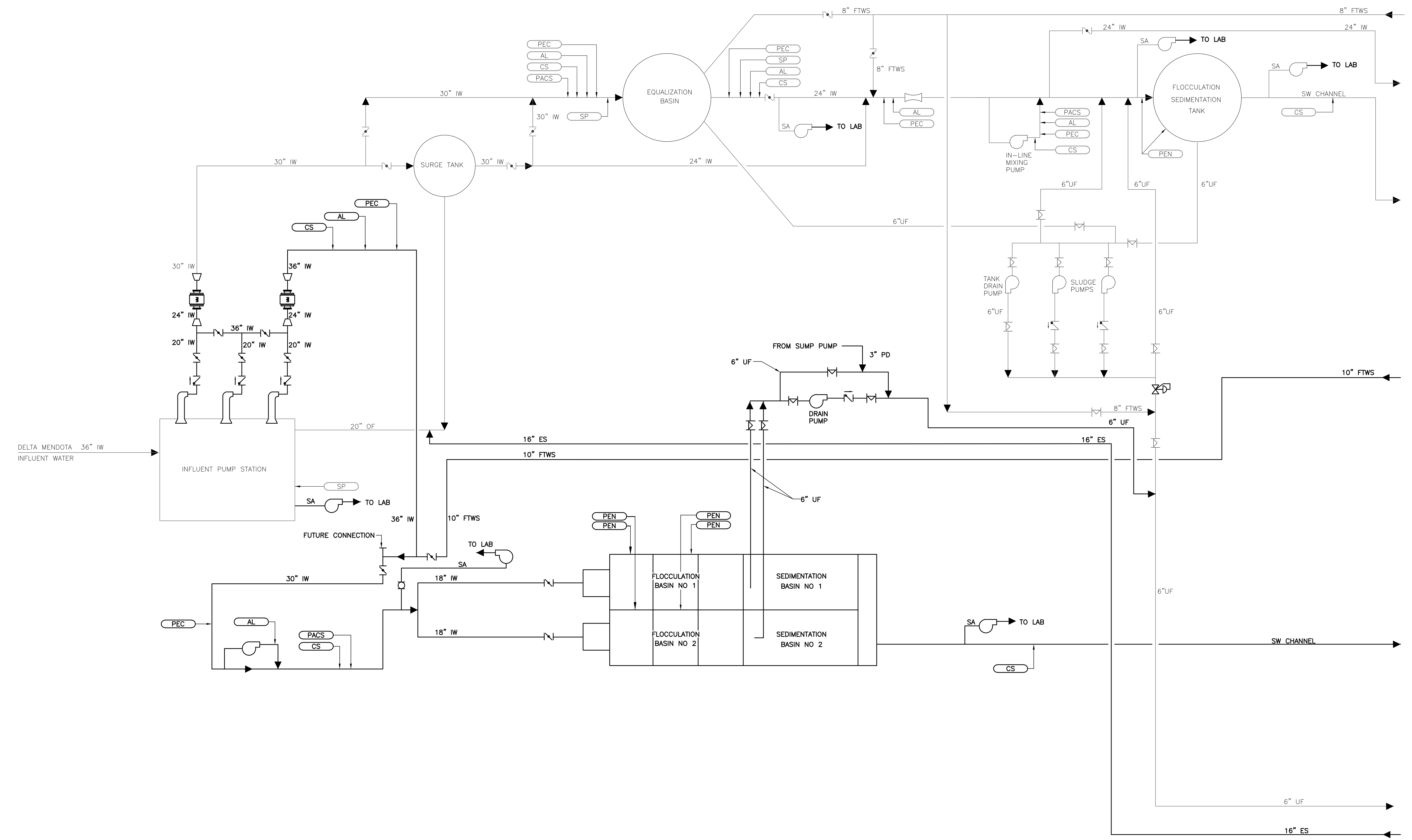

RECORD DRAWING

THESE RECORD DRAWINGS HAVE BEEN PREPARED BASED IN PART ON INFORMATION PROVIDED BY OTHERS

THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE

DESIGNED	MAL
DRAWN	SJB
CHECKED	BTF
DATE	MAR 2005

DISCIPLINE ENGINEER

PROJECT ENGINEER

PARTNER

carollo engineers

CITY OF TRACY

JOHN JONES WTP – EXPANSION PROJECT

GENERAL

PROCESS SCHEMATIC
SHEET 1 OF 2

VERIFY SCALES

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SHEET NO. 9 OF 573

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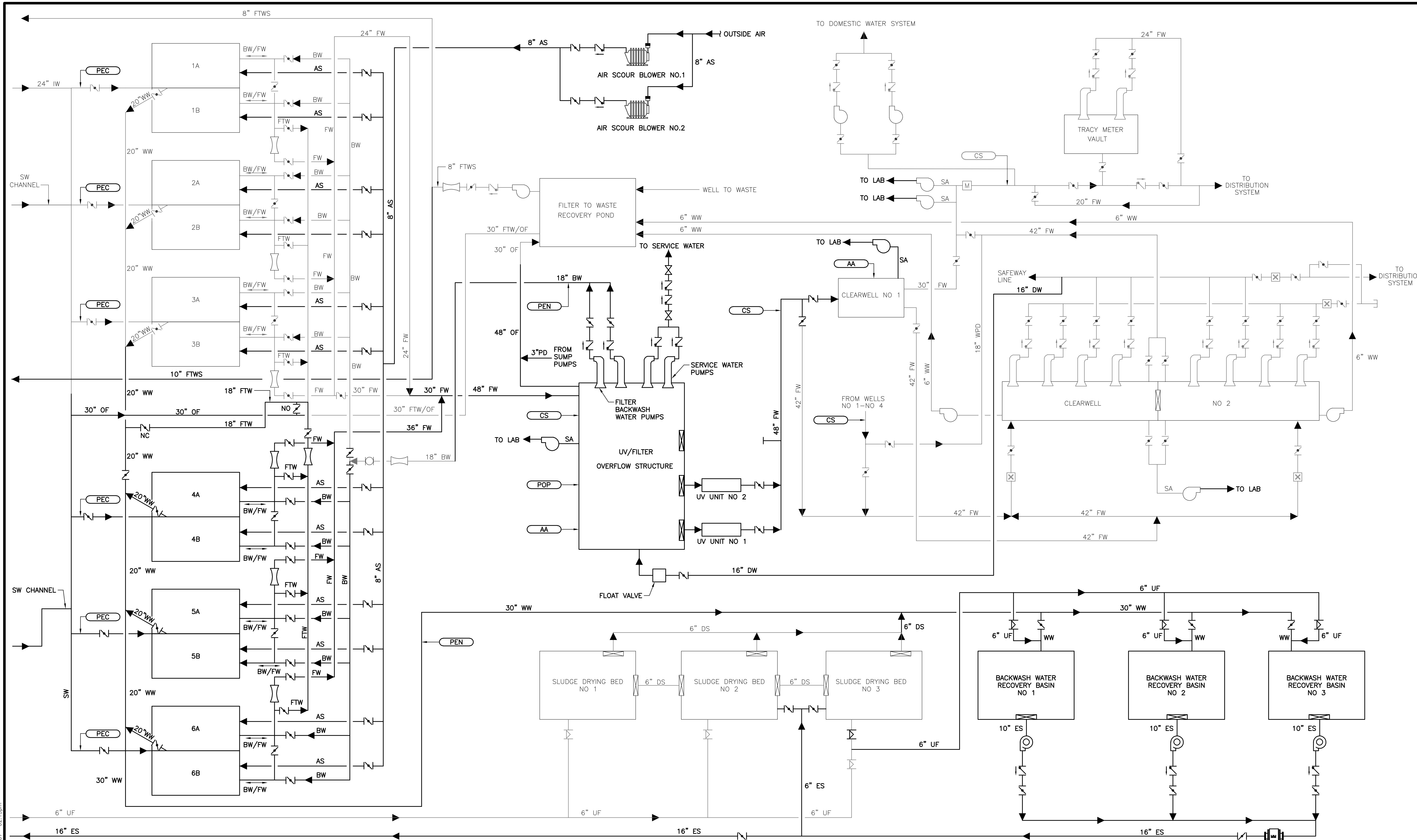

RECORD DRAWING

THESE RECORD DRAWINGS HAVE BEEN PREPARED BASED IN PART ON INFORMATION PROVIDED BY OTHERS

THIS DRAWING WAS PREPARED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREON AND IS NOT TO BE USED ELSEWHERE

DESIGNED	MAL
DRAWN	SJB
CHECKED	BTF
DATE	MAR 2005

DISCIPLINE ENGINEER

PROJECT ENGINEER

PARTNER

carollo engineers

CITY OF TRACY

JOHN JONES WTP – EXPANSION PROJECT

GENERAL

PROCESS SCHEMATIC SHEET 2 OF 2

VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 6458C

DRAWING NO. G–10

SHEET NO. 10 OF 573

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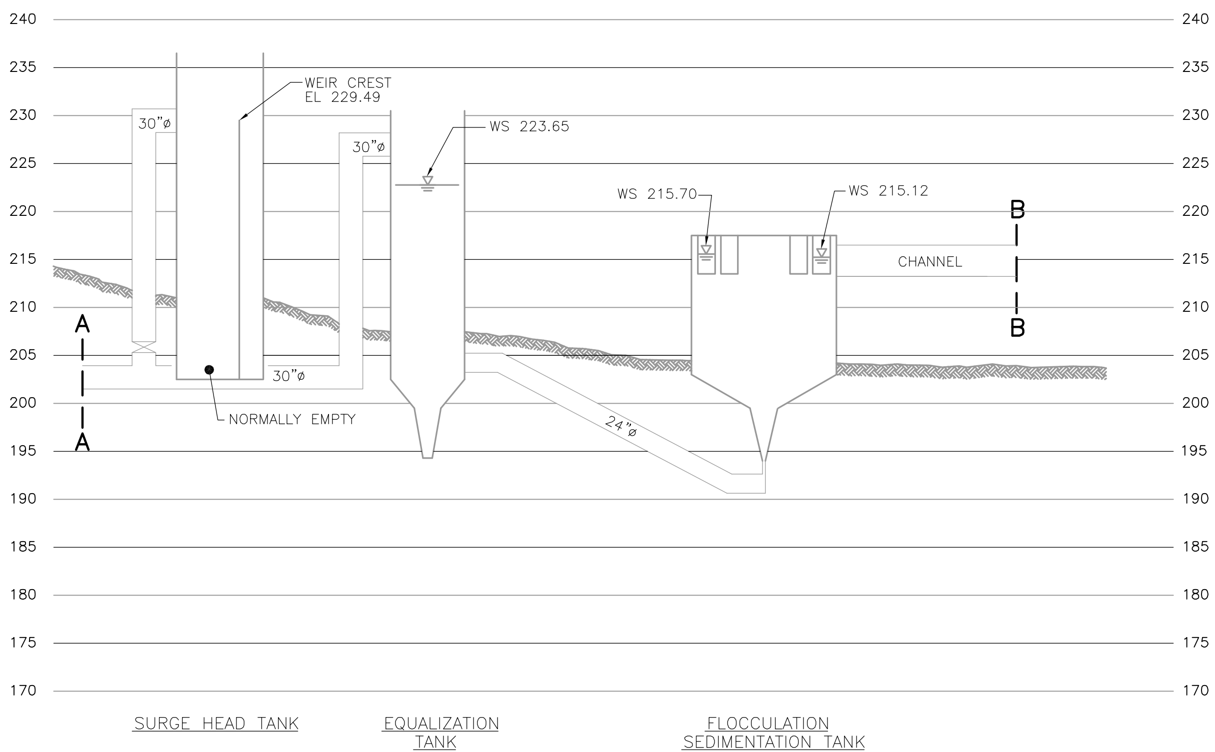
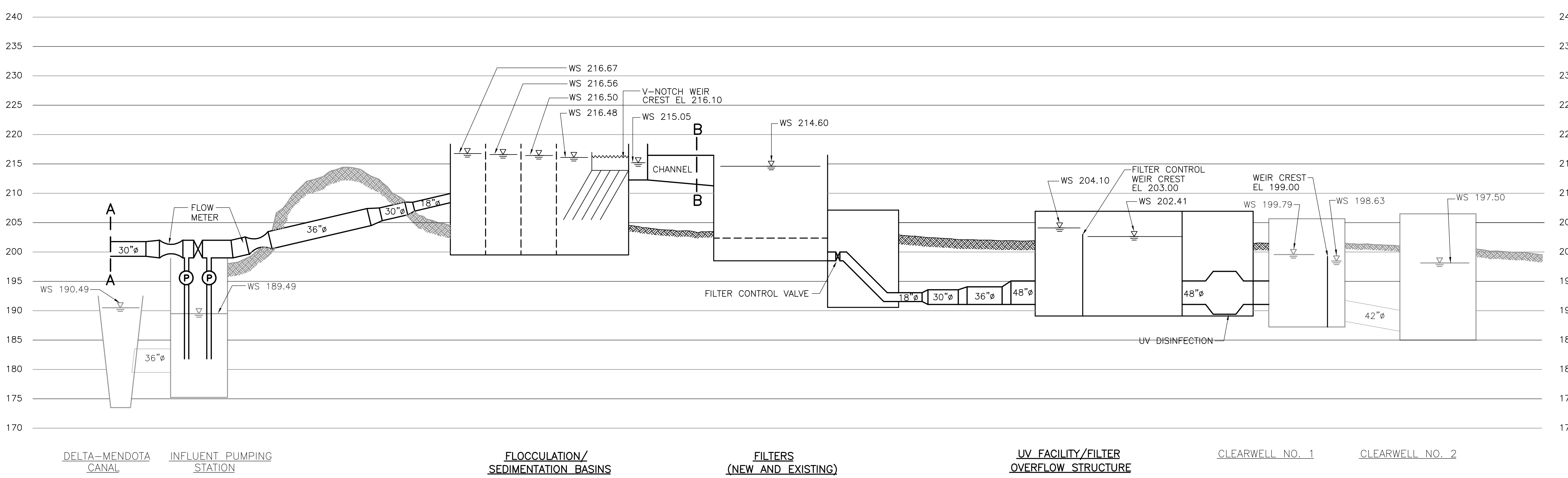




LEGEND

XXX — WATER SURFACE ELEVATION AT 30 MGD

Last Saved By: DST (WCO) 11-29-04 01:31pm

REV	DATE	BY	DESCRIPTION
			CONFORMED DOCUMENTS FOR CONSTRUCTION

DESIGNED MAL
DRAWN PGG
CHECKED AS
DATE MAR 2005

DISCIPLINE ENGINEER: ** ORIGINAL STAMPED BY MATHEW AXEL LARSON **

PROJECT ENGINEER: ** ORIGINAL STAMPED BY SUZAN K. ENGLAND **

PARTNER: ** ORIGINAL STAMPED BY KENNETH WILKINS **

carollo engineers

CITY OF TRACY
JOHN JONES WTP – EXPANSION PROJECT
GENERAL
HYDRAULIC PROFILE

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 — 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

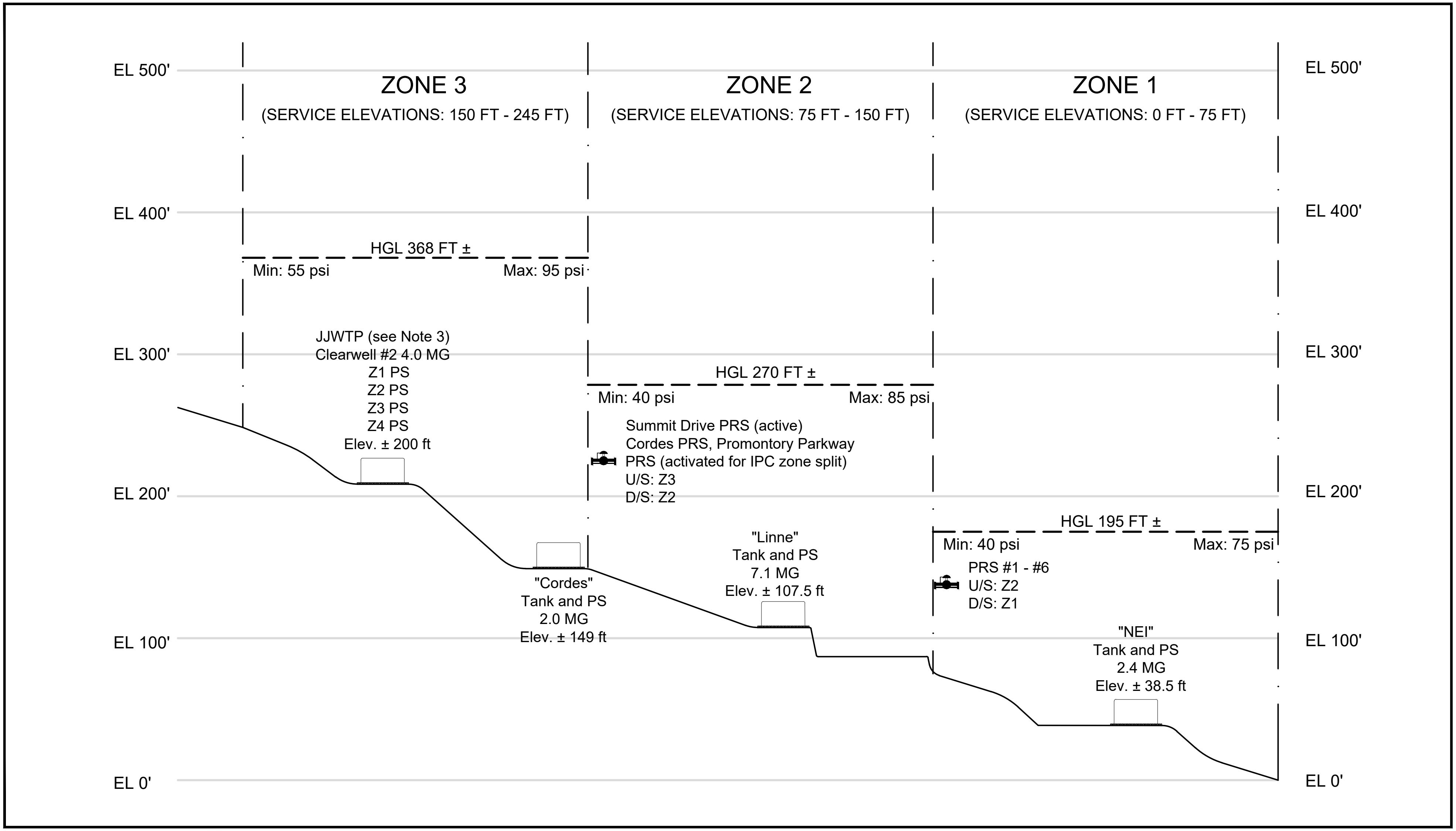
JOB NO. 6458C
DRAWING NO. G-11
SHEET NO. 11 OF 573

FILENAME: H:\Client\Tracy_WCO\6458C_Final Design\Drawings\00G015 3-21-05 10:54am NPapa XREFS: Tracy bdr; KW; SKE; MAL TracyBW;

APPENDIX C

City of Tracy

Existing Potable Water System Hydraulic Grade Schematic



Notes:

1. Elevations on this figure are from various sources and should not be used for design purposes.
2. Horizontal spacing is for illustrative purposes and is not to scale.
3. JJWTP Facilities do not currently supply Zone 3 directly.
4. Ellis Reduced Zone (not shown) is served from Zone 3 via the Summit Drive PRV. It has a hydraulic grade of approximately 323 ft, and a service elevation range of 140 ft - 185 ft.
5. Last updated December 2019.

Appendix C

Existing Potable Water System Hydraulic Grade Schematic

WEST YOST ASSOCIATES

City of Tracy Water System Master Plan Update

APPENDIX D

Lammers Road and Hood Way Design Recommendation Technical Memoranda

Note: The Technical Memoranda in this Appendix were written using the old pressure zone nomenclature. Please note that “City-side Pressure Zone 3” is now referred to as “Pressure Zone 3” using the updated pressure zone nomenclature discussed in Chapters 7 and 8.

WEST YOST ASSOCIATES

TECHNICAL MEMORANDUM

DATE:	September 25, 2019	Project No.: 404-60-19-47 SENT VIA: EMAIL
TO:	Zabih Zaca, City of Tracy	
CC:	Robert Armijo, City of Tracy Paul Verma, City of Tracy Al Gali, City of Tracy Nanda Gottiparthy, SNG & Associates, Inc.	
FROM:	Nathaniel Homan, PE, RCE #89903 Jim Connell, PE, RCE #63052	
REVIEWED BY:	Amy Kwong, PE, RCE #73213	
SUBJECT:	Design Recommendations for Lammers Road Pipeline	

REGISTERED PROFESSIONAL ENGINEER
JAMES P. CONNELL
No. 63052
Exp. 6-30-20
CIVIL
STATE OF CALIFORNIA

In a technical memorandum (TM) prepared for the City of Tracy (City) titled *Hydraulic Evaluation of International Park of Commerce (IPC) Buildings 3, 4, and 12*, dated May 18, 2017 (May 2017 TM), West Yost Associates (West Yost) recommended that 3,440 lineal feet (lf) of 20-inch diameter Pressure Zone 2 (Zone 2) transmission main be constructed in Lammers Road between Valpico Road and Schulte Road in addition to the 3,025 lf of City-side Pressure Zone 3 (Zone 3) transmission main to be constructed in Lammers Road between the northwest corner of the Ellis Specific Plan development and Valpico Road. The purpose of this recommended Zone 2 pipeline improvement was to maintain the Zone 2 transmission main system after the existing 24-inch diameter Zone 2 transmission main in the above-mentioned section of Lammers Road is re-zoned to Zone 3. The key figures from the May 2017 TM are included for reference as Attachment 1.

This TM summarizes the findings and conclusions of West Yost's technical evaluation of four alternatives to the recommendations from the May 2017 TM:

- <u>Alternative 1</u>: Re-zone the existing 24-inch diameter Zone 2 transmission main in Lammers Road between Valpico Road and Schulte Road without any improvements. This alternative was previously evaluated in the May 2017 TM, but system conditions have changed with additional development. Therefore, this condition was re-evaluated to confirm if improvements are required.
- <u>Alternative 2</u>: Re-zone the existing 24-inch diameter Zone 2 transmission main in Lammers Road between Valpico Road and Schulte Road and construct a new Pressure Regulating Station (PRS) at the intersection of Lammers Road and Schulte Road to support Zone 2.

6800 Koll Center Parkway, Suite 150 Pleasanton, CA 94566 Phone 925.426.2580 Fax 530.756.5991 westyost.com

- Alternative 3: Construct a new Zone 3 transmission main in Lammers Road between Valpico Road and Schulte Road instead of re-zoning the existing transmission main.
- Alternative 4: Re-zone the existing 24-inch diameter Zone 2 transmission main in Lammers Road between Valpico Road and Schulte Road and construct a new Zone 2 transmission main in Lammers Road between Valpico Road and Schulte Road (similar to the recommendation from the May 2017 TM).

West Yost first performed hydraulic modeling[1] and reviewed plans and record drawings of the construction areas to determine which of the four alternatives are both hydraulically feasible and constructible. West Yost then compared the various alternatives and developed design recommendations for the preferred alternative. It should be noted that all evaluations performed for this TM assume that the improvements identified in the evaluation for Design Recommendations for Hood Way Pipeline have been completed.

This TM is submitted in accordance with West Yost's January 2019 Scope of Services. The following sections summarize our findings and conclusions:

- Alternative 1: No New Pipeline
- Alternative 2: New PRS (No New Pipeline)
- Alternative 3: New Zone 3 Pipeline
- Alternative 4: New Zone 2 Pipeline
- Comparison of Alternatives and Conclusions

ALTERNATIVE 1: NO NEW PIPELINE

In Alternative 1, no new infrastructure would be constructed in Lammers Road between Valpico Road and Schulte Road. The existing 24-inch diameter Zone 2 pipeline in Lammers Road south of Schulte Road would be re-zoned to Zone 3 by closing existing valves located at the intersection of Valpico Road and Lammers Road and at the intersection of Schulte Road and Lammers Road. A depiction of Alternative 1 is shown on Figure 1.

While Alternative 1 is much less expensive than constructing the additional pipeline recommended in the May 2017 TM, re-zoning the existing pipeline in Lammers Road without providing a new Zone 2 transmission line would significantly impact the ability of the Zone 2 system west of Corral Hollow Road to convey large quantities of water. Increased headloss in the water distribution

[1] Hydraulic modeling was performed using the City's developer hydraulic model, which includes all of the previously evaluated development projects that have been proposed and is separate from the 2012 Water System Master Plan model. It is assumed that the Cordes Tank and Booster Pump Station are operational and that the 16-inch diameter Zone 2 transmission main connection to Lammers Road is in service. Planning and modeling criteria used to evaluate the various alternatives are based on the system performance and operational criteria developed in the 2012 WSMP and are provided in Attachment 2 for reference.

pipelines due to the lack of a major transmission main would cause a decrease in pressure in this portion of the Zone 2 system. Additional consequences from Alternative 1 include the following:

1. PRS #6 would no longer provide supply to Zone 1 during a normal maximum day demand condition. This is because the Zone 2 pressure upstream of PRS #6 would fall below the pressure sustaining setting of 78 pounds per square inch (psi).
2. Zone 1 would not meet fire flow requirements at Kimball High School during a maximum day demand condition[2], as shown on Figure 2. This is because PRS #6 would no longer be available to support Zone 1 as discussed in Item 1 above.
3. Zone 2 would also not meet fire flow requirements in portions of the IPC during a maximum day demand condition, as shown on Figure 2. Some hydrants in the IPC are located at the highest elevations in Zone 2 and the decrease in Zone 2 pressure and reduced transmission capacity of the Zone 2 system would cause some locations in the IPC to be deficient in meeting fire flow requirements.
4. The existing 24-inch diameter pipeline in Valpico Road would become a dead-end and would experience a decrease in water quality.

Alternative 1 is not recommended because it results in fire flow deficiencies within Zone 1 and Zone 2 and water quality concerns in the existing 24-inch diameter pipeline in Valpico Road.

ALTERNATIVE 2: NEW PRS (NO NEW PIPELINE)

After evaluating Alternative 1, West Yost evaluated whether a new Zone 3 to Zone 2 PRS at the intersection of Lammers Road and Schulte Road would be a viable alternative to a new transmission pipeline (i.e. Alternatives 3 and 4) and alleviate the fire flow deficiencies in Zone 1 and Zone 2 that were observed in the Alternative 1 evaluation.

To resolve the fire flow deficiencies in Zone 1, the proposed Zone 3 to Zone 2 PRS would have to provide enough supply to sustain pressure in Zone 2 sufficiently to allow PRS #6 to open and support Zone 1. However, as stated above, the Zone 2 pressure upstream of PRS #6 would fall below the pressure sustaining setting of 78 psi during a normal maximum day demand condition if the Zone 2 transmission main in Lammers Road were re-zoned without constructing a new Zone 2 transmission main. Therefore, any PRS designed to alleviate the fire flow deficiencies in Zone 1 would have to provide sufficient flow from Zone 3 to Zone 2 continuously under normal operating conditions so that the pressure upstream of PRS #6 would remain above the pressure sustaining setting. However, operating the new Zone 3 to Zone 2 PRS in this manner would require at least 1,000 gallons per minute (gpm) of flow through the new PRS from Zone 3 to Zone 2 under a maximum day demand condition, which would significantly increase the demand on Zone 3 facilities that were not designed to accommodate this additional flow. Therefore, Alternative 2 is not recommended.

[2] Available fire flow simulations for the evaluated alternatives was performed during a maximum day demand condition while maintaining 30 psi residual system pressure.

ALTERNATIVE 3: NEW ZONE 3 PIPELINE

In Alternative 3, 3,240 lf of 24-inch diameter Zone 3 pipeline would be constructed in Lammers Road between Valpico Road and Schulte Road, while the existing 24-inch diameter Zone 2 pipeline in Lammers Road between Valpico Road and Schulte Road would continue to serve Zone 2. An existing valve at the intersection of Schulte Road and Lammers Road would be used to isolate the Zone 2 and Zone 3 transmission lines. The proposed Zone 3 pipeline south of Valpico Road would not connect to the existing pipelines at the intersection of Valpico Road and Lammers Road, but would instead connect to the recommended Zone 3 pipeline. Refer to Figure 3A for a depiction of Alternative 3. A detailed schematic of the connection to existing pipelines which would be required to construct Alternative 3 is shown on Figure 3B.

As part of Alternative 3, West Yost also evaluated the feasibility of constructing 830 lf of new 20-inch diameter Zone 2 pipeline to connect the existing 24-inch diameter Zone 2 pipeline at the intersection of Lammers Road and Schulte Road to the existing 20-inch diameter Zone 2 pipeline at the intersection of Lammers Road and Redbridge Road.

In the existing system, the 24-inch and 20-inch diameter transmission mains in Lammers Road are interrupted by 830 lf of 12-inch diameter pipeline through which large volumes of water must pass to reach PRS #6. Under a maximum day demand condition, the headloss in this 12-inch diameter pipeline exceeds 7 feet per 1,000 feet (ft/kft). While not critical to meeting existing fire flow requirements, the recommended 830 lf of 20-inch diameter pipeline would reduce the velocity and headloss and improve the Zone 2 backbone transmission system.

Refer to Figures 3C and 3D for detailed schematics of the connections to existing pipelines which would be required to construct Alternative 3 with the optional 830 lf of Zone 2 pipeline. It should be noted that surface features at the intersection of Lammers Road and Redbridge Road do not match those shown on the record drawings for that area as depicted on Figure 3D. The configuration of the existing pipelines in this area should be confirmed during design.

Zones 1 and 2 would meet fire flow requirements during a maximum day demand condition under Alternative 3, as shown on Figure 4. For the evaluation results shown on Figure 4, it was assumed that the optional 830 lf of Zone 2 pipeline would not be constructed for more conservative results. In summary, Alternative 3 is both hydraulically feasible and constructible.

ALTERNATIVE 4: NEW ZONE 2 PIPELINE

In Alternative 4, 3,240 lf of 24-inch diameter Zone 2 pipeline would be constructed in Lammers Road between Valpico Road and Schulte Road, while the existing 24-inch diameter Zone 2 pipeline in Lammers Road between Valpico Road and Schulte Road would be re-zoned to Zone 3. The proposed Zone 3 pipeline south of Valpico Road would connect to the existing pipelines at the intersection of Valpico Road and Lammers Road. An existing valve would be used to isolate the Zone 2 and Zone 3 transmission lines. Alternative 4 is similar to the recommendation presented in the May 2017 TM, and is shown on Figure 5A. Detailed schematics of the connections to existing pipelines which would be required to construct Alternative 4 are shown on Figures 5B and 5C.

As part of Alternative 4, West Yost also evaluated the feasibility of constructing 830 lf of new 20-inch diameter Zone 2 pipeline to connect the proposed 24-inch diameter Zone 2 pipeline to be constructed for Alternative 4 to the existing 20-inch diameter Zone 2 pipeline at the intersection of Lammers Road and Redbridge Road.

In the existing system, the 24-inch and 20-inch diameter transmission mains in Lammers Road are interrupted by 830 lf of 12-inch diameter pipeline through which large volumes of water must pass to reach PRS #6. Under a maximum day demand condition, the headloss in this 12-inch diameter pipeline exceeds 7 ft/kft. While not critical to meeting existing fire flow requirements, the recommended 830 lf of 20-inch diameter pipeline would reduce the velocity and headloss and improve the Zone 2 backbone transmission system.

Refer to Figures 5D and 5E for detailed schematics of the connections to existing pipelines which would be required to construct Alternative 4 with the optional 830 lf of Zone 2 pipeline. It should be noted that surface features at the intersection of Lammers Road and Redbridge Road do not match those shown on the record drawings for that area as depicted on Figure 5E. The configuration of the existing pipelines in this area should be confirmed during design.

As shown on Figure 6, Zones 1 and 2 would meet fire flow requirements during a maximum day demand condition under Alternative 4. For the evaluation results shown on Figure 6, it was assumed that the optional 830 lf of Zone 2 pipeline would not be constructed for more conservative results. In summary, Alternative 4 is both hydraulically feasible and constructible.

COMPARISON OF ALTERNATIVES AND CONCLUSIONS

Alternatives 1 and 2 do not meet the City's existing fire flow requirements and are therefore not hydraulically feasible. Therefore, West Yost does not recommend that the City proceed with either of these alternatives.

Alternatives 3 and 4, on the other hand, both meet existing fire flow requirements and are also constructible. Although Alternatives 3 and 4 are similar in many respects, West Yost recommends that the City construct Alternative 4 over Alternative 3 because it would avoid construction near the existing 8-inch diameter natural gas transmission main in the west side of Lammers Road. West Yost also recommends that the proposed 20-inch diameter Zone 2 pipeline between Schulte Road and Redbridge Road be constructed to improve Zone 2 transmission capacity.

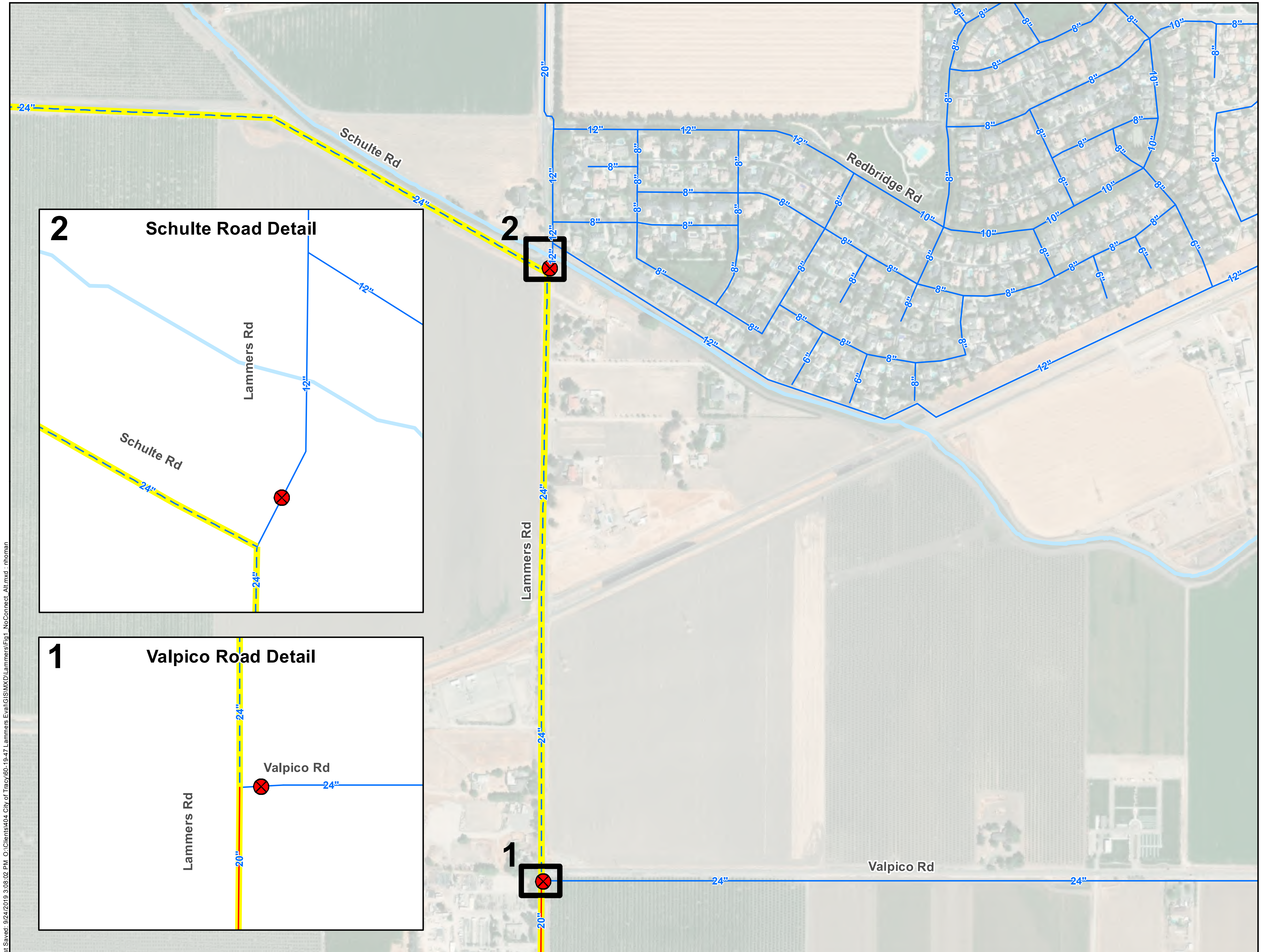
It should be noted that the hydraulic analysis performed in this evaluation did not include buildout water system demands. In addition, the proposed alternative operations could potentially impact future developments such as Gateway and Westside Industrial, which are located in Zone 2, as they would no longer be able to connect directly to the existing 24-inch diameter pipeline in Schulte Road. The City's buildout water system hydraulic model is currently being updated by West Yost as part of the City's 2018 Water System Master Plan (WSMP). For the 2018 WSMP, West Yost will confirm whether Alternatives 3 and 4 are hydraulically feasible at buildout of the City's potable water system and also address any potential impacts to future developments. While it is likely that construction of either a new Zone 3 transmission pipeline (as in Alternative 3) or a new Zone 2 transmission pipeline (as in Alternative 4) will continue to be hydraulically feasible at buildout, the buildout analysis may determine that the new transmission pipeline should be of a larger diameter than is recommended in this evaluation.

In conclusion, West Yost currently recommends that the City construct the following infrastructure improvements in Lammers Road:

- 3,240 lf of new 24-inch diameter Zone 2 pipeline between Valpico Road and Schulte Road; and
- 830 lf of new 20-inch diameter Zone 2 pipeline from Schulte Road to Redbridge Road to improve existing deficiencies in the City's Zone 2 system. As noted above, the configuration of the existing pipelines in this area should be confirmed during design.

These recommendations should be confirmed using the buildout water system model as part of the 2018 WSMP.

No estimates of infrastructure costs were developed as part of this evaluation. The locations of existing pipelines and valves shown on the figures attached here-in should be confirmed prior to design. If existing pipelines or valves are not as shown on the reviewed plans and record drawings, additional evaluation of the feasibility of the recommended connections may be required.



N
0 250 500
Scale in Feet

- Closed Valve Due to Re-zoning
- Proposed Zone 3 Pipeline
- Existing Pipeline to be Re-zoned to Zone 3
- Existing Zone 2 Pipeline
- Irrigation Canal

Notes:
1. Details are not to scale.

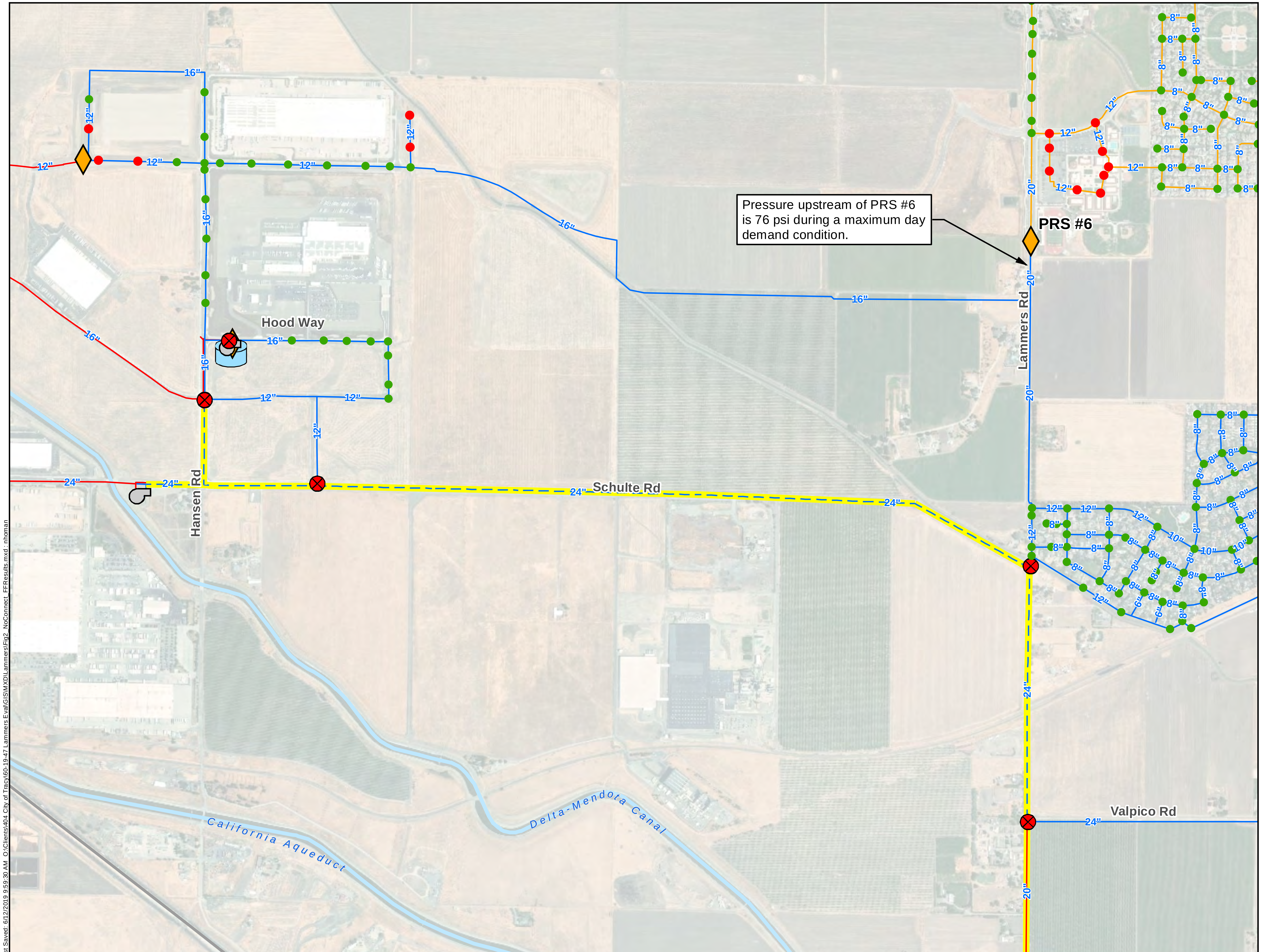
TRACY

WEST YOST ASSOCIATES

Figure 1

Alternative 1
No New Pipeline from Valpico Road to Schulte Road

City of Tracy
Design Recommendations for Lammers Road Pipeline



Available Fire Flow

- Does Not Meet Requirements
- Meets Requirements
- Closed Valve Due to Re-zoning
- Pressure Regulating Station
- Booster Pump Station
- Cordes Tank
- Proposed Zone 3 Pipeline
- Existing Pipeline to be Re-zoned to Zone 3

Existing Pipeline

- Zone 1
- Zone 2
- Zone 3

Notes:
1. Results assume that connections in Hood Way and Hansen Road are constructed as recommended in the Design Recommendations for Hood Way Pipeline annotated figures.
2. The available fire flow shown is the maximum flow available while maintaining 30 psi residual system pressure. Fire flow evaluation performed under maximum day demand conditions.

TRACY

WEST YOST ASSOCIATES

Figure 2

Alternative 1
Available Fire Flow

City of Tracy
Design Recommendations for
Lammers Road Pipeline

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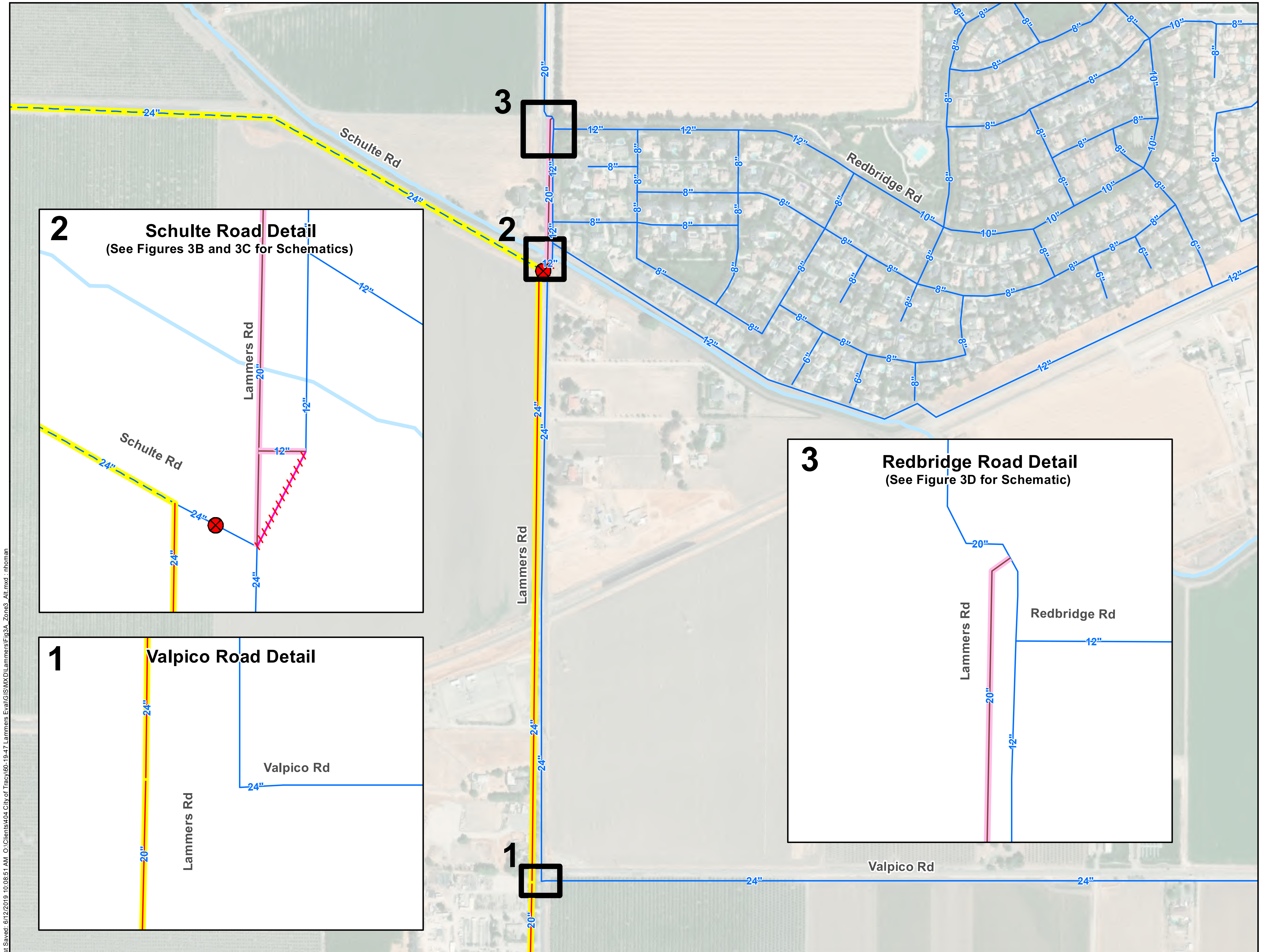


N

0 250 500
Scale in Feet

- Closed Valve Due to Re-zoning
- Proposed Zone 3 Pipeline
- Existing Pipeline to be Re-zoned to Zone 3
- Optional Zone 2 Pipeline
- Existing Pipeline to be Removed if Optional Zone 2 Pipeline Constructed
- Existing Zone 2 Pipeline
- Irrigation Canal

Notes:
1. Details are not to scale.

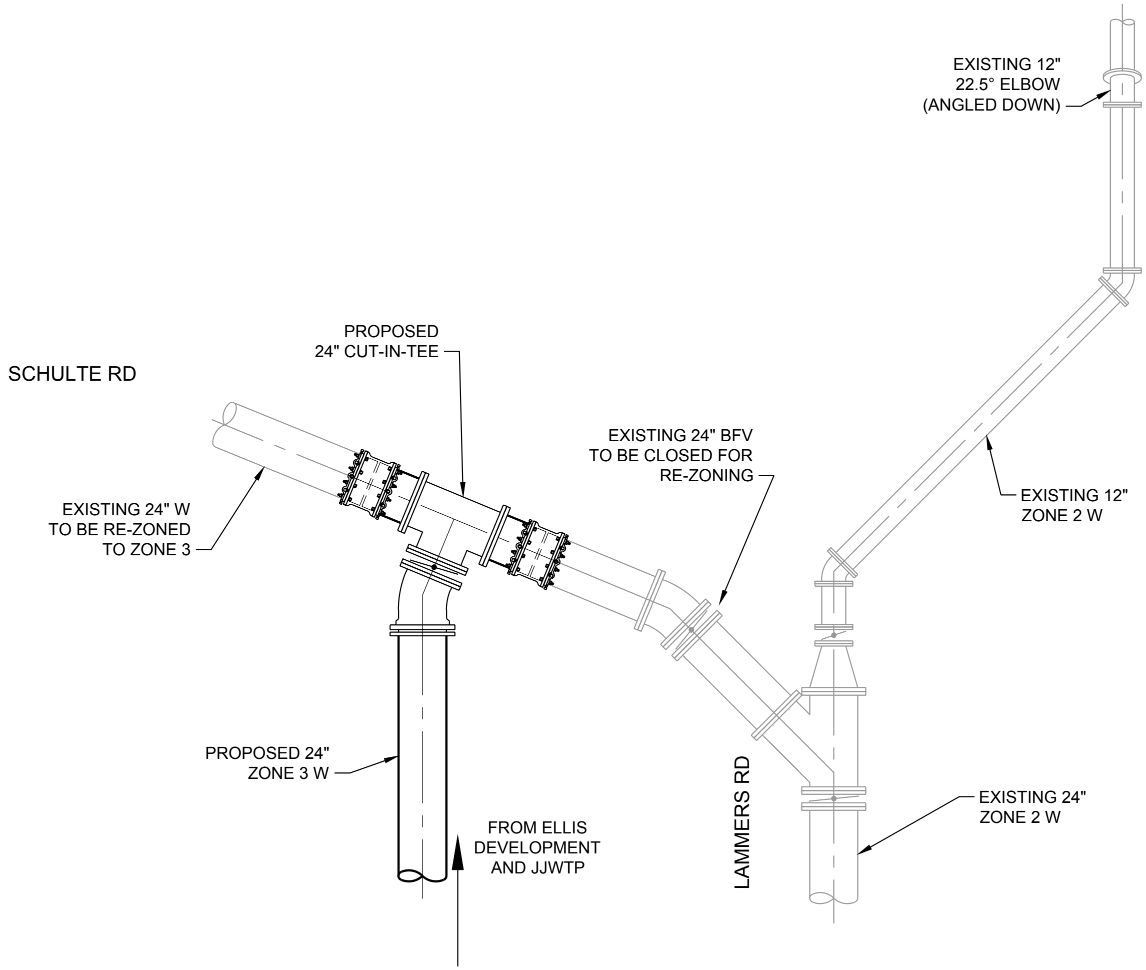
TRACY

WEST YOST ASSOCIATES

Figure 3A

Alternative 3
New Zone 3 Pipeline from Valpico Road to Schulte Road

City of Tracy
Design Recommendations for
Lammers Road Pipeline



Notes:
1. Schematic connection points are for illustrative purposes only for the conceptual understanding of the likely components involved in installing the recommended connections. These schematics are not to be used for construction purposes.

N

0 4 8
SCALE IN FEET

TRACY

WEST YOST ASSOCIATES

Figure 3B

Alternative 3
Schematic of Schulte Road and Lammers Road Connection

City of Tracy
Design Recommendations for
Lammers Road Pipeline

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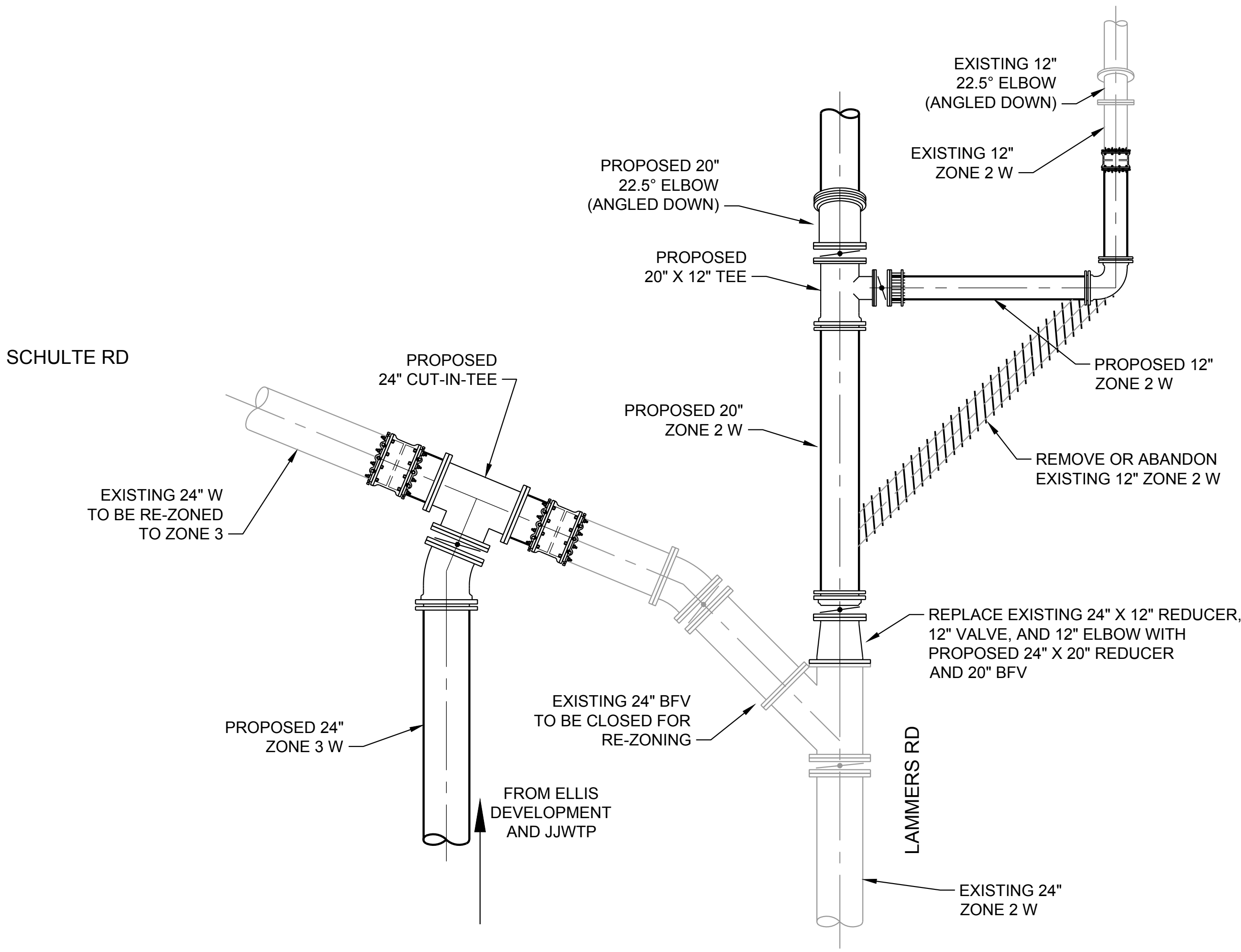


Notes:
1. Schematic connection points are for illustrative purposes only for the conceptual understanding of the likely components involved in installing the recommended connections. These schematics are not to be used for construction purposes.

N

0 4 8
SCALE IN FEET

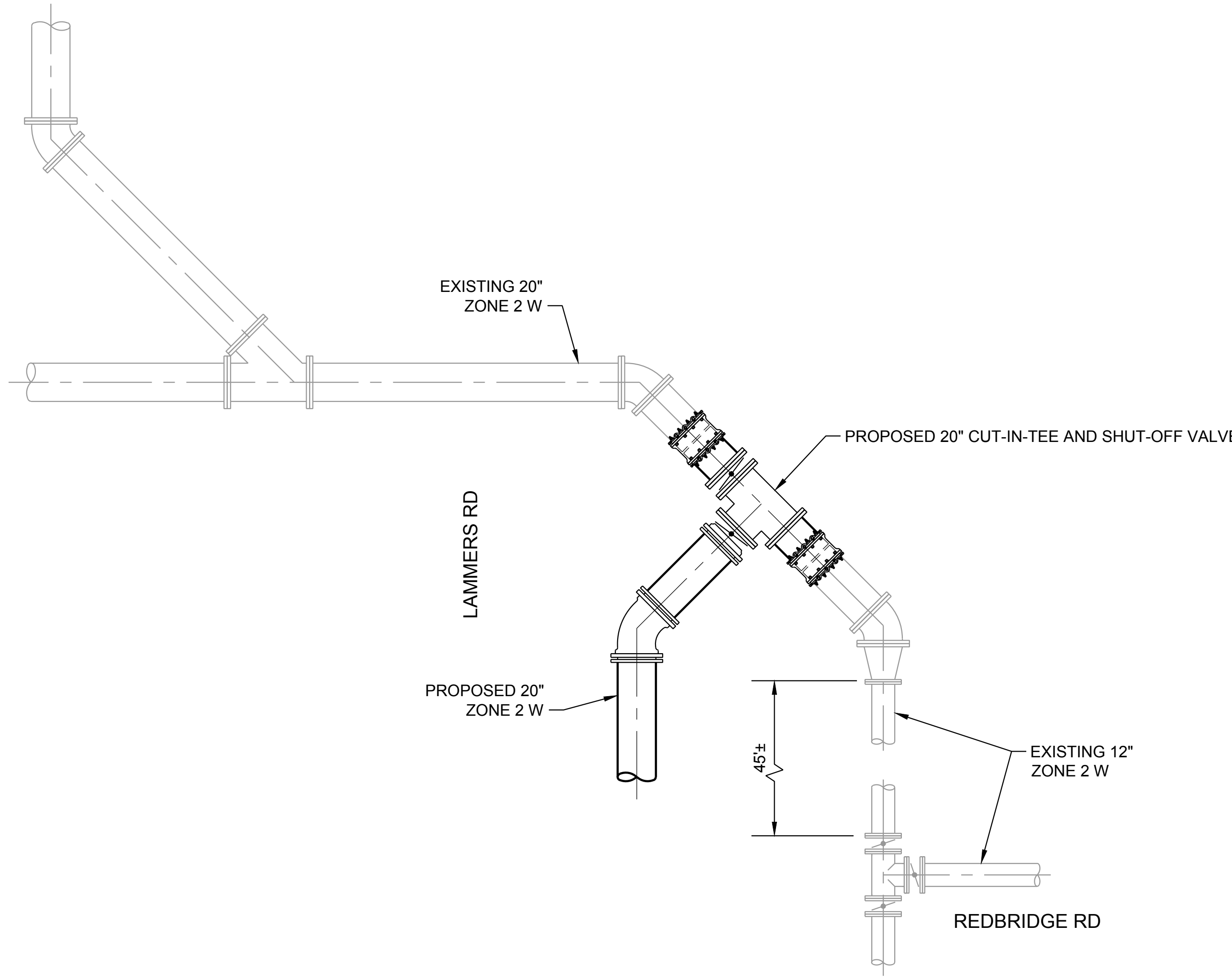
TRACY

WEST YOST ASSOCIATES

Figure 3C

Alternative 3
Schematic of Schulte Road and Lammers Road Connection with Optional Zone 2 Pipeline

City of Tracy
Design Recommendations for
Lammers Road Pipeline



Notes:

1. Schematic connection points are for illustrative purposes only for the conceptual understanding of the likely components involved in installing the recommended connections. These schematics are not to be used for construction purposes.
2. Existing pipelines presented in this schematic are based on available record drawings. Visible surface features near the intersection of Lammers Road and Redbridge Road do not match those shown on the record drawings. Configuration of existing pipelines in this area should be confirmed.

N

0 4 8
SCALE IN FEET

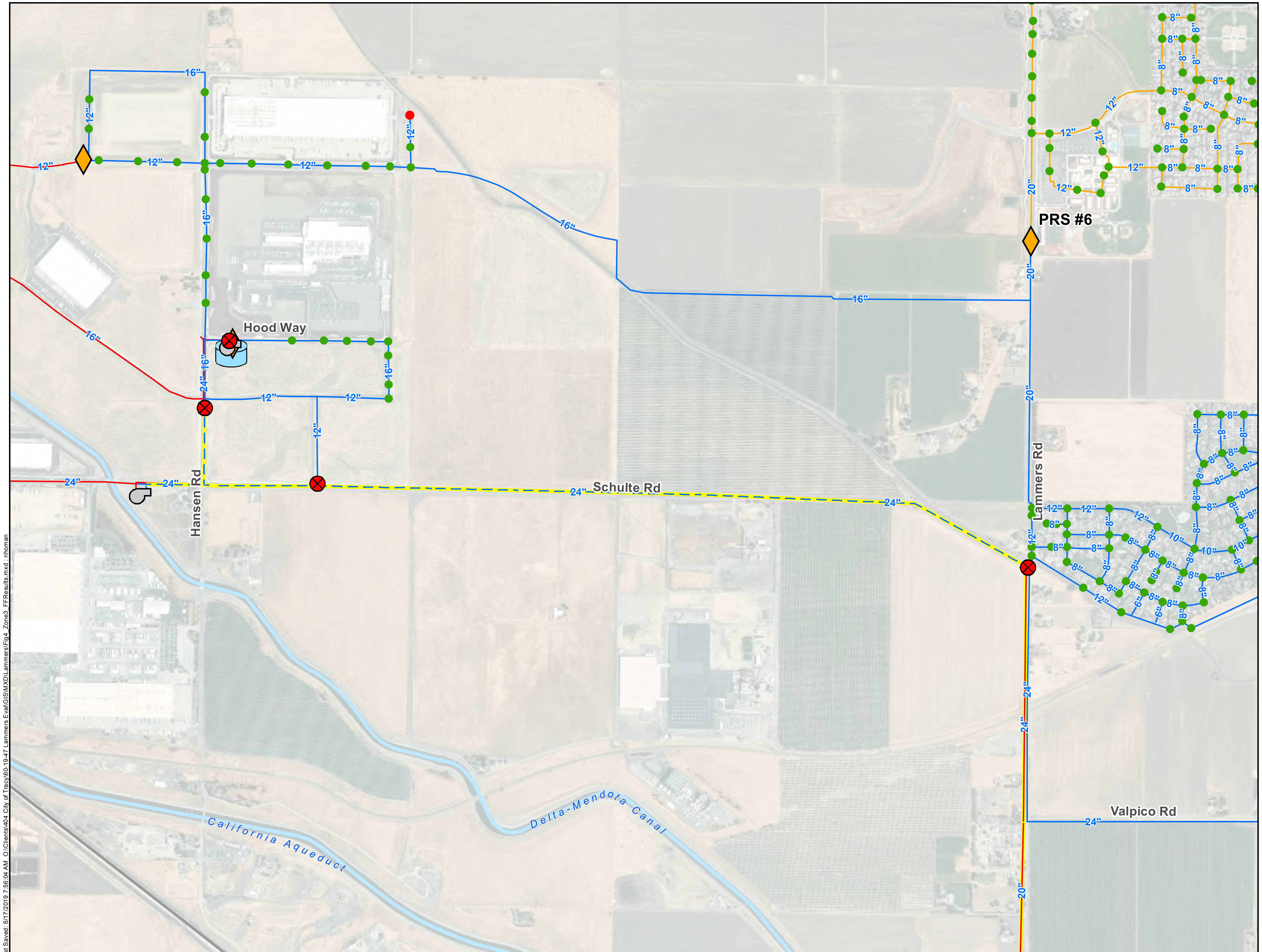
TRACY

WEST YOST ASSOCIATES

Figure 3D

Alternative 3
Schematic of Redbridge Road and Lammers Road Connection with Optional Zone 2 Pipeline

City of Tracy
Design Recommendations for Lammers Road Pipeline



N

0 600 1,200
Scale in Feet

Available Fire Flow

- Does Not Meet Requirements
- Meets Requirements
- Closed Valve Due to Re-zoning
- Pressure Regulating Station
- Booster Pump Station
- Cordes Tank
- Proposed Zone 3 Pipeline
- Existing Pipeline to be Re-zoned to Zone 3

Existing Pipeline

- Zone 1
- Zone 2
- Zone 3

Notes:
1. Results assume that connections in Hood Way and Hansen Road are constructed as recommended in the Design Recommendations for Hood Way Pipeline annotated figures.
2. Results assume that optional Zone 2 pipeline will not be constructed (see Figure 5A).
3. The available fire flow shown is the maximum flow available while maintaining 30 psi residual system pressure. Fire flow evaluation performed under maximum day demand conditions.

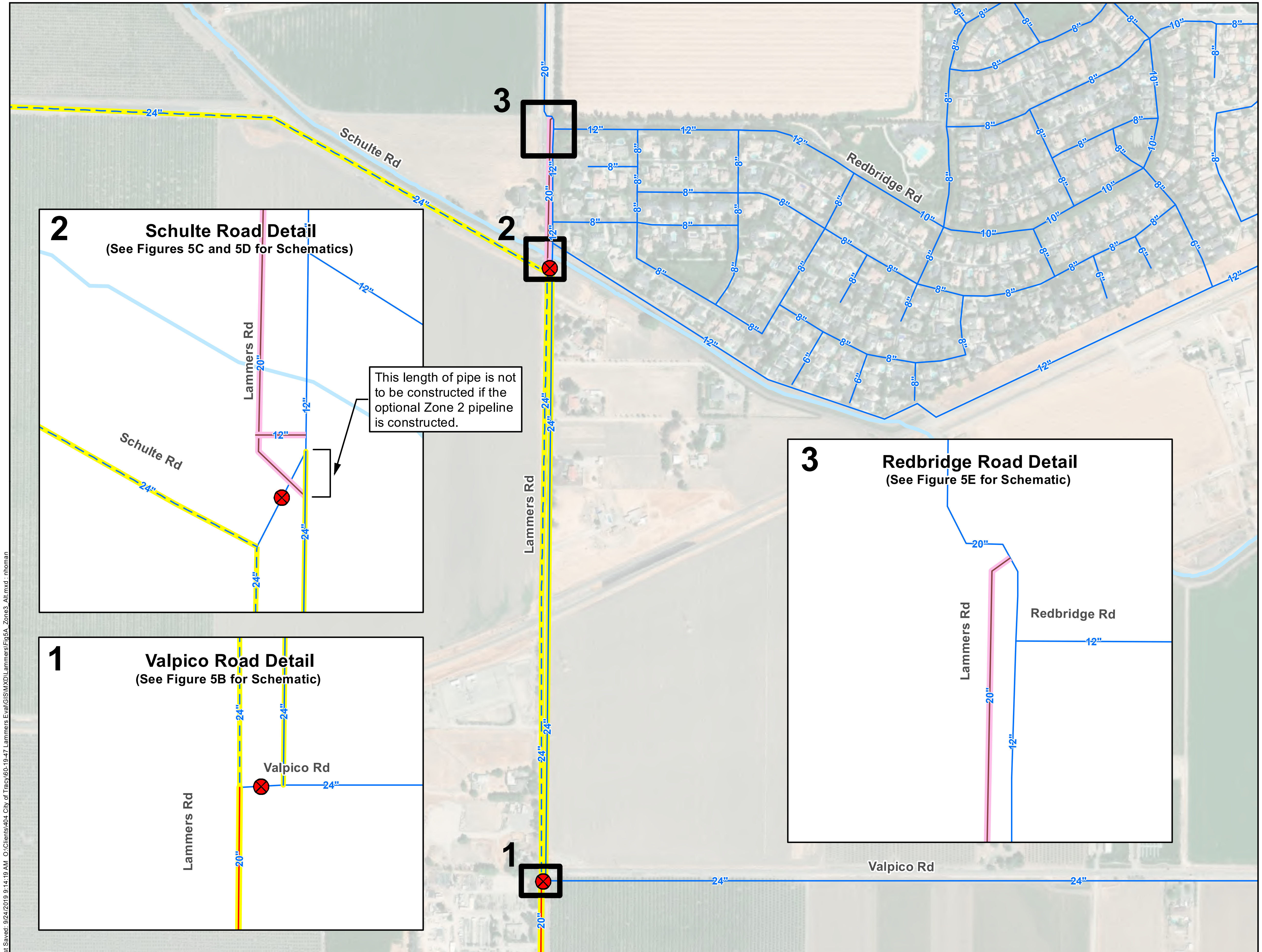
TRACY

WEST YOST ASSOCIATES

Figure 4

Alternative 3
Available Fire Flow

City of Tracy
Design Recommendations for
Lammers Road Pipeline

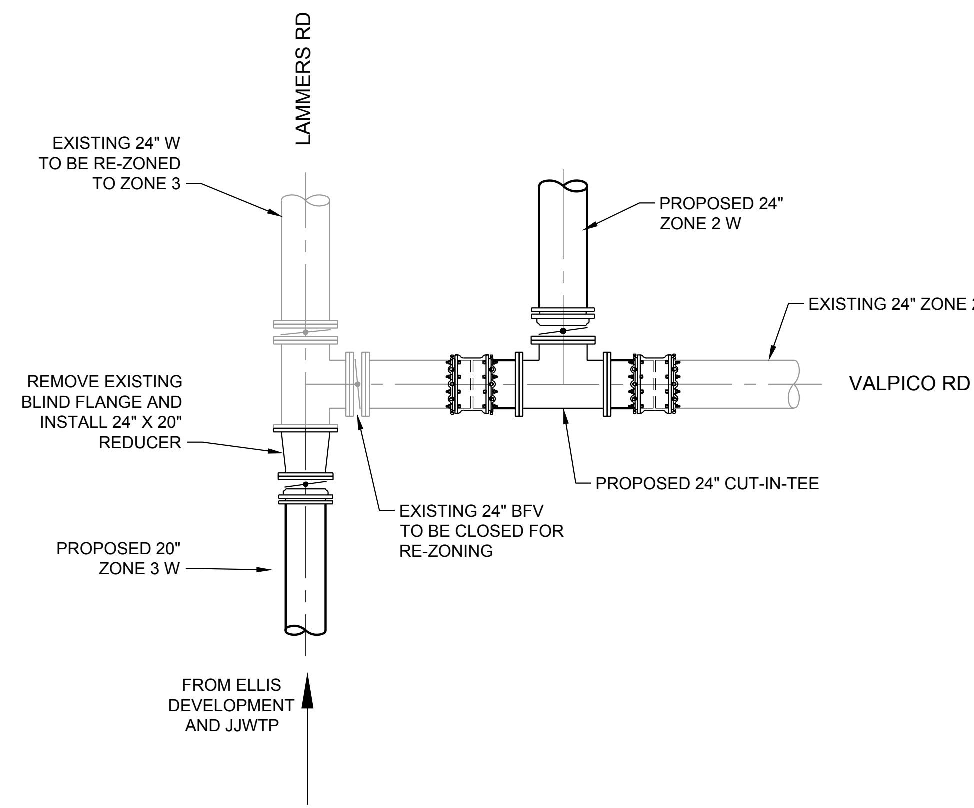


Notes:
1. Details are not to scale.

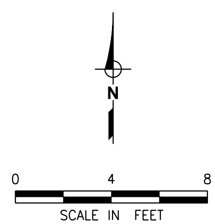
Figure 5A

Alternative 4
New Zone 2 Pipeline from Valpico Road to Schulte Road

City of Tracy
Design Recommendations for Lammers Road Pipeline



Notes:
1. Schematic connection points are for illustrative purposes only for the conceptual understanding of the likely components involved in installing the recommended connections. These schematics are not to be used for construction purposes.



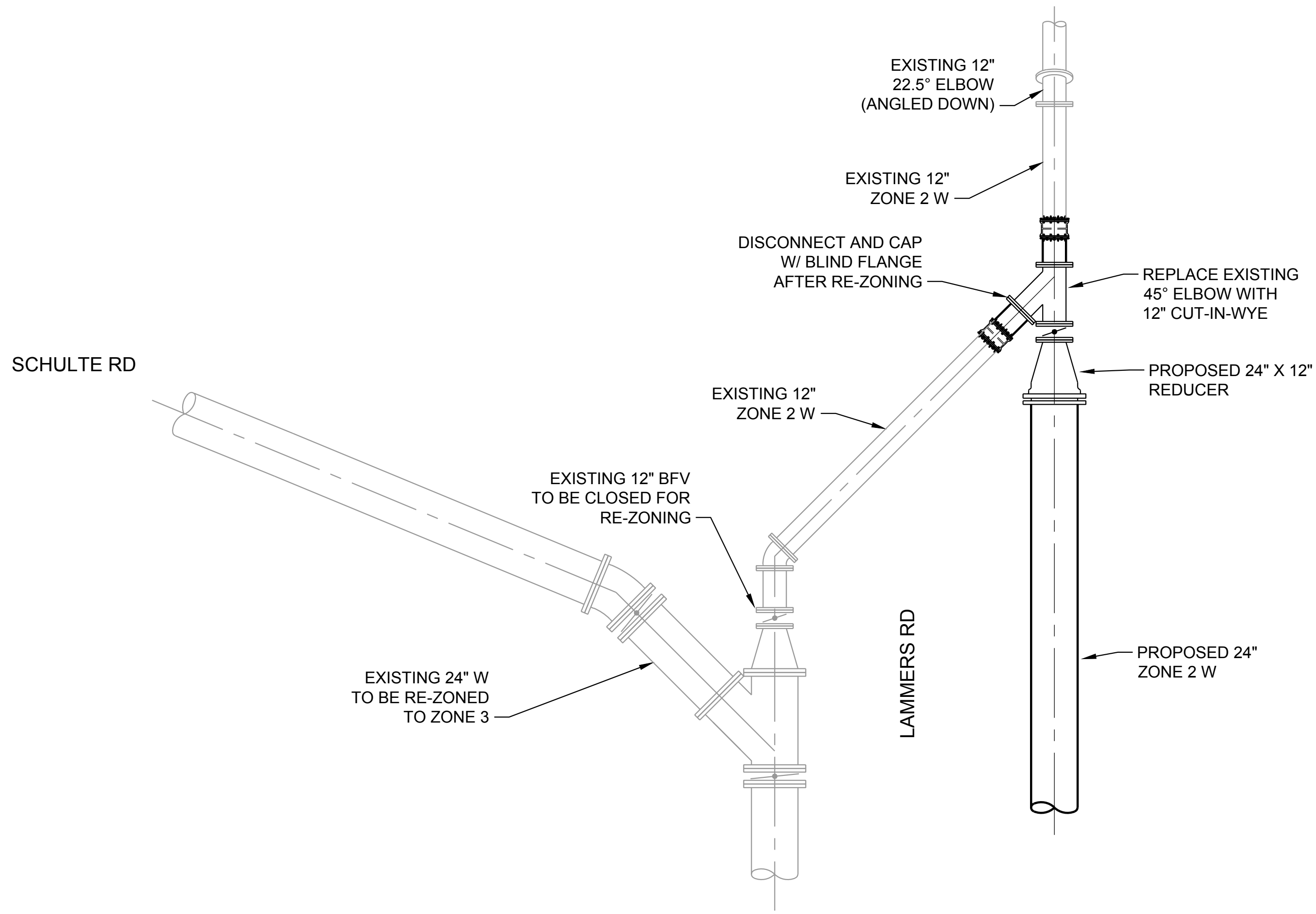
TRACY

WEST YOST ASSOCIATES

Figure 5B

Alternative 4
Schematic of Valpico Road and Lammers Road Connection

City of Tracy
Design Recommendations for
Lammers Road Pipeline



Notes:
1. Schematic connection points are for illustrative purposes only for the conceptual understanding of the likely components involved in installing the recommended connections. These schematics are not to be used for construction purposes.

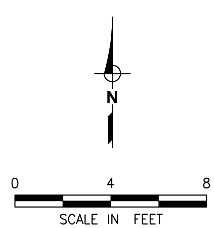
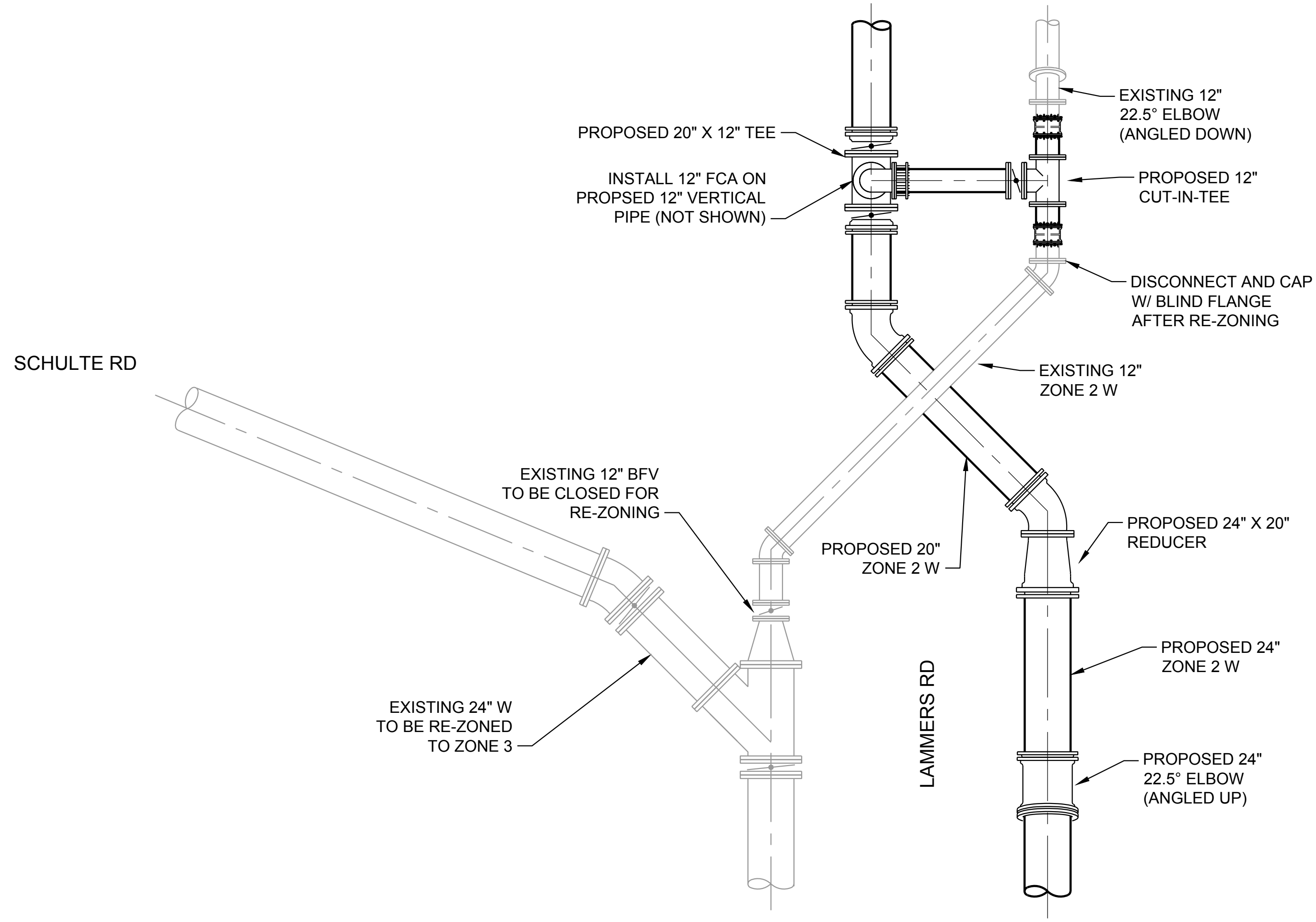


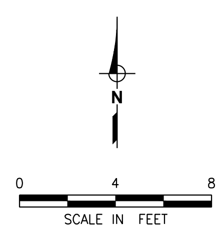
Figure 5C

Alternative 4
Schematic of Schulte Road and Lammers Road Connection

City of Tracy
Design Recommendations for
Lammers Road Pipeline



Notes:
1. Schematic connection points are for illustrative purposes only for the conceptual understanding of the likely components involved in installing the recommended connections. These schematics are not to be used for construction purposes.



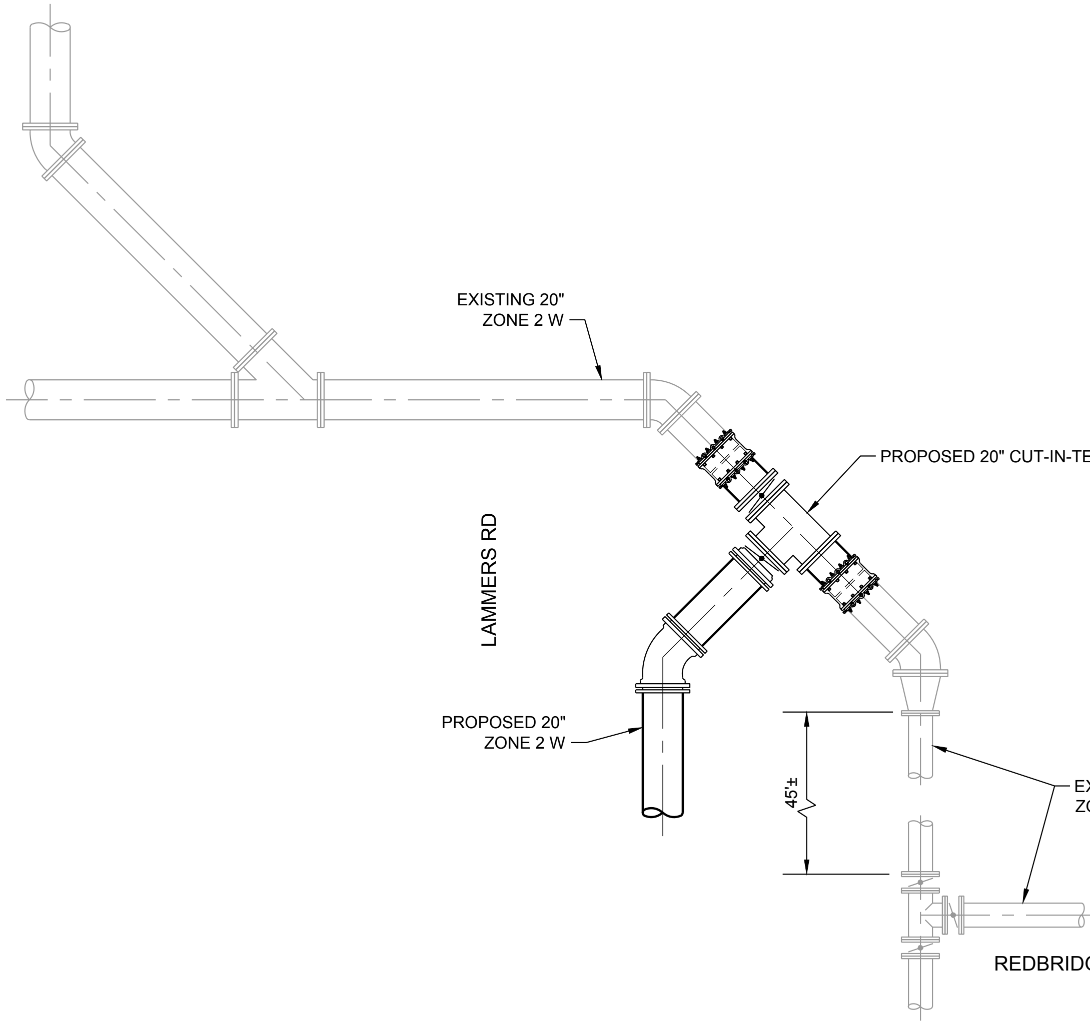
TRACY

WEST YOST ASSOCIATES

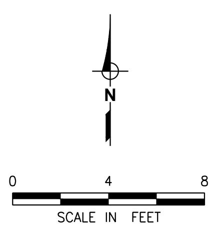
Figure 5D

Alternative 4
Schematic of Schulte Road and Lammers Road Connection with Optional Zone 2 Pipeline

City of Tracy
Design Recommendations for Lammers Road Pipeline



Notes:
1. Schematic connection points are for illustrative purposes only for the conceptual understanding of the likely components involved in installing the recommended connections. These schematics are not to be used for construction purposes.
2. Existing pipelines presented in this schematic are based on available record drawings. Visible surface features near the intersection of Lammers Road and Redbridge Road do not match those shown on the record drawings. Configuration of existing pipelines in this area should be confirmed.



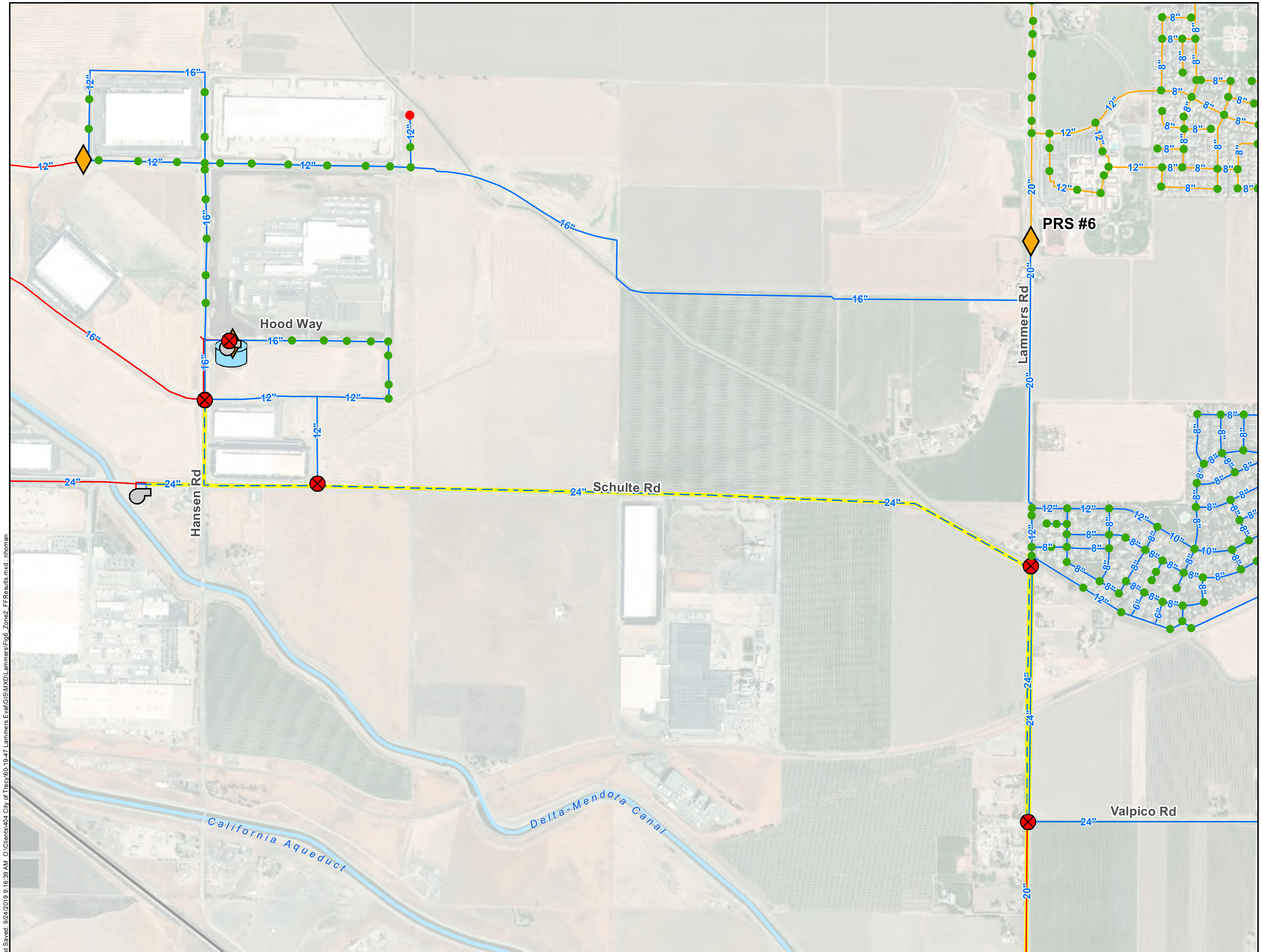
TRACY

WEST YOST ASSOCIATES

Figure 5E

Alternative 4
Schematic of Redbridge Road and Lammers Road Connection with Optional Zone 2 Pipeline

City of Tracy
Design Recommendations for Lammers Road Pipeline



0 600 1,200
Scale in Feet

Available Fire Flow

- Does Not Meet Requirements
- Meets Requirements
- Closed Valve Due to Re-zoning
- Pressure Regulating Station
- Booster Pump Station
- Cordes Tank
- Proposed Zone 3 Pipeline
- Proposed Zone 2 Pipeline
- Existing Pipeline to be Re-zoned to Zone 3

Existing Pipeline

- Zone 1
- Zone 2
- Zone 3

Notes:
1. Results assume that connections in Hood Way and Hansen Road are constructed as recommended in the Design Recommendations for Hood Way Pipeline annotated figures.
2. Results assume that optional Zone 2 pipeline will not be constructed (see Figure 5A).
3. The available fire flow shown is the maximum flow available while maintaining 30 psi residual system pressure. Fire flow evaluation performed under maximum day demand conditions.

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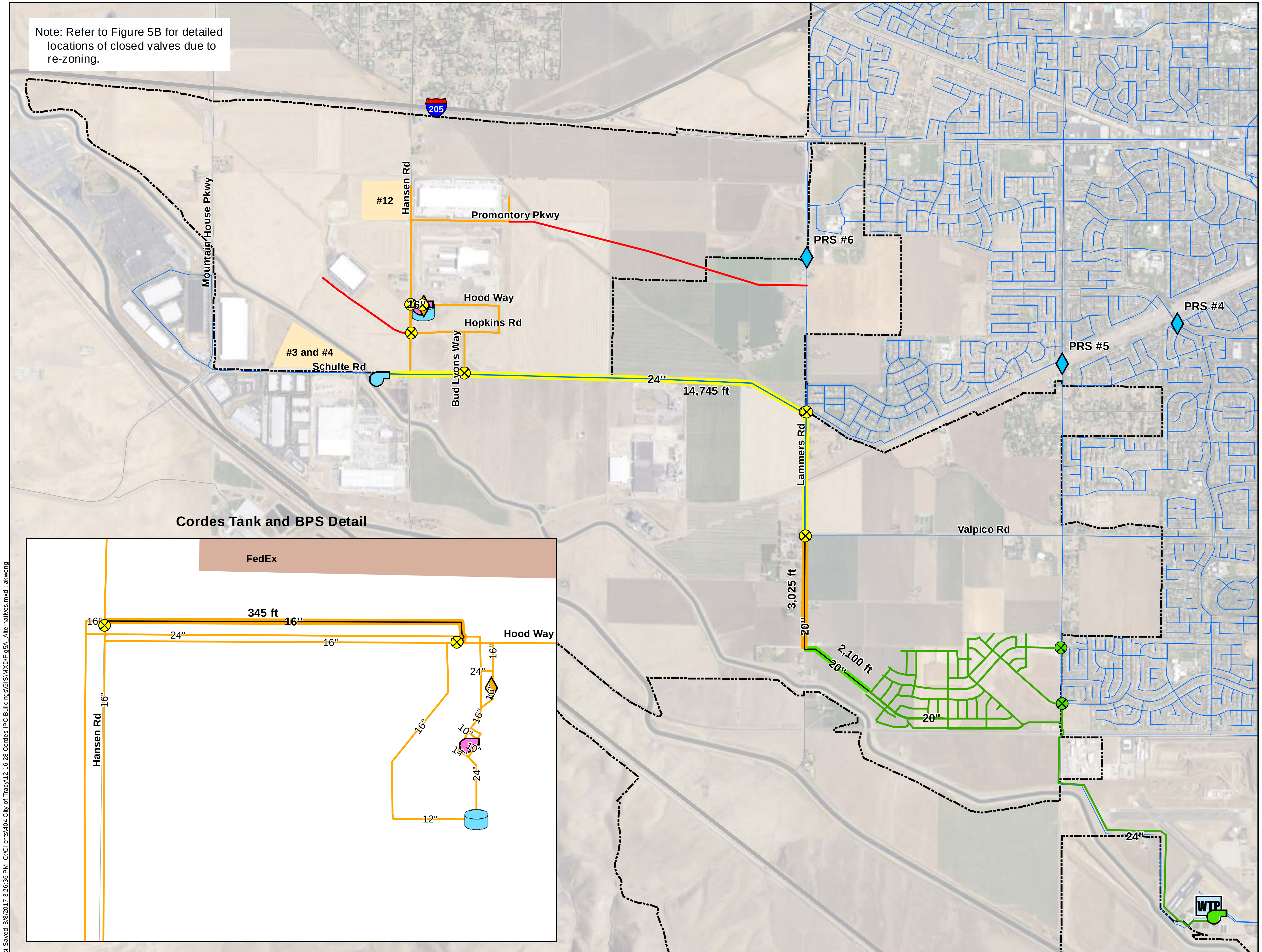
Figure 6

Alternative 4
Available Fire Flow

City of Tracy
Design Recommendations for
Lammers Road Pipeline

ATTACHMENT 1

Key Figures from Hydraulic Evaluation of
IPC Buildings 3, 4, and 12 TM, May 18, 2017



Symbology

- Closed Valve Due to Re-zoning
- Previously Proposed Check Valve
- Pressure Regulating Station #9
- Existing Pressure Regulating Station
- Cordes Booster Pump Station
- Existing Patterson Pass Booster Pump Station
- Previously Proposed Interim Booster Pump and Pressure Regulating Station
- Cordes Tank
- WTP John Jones Water Treatment Plant
- Pipeline Required for Alternative Operations (Ellis)
- Proposed Pipeline Required for Alternative Operations (IPC)
- Existing Pipeline to be Re-zoned
- Existing Pipeline
- Ellis Pipeline
- Cordes Phases 1 and 2 Pipeline
- Smuckers Pipeline
- Proposed Project
- City Limit

N

0 1,250 2,500
Scale in Feet

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Figure 5A

Proposed Alternative Operations

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12

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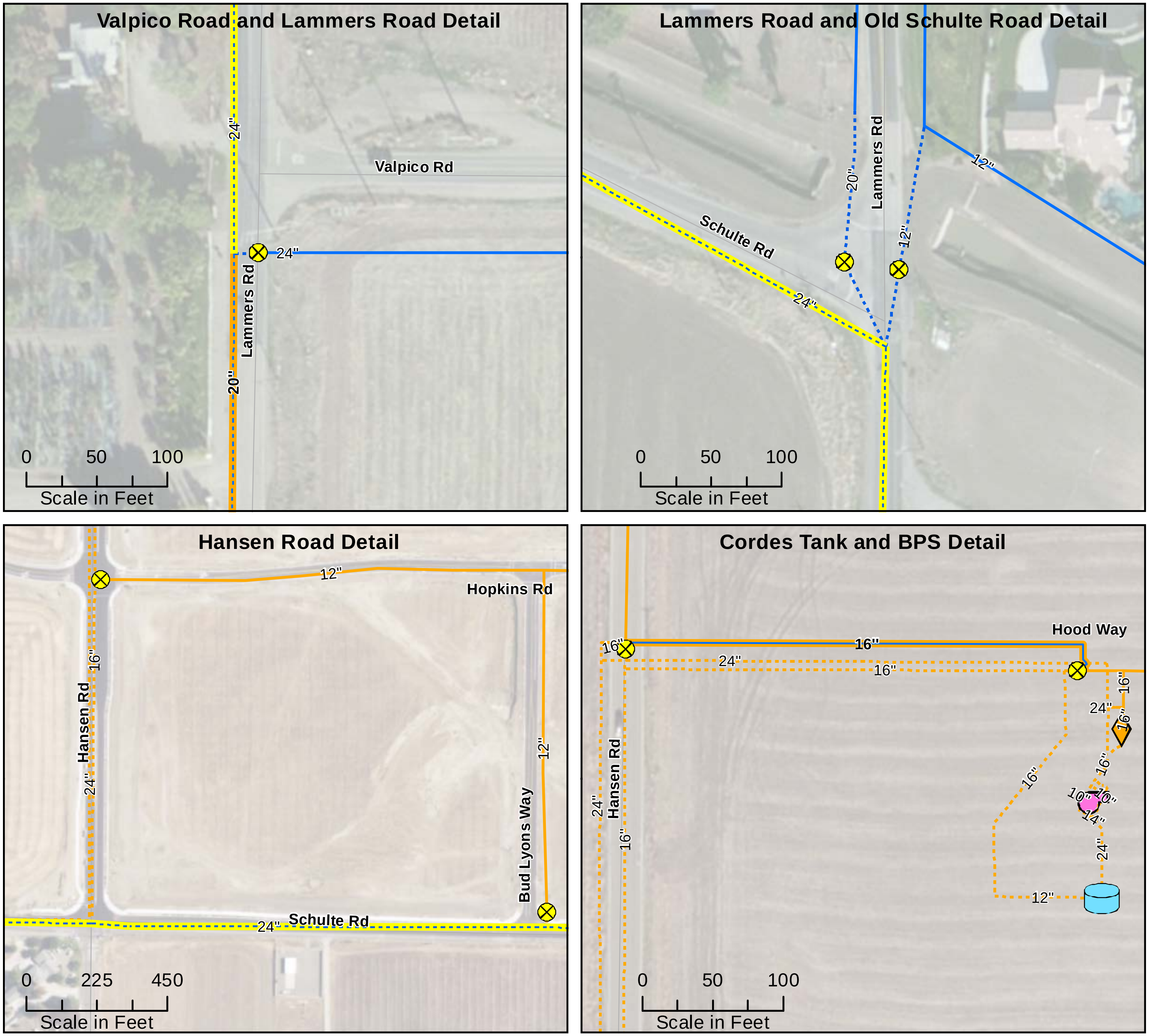

Symbology

- Closed Valve Due to Re-zoning
- Pressure Regulating Station #9
- Cordes Booster Pump Station
- Existing Patterson Pass Booster Pump Station
- Cordes Tank
- Existing Pipeline to be Re-zoned
- Proposed Zone 3 Pipeline Required for Alternative Operations (IPC)
- Proposed Zone 2 Pipeline Required for Alternative Operations (IPC)

Existing Pipeline

- Zone 2
- Zone 3

Cordes Phases 1 and 2 Pipeline

- Zone 2
- Zone 3

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Figure 5B

Proposed Alternative Operations: Details for Closed Valves

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12

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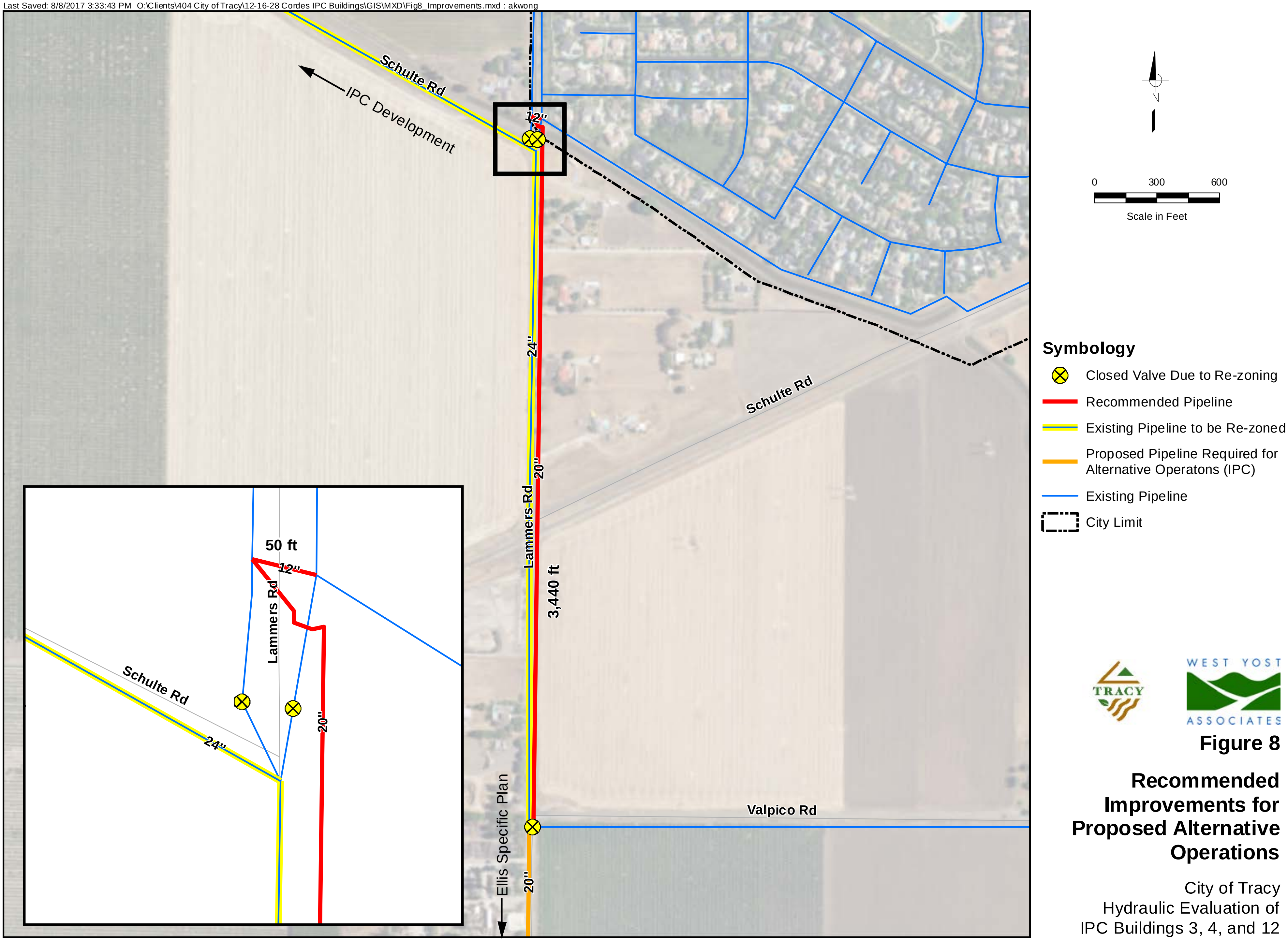

TRACY

WEST YOST ASSOCIATES

Figure 8

Recommended Improvements for Proposed Alternative Operations

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12

ATTACHMENT 2

Planning and Modeling Criteria
(2012 Citywide Water System Master Plan)

Planning and modeling criteria used to evaluate the various alternatives are based on the system performance and operational criteria developed in the 2012 Citywide Water System Master Plan. The criteria used to evaluate the existing water system and the proposed pipelines for the various alternatives are listed as follows:

- Residual pressure at the flowing hydrant (during an assumed maximum day demand plus fire flow condition) and throughout the water system must be equal to or greater than 30 pounds per square inch (psi) during the simulated fire condition.
- Minimum allowable service pressure is 40 psi during all other non-fire demand conditions.
- Maximum allowable service pressure is 80 psi. A pressure reducing valve (PRV) will be required on all water services with a static pressure greater than 80 psi and should conform with the requirements from the Uniform Plumbing Code.
- Maximum allowable distribution pipeline velocity is 12 feet per second (fps) during the simulated fire flow demand condition.
- Maximum allowable transmission and distribution pipeline velocity is 6 fps and 8 fps, respectively, during a non-fire demand condition.
- Maximum allowable head loss rate is 10 feet per 1,000 feet (ft/kft) during the simulated fire demand condition.
- Maximum head losses in distribution system pipelines should be limited to 7 ft/kft during a non-fire demand condition.
- New and required pipelines will be modeled with a roughness coefficient (C-factor) of 130.
- Available fire flow demand must meet a minimum flow of 1,500 gallons per minute (gpm), 2,500 gpm, 3,500 gpm, or 4,500 gpm depending on land use during a maximum day demand condition. These required fire flow demands assume that buildings are sprinklered.
- The 2012 Master Plan hydraulic model of the City's water distribution system was used as the basis for evaluation.[1] However, the hydraulic model was updated to include the following major existing system improvements:
  - Improvements that have been recently constructed on South Lammers Road (20-inch diameter pipeline and pressure regulating station (PRS #6)); and
  - Proposed improvements on South MacArthur Drive (24-inch diameter pipeline).

[1] This hydraulic model was updated to include projected water demands from new developments such as Valpico and MacDonald Apartments, Sierra Hills (Aspire I) Apartments, Tiburon Village, Middlefield Drive Apartments and Self-Storage Facility, I-205 Parcels M1 and M2 and Infill Parcels 7 and 13, Grant Line Road Apartments, South Lammers Road Development, Aspire II Development, Pescadero IPT Development, first three buildings at Cordes Ranch, Ellis Specific Plan Phase 1A and Phase 1A Extension, Marriott TownePlace Suites, Larch Clover Interim Annexation, Ellis Specific Plan Phase 2 - The Gardens, IPC Buildings 3, 4, and 12, IPC Building 25, IPC Buildings 22, 23, and Thermo Fisher, Tracy Village Specific Plan, Avenues Specific Plan, IPC Buildings 9, 10, and 14, NEI Specific Plan, and Tracy Hills Phases 1A, 1B, and 1C. City staff also requested West Yost to incorporate the following developments, which were evaluated by Black Water Consulting Engineers, Inc. into the City's hydraulic model: Barcelona Infill, Berg Road Properties, Harvest Apartments, 321 E. Grant Line Apartments, Project Hawk/IPC, and Home 2 Suites.

WEST YOST ASSOCIATES

TECHNICAL MEMORANDUM

DATE:	November 11, 2019	Project No.: 404-60-19-47 SENT VIA: EMAIL
TO:	Zabih Zaca, City of Tracy	
CC:	Robert Armijo, City of Tracy Paul Verma, City of Tracy Al Gali, City of Tracy Nanda Gottiparthy, SNG & Associates, Inc.	
FROM:	Nathaniel Homan, PE, RCE #89903 Jim Connell, PE, RCE #63052	
REVIEWED BY:	Amy Kwong, PE, RCE #73213	
SUBJECT:	Design Recommendations for Hood Way Pipeline	

REGISTERED PROFESSIONAL ENGINEER JAMES P. CONNELL No. 63052 Exp. 6-30-20 CIVIL STATE OF CALIFORNIA

In a technical memorandum (TM) prepared for the City of Tracy (City) titled *Hydraulic Evaluation of International Park of Commerce (IPC) Buildings 3, 4, and 12*, dated May 18, 2017, West Yost Associates (West Yost) recommended that 345 lineal feet (lf) of 16-inch diameter City-side Pressure Zone 2 (Zone 2) transmission main be constructed in Hood Way. The purpose of this recommended pipeline improvement was to provide pipeline network looping for Zone 2 pipelines located in Hood Way and Hansen Road after portions of the existing Zone 2 transmission main system are re-zoned to City-side Pressure Zone 3 (Zone 3).

This TM summarizes the findings and conclusions of West Yost's technical evaluation of the feasibility of constructing two shorter 16-inch diameter connections in Hood Way and Hansen Road, in place of the previously recommended pipeline. The locations of the proposed connections are shown on Figure 1.

The proposed connection in Hood Way would consist of approximately 36 lf of 16-inch diameter pipeline connecting the existing 16-inch diameter Zone 2 Cordes Tank fill line with the existing 24-inch diameter Zone 3 Cordes Pump Station discharge line. A detailed schematic of this connection is shown on Figure 2. An existing 16-inch butterfly valve would be permanently closed to re-zone the Cordes Tank fill line to Zone 3.

The proposed connection in Hansen Road would consist of approximately 20 lf of 16-inch diameter pipeline connecting the existing 16-inch diameter Zone 2 pipeline and the existing 24-inch diameter Zone 3 pipeline in Hansen Road. A detailed schematic of this connection is shown on Figure 3. This connection would be placed approximately 135 ft south of the intersection of Hopkins Road and Hansen Road to take advantage of the existing butterfly valve on the 24-inch diameter pipeline. This existing butterfly valve would be used to isolate the 24-inch diameter pipeline between Schulte Road and Hopkins Road so that the pipeline in Hopkins Road west of Hansen Road could continue to serve Zone 3 during construction. The existing butterfly valve would be re-opened after construction is completed. The proposed new butterfly valve, to be installed north of the proposed cut-in-tee on the 16-inch diameter pipeline, would be permanently closed to re-zone the 16-inch diameter pipeline south of the proposed connection to Zone 3.

These proposed connections have two advantages over the previously recommended pipeline:

1. The total length of new pipeline required is 289 ft shorter than the previously recommended pipeline, making this alternative less expensive.
2. The proposed connections preserve the existing Zone 2 pipeline loop in Hansen Road, Hood Way, and Hopkins Road, unlike the alternative recommended in the May 2017 TM, which would break this loop by re-zoning the existing 16-inch diameter Zone 2 pipeline in Hansen Road between Hood Way and Hopkins Way to Zone 3.

After reviewing available plans and record drawings of the proposed construction areas, West Yost determined that the proposed connections are constructible. West Yost recommends the City construct the proposed connections instead of constructing the pipeline recommended in the May 2017 TM.

It should be noted that the re-zoning will close the valve at the southern end of the 12-inch diameter pipeline in Bud Lyons Way. This will create a long stretch of dead-end pipe and could potentially lead to water quality issues. Solutions to address these issues include:

1. Placing the water service lateral for the future building located east of Bud-Lyons Way as close as possible to the southern end of Bud Lyons Way. The demands from the building would keep water flowing through the pipeline and prevent stagnant water from forming.
2. Abandoning the pipeline in Bud Lyons Way. This option is only feasible if this pipeline is not needed for future water service connections.
3. Implementing a program to regularly flush the pipeline using a hydrant or blow off valve near the southern end of Bud Lyons Way.

This TM is submitted in accordance with West Yost's January 2019 Scope of Services. No estimates of infrastructure costs were developed as part of this evaluation. The locations of existing pipelines and valves shown on the figures attached here-in should be confirmed prior to design. If existing pipelines or valves are not as shown on the reviewed plans and record drawings, additional evaluation of the feasibility of the recommended connections may be required.

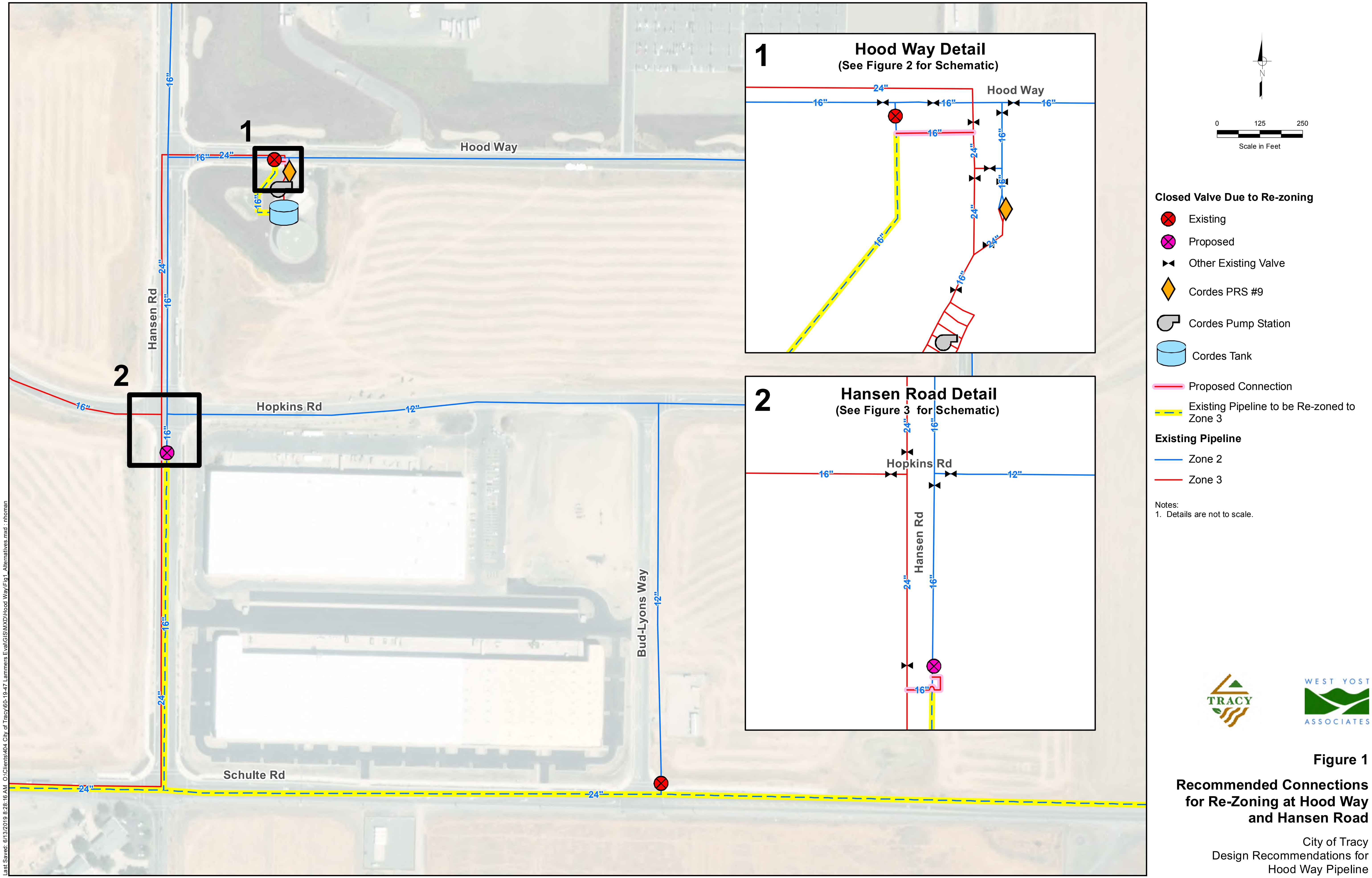

Figure 1

Recommended Connections for Re-Zoning at Hood Way and Hansen Road

City of Tracy
Design Recommendations for Hood Way Pipeline

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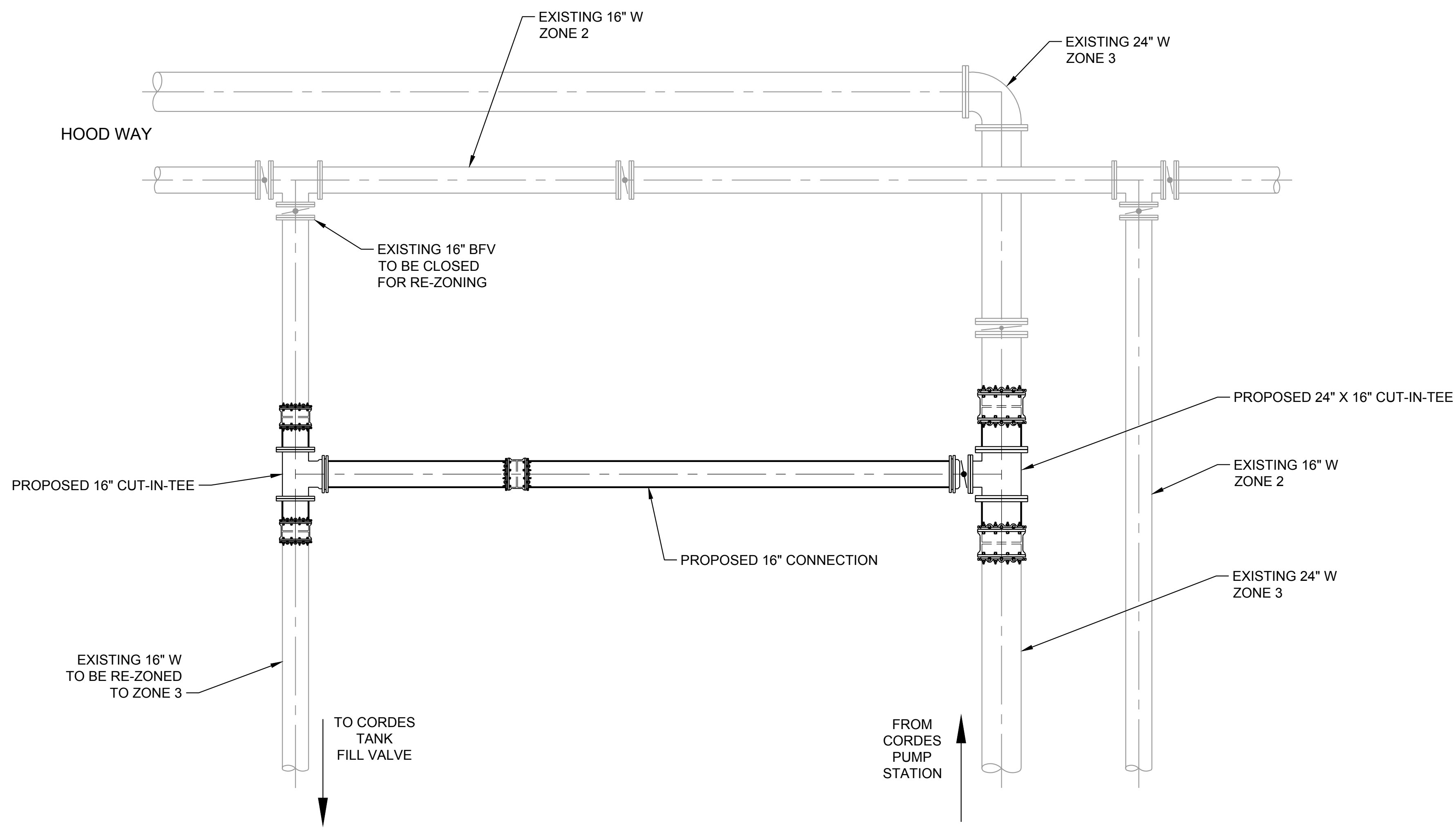
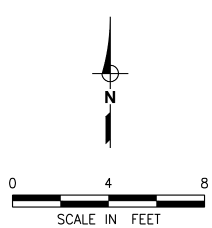


Notes:
1. Schematic connection points are for illustrative purposes only for the conceptual understanding of the likely components involved in installing the recommended connections. These schematics are not to be used for construction purposes.



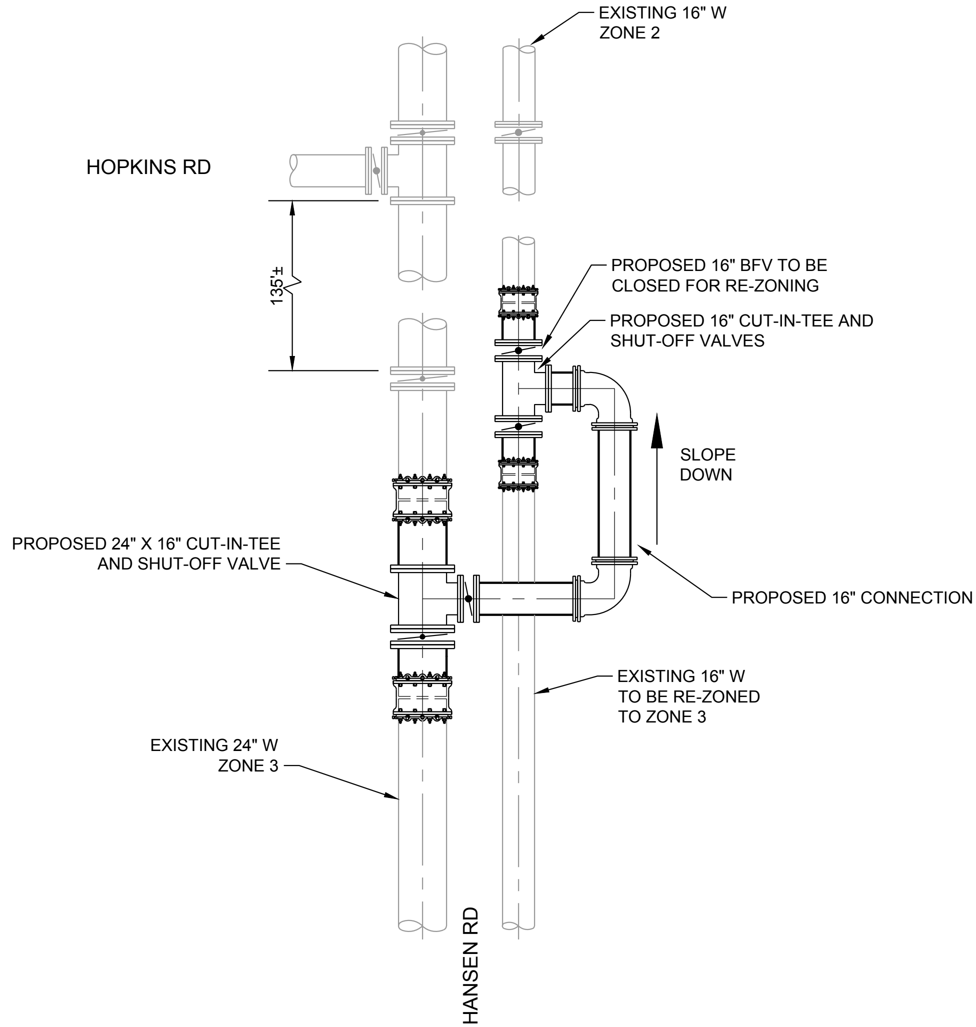
TRACY

WEST YOST ASSOCIATES

Figure 2

Schematic
Hood Way Connection

City of Tracy
Design Recommendations for
Hood Way Pipeline



Notes:
1. Schematic connection points are for illustrative purposes only for the conceptual understanding of the likely components involved in installing the recommended connections. These schematics are not to be used for construction purposes.

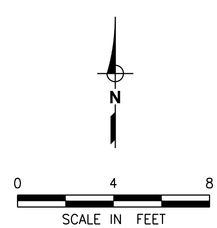


Figure 3

Schematic
Hansen Road Connection

City of Tracy
Design Recommendations for
Hood Way Pipeline

APPENDIX E

Cost Estimating Assumptions

This appendix details West Yost's assumptions for estimating probable construction costs for the recommended potable and recycled water system facilities. Construction costs were developed based on a combination of data supplied by manufacturers, published industry standard cost data and curves, construction costs for similar facilities built by the City and/or other public agencies, and construction costs previously estimated by West Yost for similar facilities with similar construction cost indexes.

The costs presented in this appendix are for construction only and do not include estimating or construction uncertainties (e.g., variations in final quantities) or cost estimates for engineering, legal services, environmental review, inspections, and/or contract administration. Some of these items are referred to as contingency costs or mark-ups and are addressed in the last section of this appendix. It should also be noted that the construction costs presented in this appendix represent capital infrastructure costs and do not include costs for purchase of additional surface water supplies, supply reliability, or operation and maintenance.

All estimated construction costs have been adjusted to reflect 2020 dollars and should be used for conceptual cost estimates only and be updated regularly. Construction costs presented in this appendix are not intended to represent the lowest prices in the industry for each type of construction; rather they are representative of average or typical construction costs. These planning-level construction cost estimates have been prepared for guidance in evaluating various facility improvement options and are intended only for budgetary purposes within the context of this master planning effort.

The following sections of this appendix describe the assumptions used to estimate the probable construction costs for the planning and design of recommended water system facilities for the City's potable and recycled water systems:

- Land Acquisition Costs
- Potable Water System Construction Costs
- Recycled Water System Construction Costs
- Contingency Costs or Mark-ups

E.1 LAND ACQUISITION COSTS

It is assumed that land for buildout potable and recycled water facilities will be acquired at $190,000 per acre. Costs for land acquisition will only be added to major facilities such as tank sites where a large parcel is required. Consequently, land acquisition costs do not include right-of-way acquisition costs for transmission and distribution mains.

E.2 POTABLE WATER SYSTEM CONSTRUCTION COSTS

The following sections present the construction cost estimates used to project probable construction costs for recommended water system facilities in the City's potable water system and are categorized by improvement project type.

E.2.1 Treated Water Storage Reservoirs

Table 1 summarizes the estimated construction costs for treated water storage reservoirs between the size range of 0.5 to 6.0 MG. These costs generally include the installation of the storage tank, site piping, earthwork, paving, instrumentation, and related sitework. These costs are representative of construction conducted under normal excavation and foundation conditions and would be significantly higher for special or difficult foundation requirements.

It is recommended that new potable water storage reservoirs be partially buried prestressed concrete tanks to minimize impacts to developable land. These reservoirs could be located beneath City parks, allowing other uses of the land above the proposed reservoirs.

Table 1. Construction Costs for Treated Water Storage Reservoirs(a)

Capacity, MG	Estimated Construction Cost, million dollars(b) Partially Buried Prestressed Concrete
0.5	2.5
1.0	3.0
2.0	4.0
3.0	4.9
4.0	5.9
5.0	6.9
6.0	7.8

(a) Based on 2020 dollars.
(b) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

E.2.2 Aquifer Storage and Recovery Production Wells

Aquifer Storage and Recovery (ASR) well construction consists of pilot hole drilling, water quality/soil sampling, pilot hole reaming, well construction, well development and providing the necessary housing, pump, motor, automatic control equipment (SCADA), discharge piping, and disinfection equipment. All new groundwater wells will be designed to allow for both injection and extraction of water supplies in conjunction with the City's proposed ASR Well Program.

Construction costs for new groundwater wells are estimated to be approximately $3,900,000 per well (assuming a well capacity of 2,500 gpm). For wells with a capacity of 1,000 gpm, estimated construction costs are approximately $2,500,000 per well. These estimates are based on recent bids for similarly sized wells and representative of construction conducted under normal drilling conditions. Costs would be significantly higher for special or difficult locations.

E.2.3 Treated Water Booster Pump Stations

Booster pump stations will be required at ground-level and below-grade reservoirs to lift water to the appropriate pressure zones. Estimated average construction costs for distribution pumping stations, as shown in Table 2, are based on enclosed stations with architectural and landscaping treatment suitable for residential areas. Booster pump station costs can vary considerably, depending on architectural design, pumping head, and pumping capacity. Therefore, these costs presented below are representative of construction conducted under common or normal conditions and would be significantly higher for special or difficult conditions.

Booster pump station cost estimates include the installation of the booster pumps, site piping, earthwork, paving, a chemical feed system (hypochlorite), on-site backup/standby power generator, SCADA, and related sitework. Station designs will be based on the City's typical booster pump station configurations, which include 2 to 4 variable speed booster pumps installed in parallel to accommodate varying water demand conditions.

Table 2. Construction Costs for Treated Water Booster Pump Stations[(a)]

Firm Capacity[(b)], mgd	Estimated Construction Cost, million dollars[(c)]
0.5	1.3
1	1.4
2	1.5
3	1.7
5	2.0
10	2.8

(a) Based on 2020 dollars.
(b) Equal to the total pumping capacity with the largest pump out of service or on standby.
(c) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

E.2.4 Pipelines

Unit construction costs for potable water pipelines 8 through 36 inches in diameter are provided in Table 3. These unit costs are categorized by typical pipeline construction either in developed (e.g., in urban or suburban roads) or undeveloped (e.g., across open fields or in rural roads) areas and are representative of pipeline construction conducted under common or normal conditions. Special or difficult conditions would increase costs significantly.

The unit construction costs presented below generally include pipeline materials, trenching, placing and jointing pipe, valves, fittings, hydrants, service connections, placing imported pipe bedding, native backfill material, and partial asphalt pavement replacement, if required. However, the costs presented in Table 3 do not include jacking and boring pipe or constructing boring and receiving pits. It is assumed the total cost to construct one boring pit and one receiving pit is $40,000. Pipeline jack and bore costs are shown in Table 4 and should be added where required.

Table 3. Unit Construction Costs for Pipelines[a,b]		
Pipeline Diameter, inches	Unit Construction Cost, dollars/linear foot[c]	
	Developed Areas	Undeveloped Areas
8	190	160
10	220	185
12	260	225
14	300	255
16	335	285
18	370	315
20	400	340
24	465	395
30	565	480
36	660	560

(a) Based on 2020 dollars.
(b) Costs based on ductile iron cement-lined pipe.
(c) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

Table 4. Unit Construction Costs for Jack and Bore[a]	
Pipeline Size	Unit Construction Cost, dollars/linear foot[b,c]
8-inch pipe (16-inch casing)	520
12-inch pipe (21-inch casing)	595
16-inch pipe (24-inch casing)	690
20-inch pipe (30-inch casing)	845
24-inch pipe (36-inch casing)	995
30-inch pipe (42-inch casing)	1,115
54-inch pipe (66-inch casing)	1,700
Tunnel	3,540

(a) Based on 2020 dollars.
(b) Conductor pipe is not included in cost.
(c) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

E.2.5 Pressure Regulating Stations and Pressure Reducing Valves

Interconnections (i.e., pressure regulating station or pressure reducing valve) are required to provide water supply between pressure zones during peak demands and/or emergency conditions. The estimated construction cost for a pressure regulating station is $250,000, while construction of a pressure reducing valve is estimated at $125,000. These costs are representative of construction conducted under normal conditions and would be significantly higher for special or difficult conditions.

Construction cost estimates for a pressure regulating station include the installation of a 12-inch diameter control valve, a concrete utility vault, access hatches, site piping, earthwork, paving, SCADA, and related sitework. Construction cost estimates for a pressure reducing valve include the same items as a pressure regulating station; however, since a pressure reducing valve is typically used for emergency conditions, it requires a less complicated control valve and does not include SCADA installation.

E.2.6 Backup Power Generators

On-site backup power generators are recommended so pumps can continue delivering water to the distribution system in the event of a power outage. These generators should be sized to meet the power demands of the pumps. The construction cost for a new on-site backup power generator is estimated to be approximately $250,000. This cost is representative of construction conducted under normal conditions and would be significantly higher for special or difficult conditions.

E.2.7 SCADA System Improvements

SCADA system improvements are recommended to provide operators with real-time system data and flexibility in system operations. The construction cost for the installation of SCADA monitoring is estimated to be $125,000. This cost is representative of construction conducted under normal conditions and would be significantly higher for special or difficult conditions. Any discrepancies or inaccurate data tags should also be corrected to provide accurate real-time system flow and pressure monitoring.

E.3 RECYCLED WATER SYSTEM CONSTRUCTION COSTS

The following sections present the construction cost estimates used to project probable construction costs for recommended recycled water system facilities and are categorized by improvement project type.

The construction cost estimates of the recycled water system are based on similar assumptions to the construction cost estimates of the potable water system.

E.3.1 Recycled Water Storage Reservoirs

For partially buried prestressed concrete tanks, estimated storage reservoir costs are the same for recycled water and potable water and are repeated in Table 5 for reference. Table 5 also includes estimated costs for above ground, welded steel storage reservoirs. Costs for both concrete and welded steel tanks generally include the installation of the storage tank, site piping, earthwork, paving, instrumentation, and related sitework. Estimates are representative of construction conducted under normal excavation and foundation conditions and would be significantly higher for special or difficult foundation requirements. It is assumed that the recommended Zone A Tank (refer to Chapter 9) will be an above ground welded steel storage reservoir, while the remaining recommended storage reservoir(s) for the recycled water system will be partially buried prestressed concrete tanks.

Table 5. Construction Costs for Recycled Water Storage Reservoirs[a]		
Capacity, MG	Estimated Construction Cost, million dollars[b]	
	Partially Buried Prestressed Concrete	Welded Steel
0.5	2.5	1.7
1.0	3.0	2.1
2.0	4.0	2.9
3.0	4.9	3.7
4.0	5.9	4.5
5.0	6.9	5.3
6.0	7.8	6.0

(a) Based on 2020 dollars.
(b) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

E.3.2 Recycled Water Booster Pump Stations

Additional recycled water booster pump stations will be required at the Holly Drive WWTP and other locations to lift recycled water to the appropriate pressure zones. Estimated average construction costs for distribution pumping stations, as shown in Table 6, are based on enclosed stations with architectural and landscaping treatment suitable for residential areas. Booster pump station costs can vary considerably, depending on factors such as architectural design, pumping head, and pumping capacity. Therefore, these costs presented below are representative of construction conducted under common or normal conditions and would be significantly higher for special or difficult conditions.

Costs presented in Table 6 are discounted 10 percent from the potable water booster pump station costs presented in Table 2. This is because: (1) recycled water booster pump stations do not need to deliver design flows using firm capacity, so one fewer pump is required; and (2) they do not require backup generators.

Recycled water booster pump station cost estimates include the installation of the booster pumps, site piping, earthwork, paving, SCADA, and related sitework. Station designs will be based on the City's typical booster pump station configurations, which include 2 to 4 variable speed booster pumps installed in parallel to accommodate varying water demand conditions.

Table 6. Construction Costs for Recycled Water Booster Pump Stations[a]

Total Capacity, mgd	Estimated Construction Cost, million dollars[b]
0.5	1.2
1	1.2
2	1.4
3	1.5
5	1.8
10	2.6

(a) Based on 2020 dollars.
(b) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

E.3.3 Recycled Water Pipelines

Unit construction costs for recycled water pipelines 8 inches and 12 inches in diameter are slightly less than for potable water pipelines, because the 8-inch and 12-inch diameter recycled water pipeline material is assumed to be PVC instead of ductile iron. For recycled water pipelines 16 inches through 36 inches in diameter, the material is assumed to be ductile iron, so the unit construction costs for these larger diameter recycled water pipelines are the same as for the corresponding potable water pipelines. Estimated pipeline unit costs are provided in Table 7 and are categorized by typical pipeline construction either in developed (e.g., in urban or suburban roads) or undeveloped (e.g., across open fields or in rural roads) areas. These costs are representative of pipeline construction conducted under common or normal conditions and would be significantly higher for special or difficult conditions.

The unit construction costs presented below generally include pipeline materials, trenching, placing and jointing pipe, valves, fittings, hydrants, service connections, placing imported pipe bedding, native backfill material, and partial asphalt pavement replacement, if required. However, the costs presented in Table 7 do not include jacking and boring pipe or constructing boring and receiving pits. It is assumed the total cost to construct one boring pit and one receiving pit is $40,000. Pipeline jack and bore costs are shown in Table 8 and should be added where required.

Table 7. Unit Construction Costs for Recycled Water Pipelines[a,b]

Pipeline Diameter, inches	Unit Construction Cost, dollars/linear foot[c]	
	Developed Areas	Undeveloped Areas
8	175	150
12	255	220
16	335	285
24	465	395
36	660	560

(a) Based on 2020 dollars.
(b) Costs based on PVC pipe for 8-inch and 12-inch diameter and ductile iron cement-lined pipe for 16-inch diameter and larger.
(c) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

Table 8. Unit Construction Costs for Jack and Bore[(a)]

Pipeline Size	Unit Construction Cost, dollars/linear foot[(b,c)]
8-inch pipe (16-inch casing)	520
12-inch pipe (21-inch casing)	595
16-inch pipe (24-inch casing)	690
20-inch pipe (30-inch casing)	845
24-inch pipe (36-inch casing)	995
30-inch pipe (42-inch casing)	1,115
54-inch pipe (66-inch casing)	1,700
Tunnel	3,540

(a) Based on 2020 dollars.
(b) Conductor pipe is not included in cost.
(c) Estimated construction costs do not reflect an adjustment to account for the current economic bidding climate.

E.4 CONTINGENCY COSTS OR MARK-UPS

Contingency costs or mark-ups must be reviewed on a case-by-case basis, because they will vary considerably with each construction project. However, to assist City staff with budgeting for these recommended water system facility improvements, standard mark-ups have been added to the planning budget as percentages of the estimated base construction cost.

Standard mark-ups are divided into four subcategories, totaling 40 percent:

- General Contingency: The construction costs presented above are representative of the construction of water system facilities under normal construction conditions and schedules; consequently, it is appropriate to allow for estimating and construction uncertainties unavoidably associated with conceptual project planning. Unexpected construction conditions, the need for unforeseen mechanical items, and variations in final quantities are only a few of the items that can increase project costs. An allowance of 15 percent of the base construction cost will be included to cover such project-related general contingencies.
- Design and Planning: Design and planning services associated with new facilities include preliminary investigations and reports, right-of-way acquisition, foundation explorations, preparation of drawings and specifications for construction, surveying and staking, sampling of testing material, and start-up services. The cost of these items may vary, but for the purpose of this study, it is assumed that engineering design and planning costs will equal 10 percent of the base construction cost.
- Construction Management: Construction management covers items such as contract management and inspection during construction. The cost of these items may vary, but for the purpose of this study, it is assumed that construction management costs will equal 10 percent of the base construction cost.

- Program Administration: Program administration covers items such as legal fees, environmental/CEQA compliance requirements, financing expenses, and interest during construction. The cost of these items may vary, but for the purpose of this study, it is assumed that program administration costs will equal 5 percent of the base construction cost.

An example application of these standard mark-ups to a project with an assumed base construction cost of $1.0 million is shown in Table 9. As shown, the total cost of all project construction contingencies (general contingency, design and planning, construction management, and program administration costs) is 40 percent of the base construction cost for each construction project.

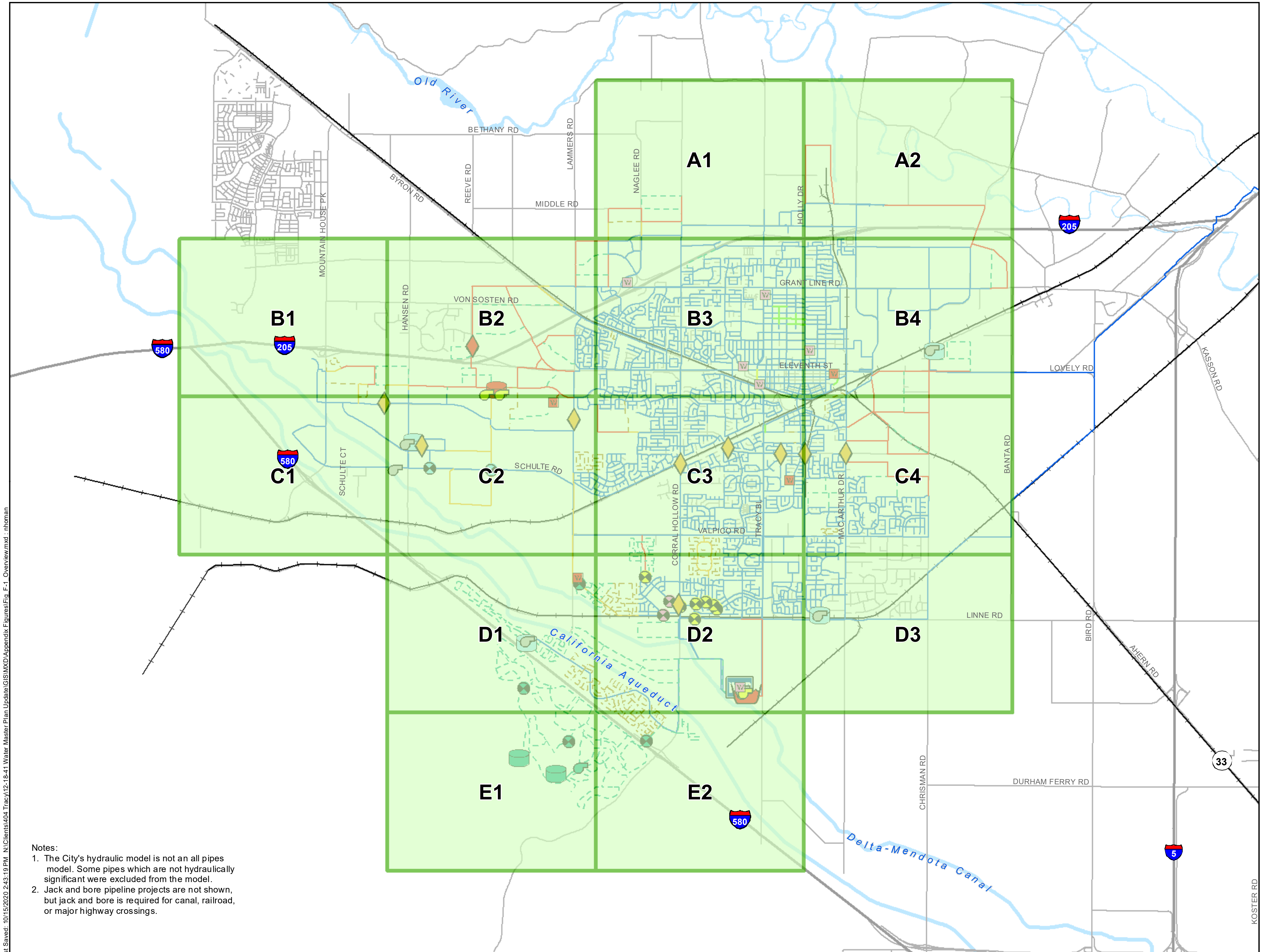
Table 9. Example Application of Mark-ups

Cost Component	Percent	Cost, dollars
Estimated Base Construction Cost before Mark-ups[(a)]		1,000,000
Mark-ups:		
General Contingency	15	150,000
Design and Planning	10	100,000
Construction Management	10	100,000
Program Administration	5	50,000
Estimated Total Project Cost		**$1,400,000**

(a) Assumed cost of an example project.

APPENDIX F

Proposed Future Potable Water System Facility Improvements



Notes:
1. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
2. Jack and bore pipeline projects are not shown, but jack and bore is required for canal, railroad, or major highway crossings.

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Symbology

Proposed Buildout Program Facilities
- Buildout Pressure Regulating Station
- Buildout Pressure Reducing Valve
- Buildout Booster Pump Station
- Buildout Groundwater Well
- Buildout Storage Tank
- Proposed Buildout Clearwell
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities
- Buildout NP Pressure Reducing Valve
- Buildout NP Booster Pump Station
- Buildout NP Storage Tank
- Buildout NP Pipeline

Proposed 2025 Program Facilities
- 2025 Pressure Reducing Valve
- 2025 System Pipeline
- 2025 Pipeline CIP

Proposed 2025 Non-Program Facilities
- 2025 Non-Program Pipeline

Existing System Facilities
- Existing Pressure Regulating Station
- Existing Pressure Reducing Valve
- Existing Booster Pump Station
- Existing Groundwater Well
- Existing Storage Tank
- WTP John Jones Water Treatment Plant
- Existing System Pipeline
- Proposed Existing System Pipeline CIP

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Figure F-1

Proposed Future Potable Water System Facility Improvements

City of Tracy
Water System Master Plan Update

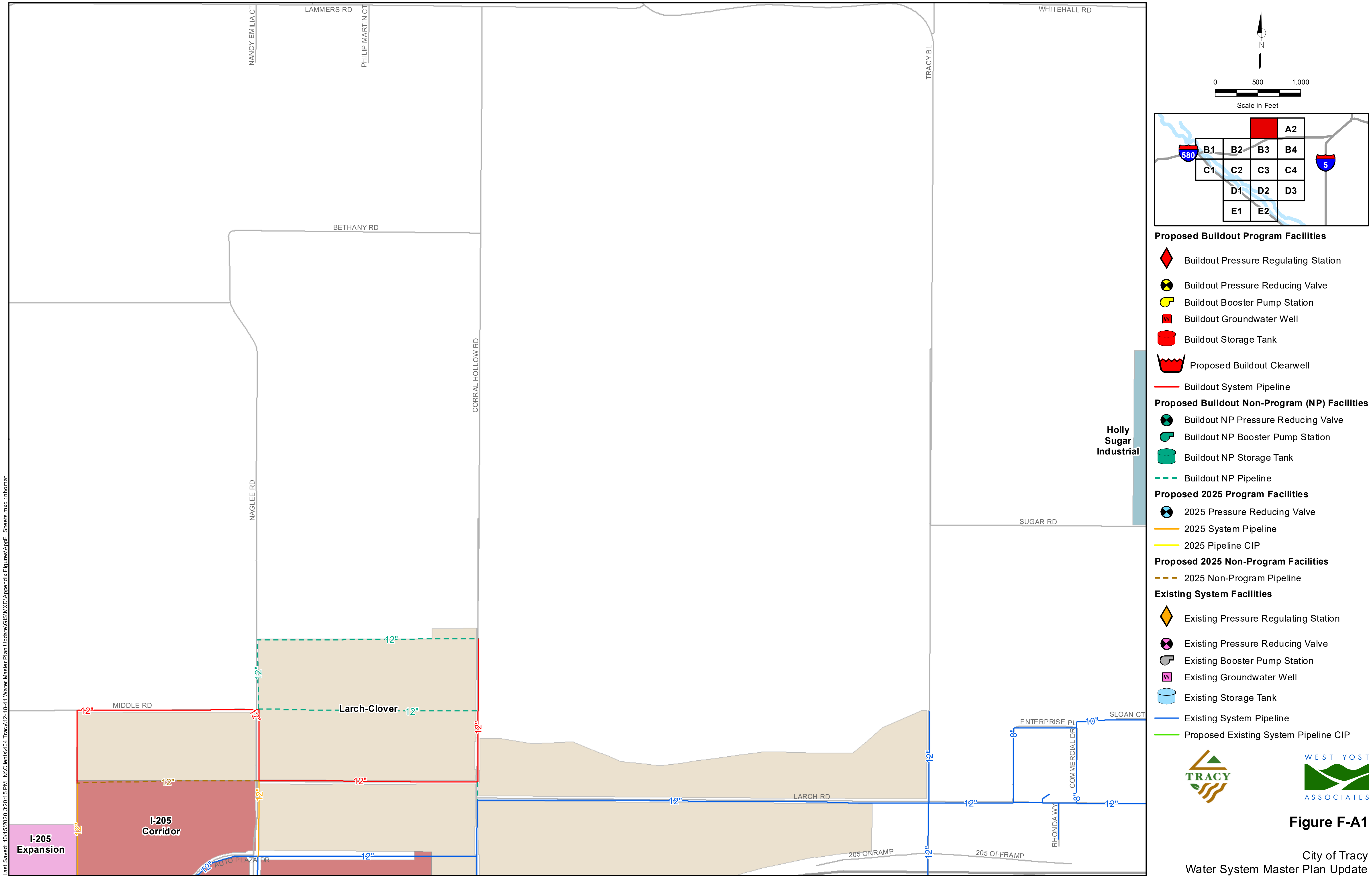

Figure F-A1

City of Tracy
Water System Master Plan Update

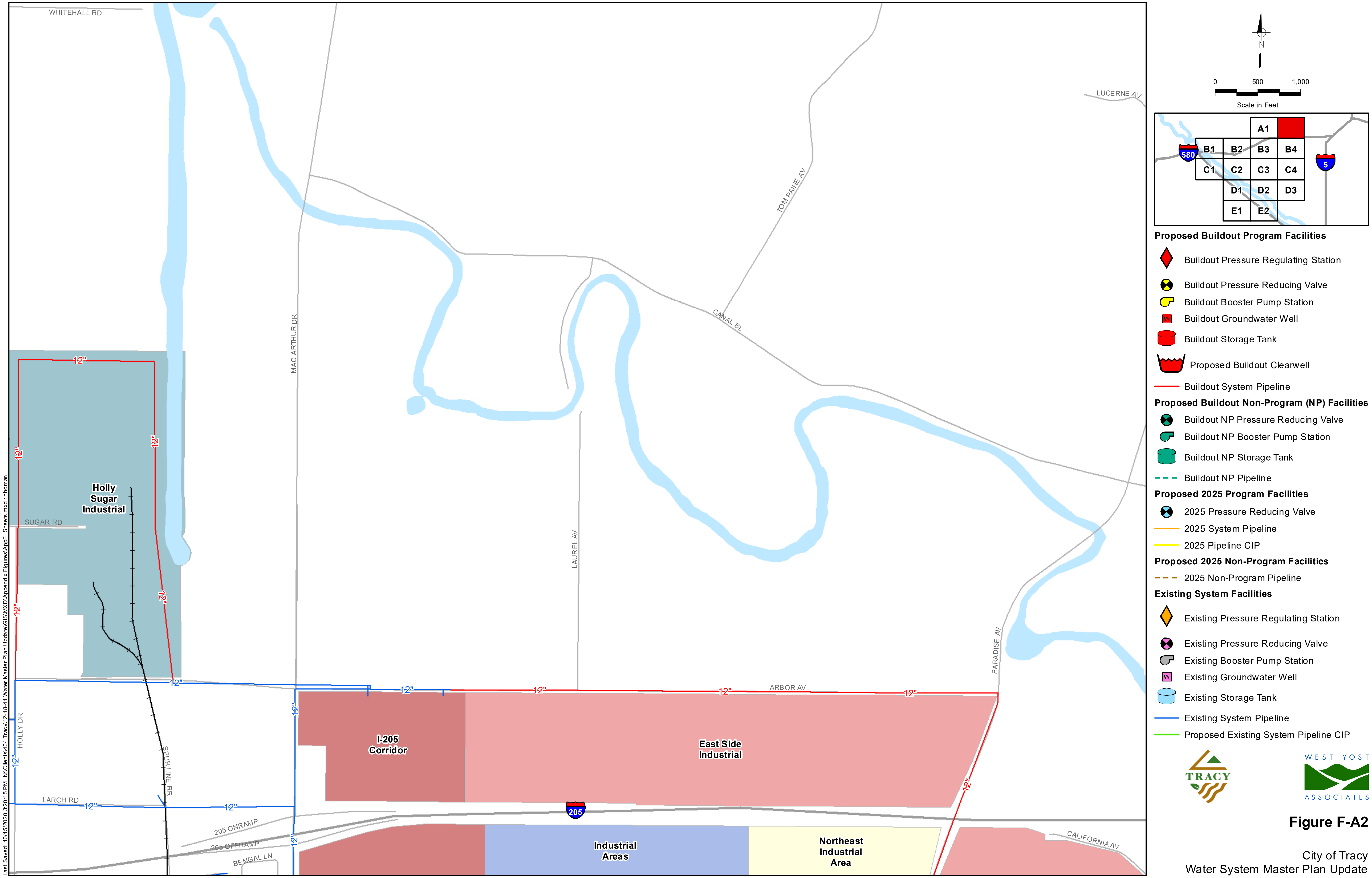

Figure F-A2

City of Tracy
Water System Master Plan Update

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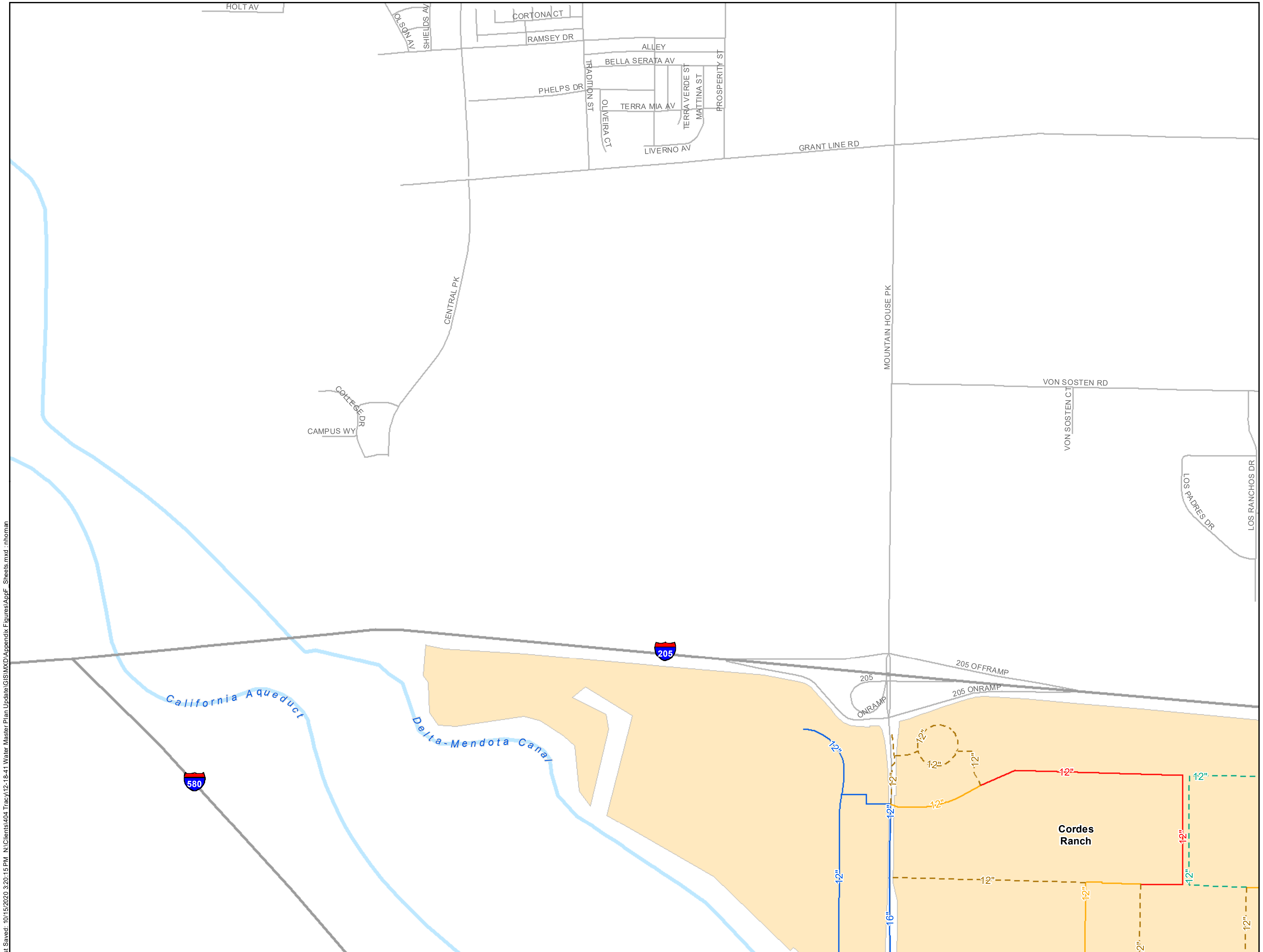

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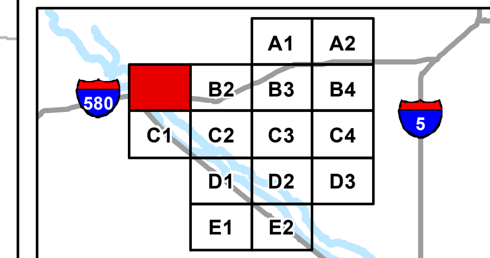

Proposed Buildout Program Facilities

- Buildout Pressure Regulating Station
- Buildout Pressure Reducing Valve
- Buildout Booster Pump Station
- Buildout Groundwater Well
- Buildout Storage Tank
- Proposed Buildout Clearwell
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities

- Buildout NP Pressure Reducing Valve
- Buildout NP Booster Pump Station
- Buildout NP Storage Tank
- Buildout NP Pipeline

Proposed 2025 Program Facilities

- 2025 Pressure Reducing Valve
- 2025 System Pipeline
- 2025 Pipeline CIP

Proposed 2025 Non-Program Facilities

- 2025 Non-Program Pipeline

Existing System Facilities

- Existing Pressure Regulating Station
- Existing Pressure Reducing Valve
- Existing Booster Pump Station
- Existing Groundwater Well
- Existing Storage Tank
- Existing System Pipeline
- Proposed Existing System Pipeline CIP

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Figure F-B1

City of Tracy
Water System Master Plan Update

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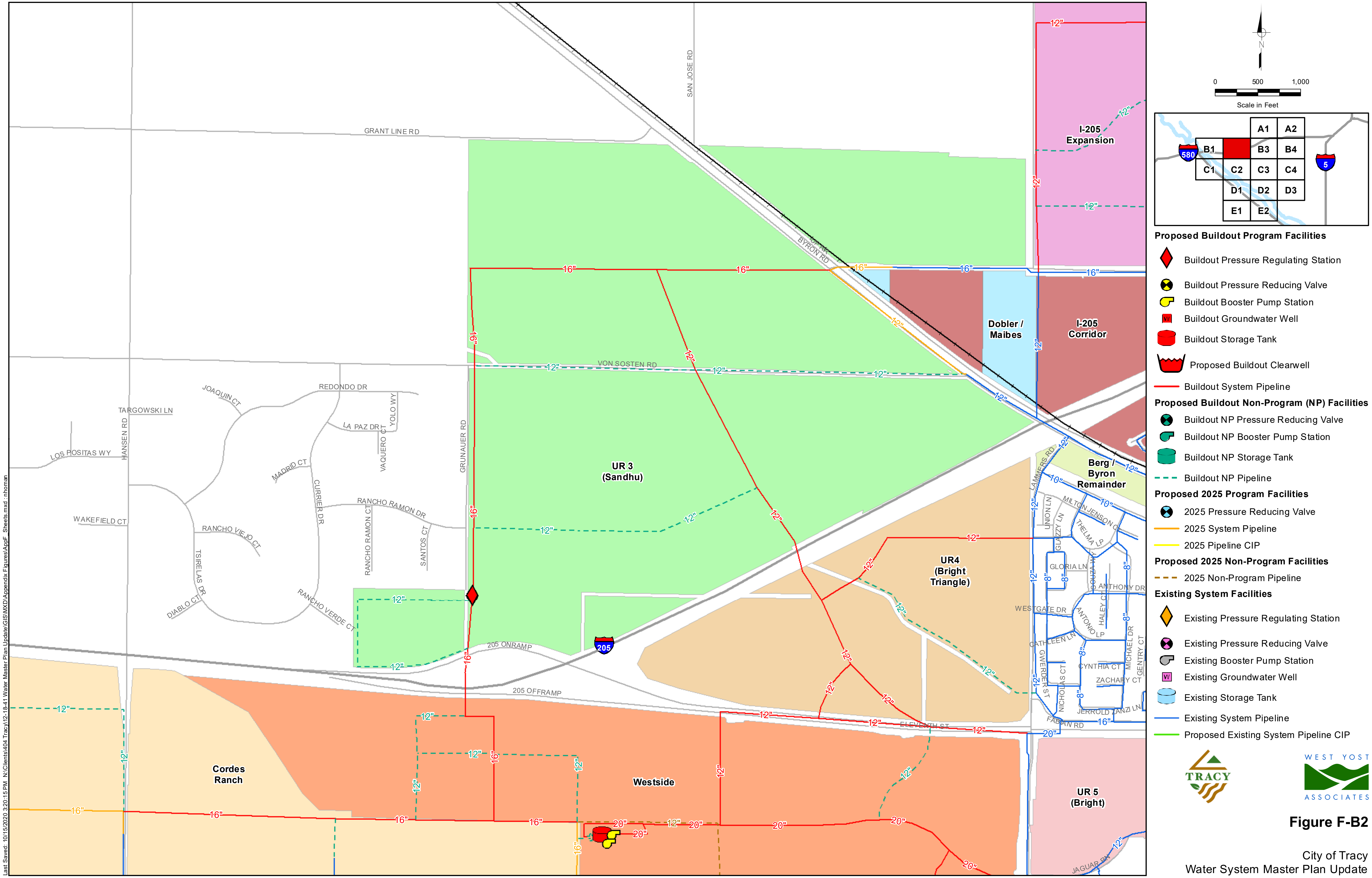

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Figure F-B2

City of Tracy
Water System Master Plan Update

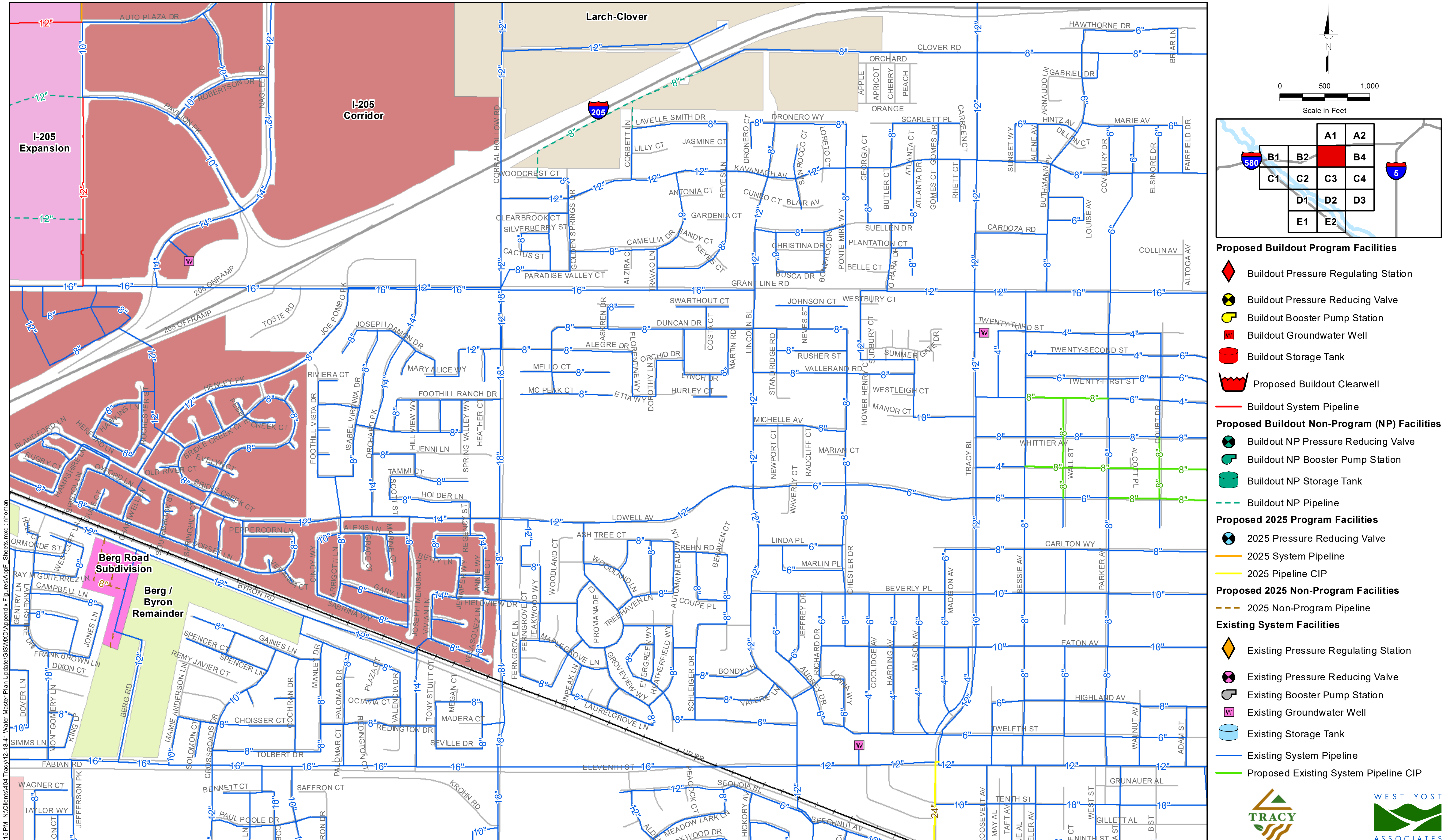

Figure F-B3

City of Tracy
Water System Master Plan Update

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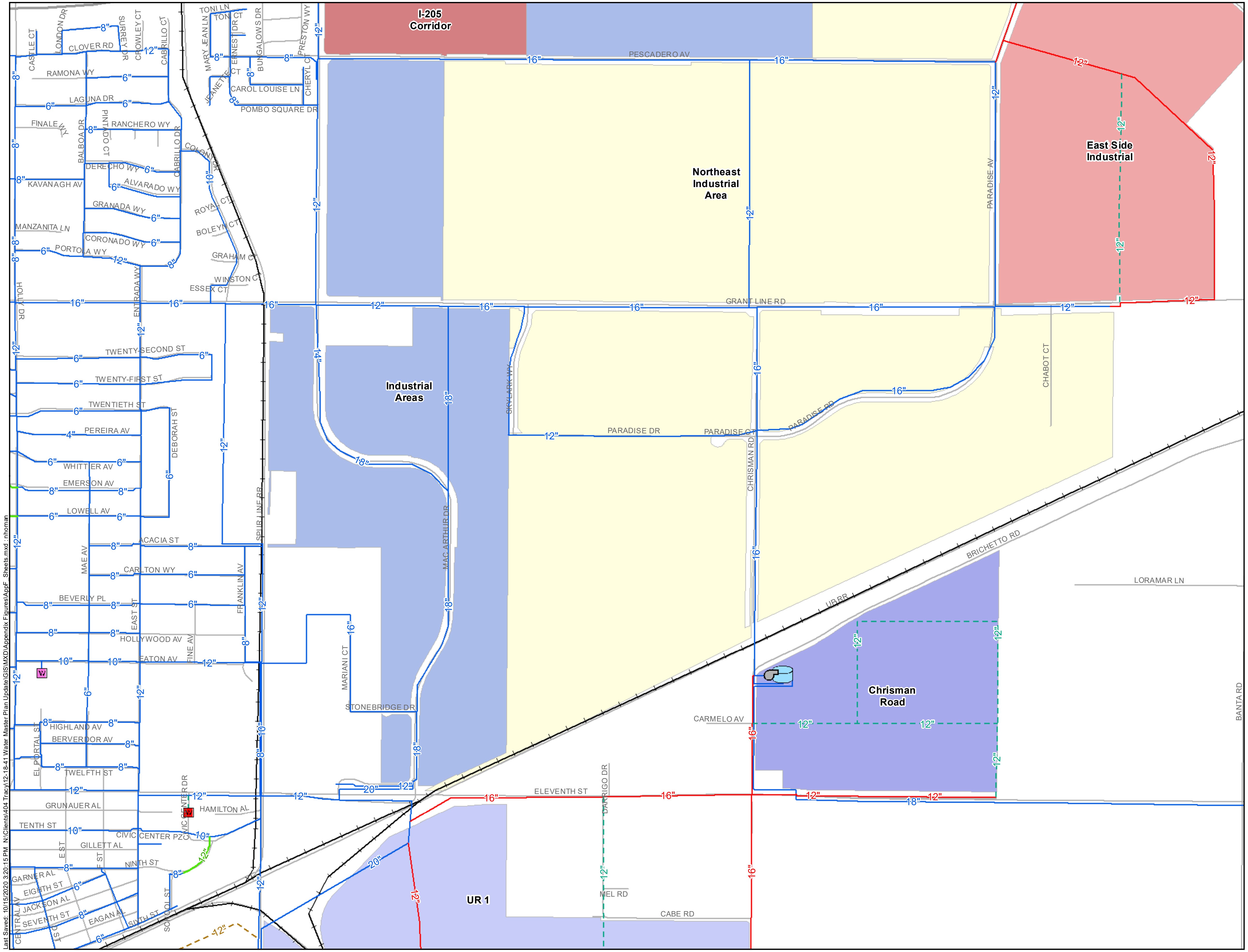

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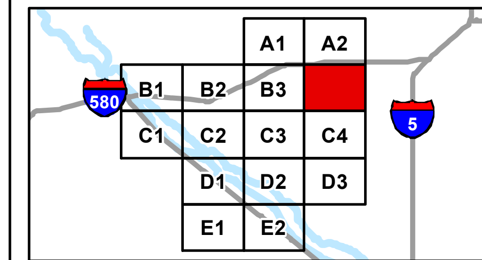
Scale in Feet



Proposed Buildout Program Facilities

- Buildout Pressure Regulating Station
- Buildout Pressure Reducing Valve
- Buildout Booster Pump Station
- Buildout Groundwater Well
- Buildout Storage Tank
- Proposed Buildout Clearwell
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities

- Buildout NP Pressure Reducing Valve
- Buildout NP Booster Pump Station
- Buildout NP Storage Tank
- Buildout NP Pipeline

Proposed 2025 Program Facilities

- 2025 Pressure Reducing Valve
- 2025 System Pipeline
- 2025 Pipeline CIP

Proposed 2025 Non-Program Facilities

- 2025 Non-Program Pipeline

Existing System Facilities

- Existing Pressure Regulating Station
- Existing Pressure Reducing Valve
- Existing Booster Pump Station
- Existing Groundwater Well
- Existing Storage Tank
- Existing System Pipeline
- Proposed Existing System Pipeline CIP

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Figure F-B4

City of Tracy
Water System Master Plan Update

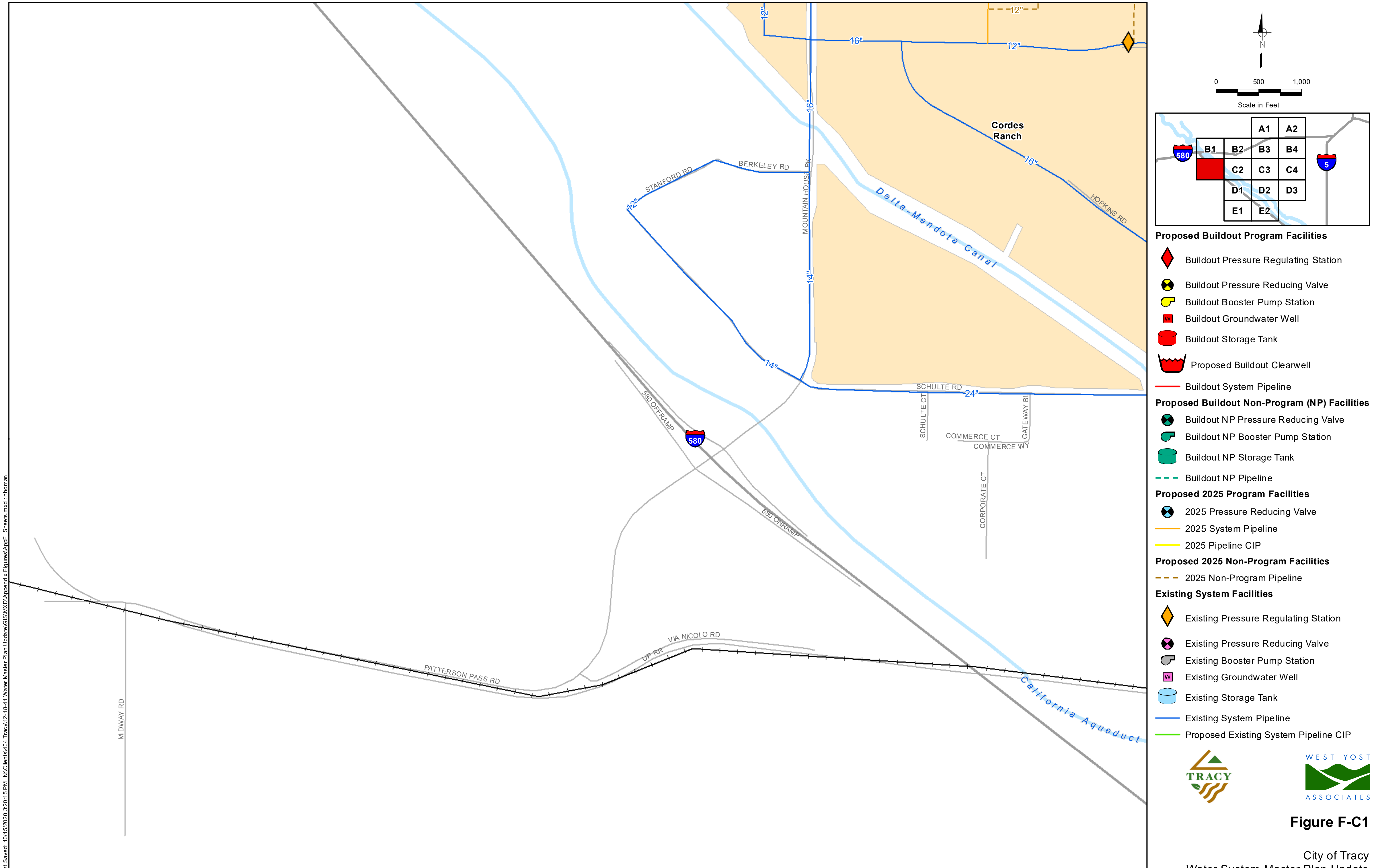
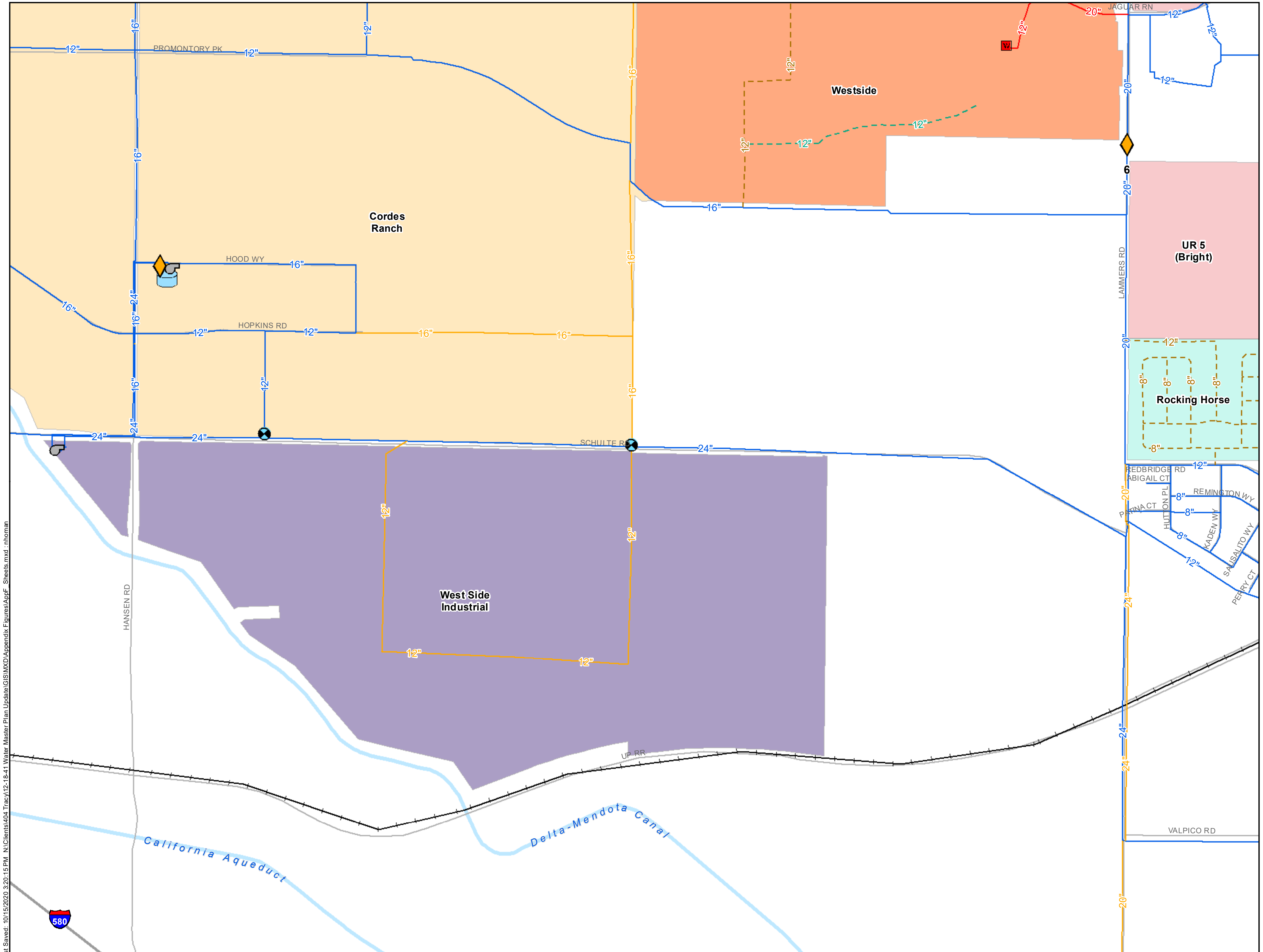


Figure F-C1

City of Tracy
Water System Master Plan Update



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0 500 1,000

Scale in Feet

A1	A2

B1 B2 B3 B4

C1 C3 C4

D1 D2 D3

E1 E2

Proposed Buildout Program Facilities

- Buildout Pressure Regulating Station
- Buildout Pressure Reducing Valve
- Buildout Booster Pump Station
- Buildout Groundwater Well
- Buildout Storage Tank
- Proposed Buildout Clearwell
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities

- Buildout NP Pressure Reducing Valve
- Buildout NP Booster Pump Station
- Buildout NP Storage Tank
- Buildout NP Pipeline

Proposed 2025 Program Facilities

- 2025 Pressure Reducing Valve
- 2025 System Pipeline
- 2025 Pipeline CIP

Proposed 2025 Non-Program Facilities

- 2025 Non-Program Pipeline

Existing System Facilities

- Existing Pressure Regulating Station
- Existing Pressure Reducing Valve
- Existing Booster Pump Station
- Existing Groundwater Well
- Existing Storage Tank
- Existing System Pipeline
- Proposed Existing System Pipeline CIP

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Figure F-C2

City of Tracy
Water System Master Plan Update

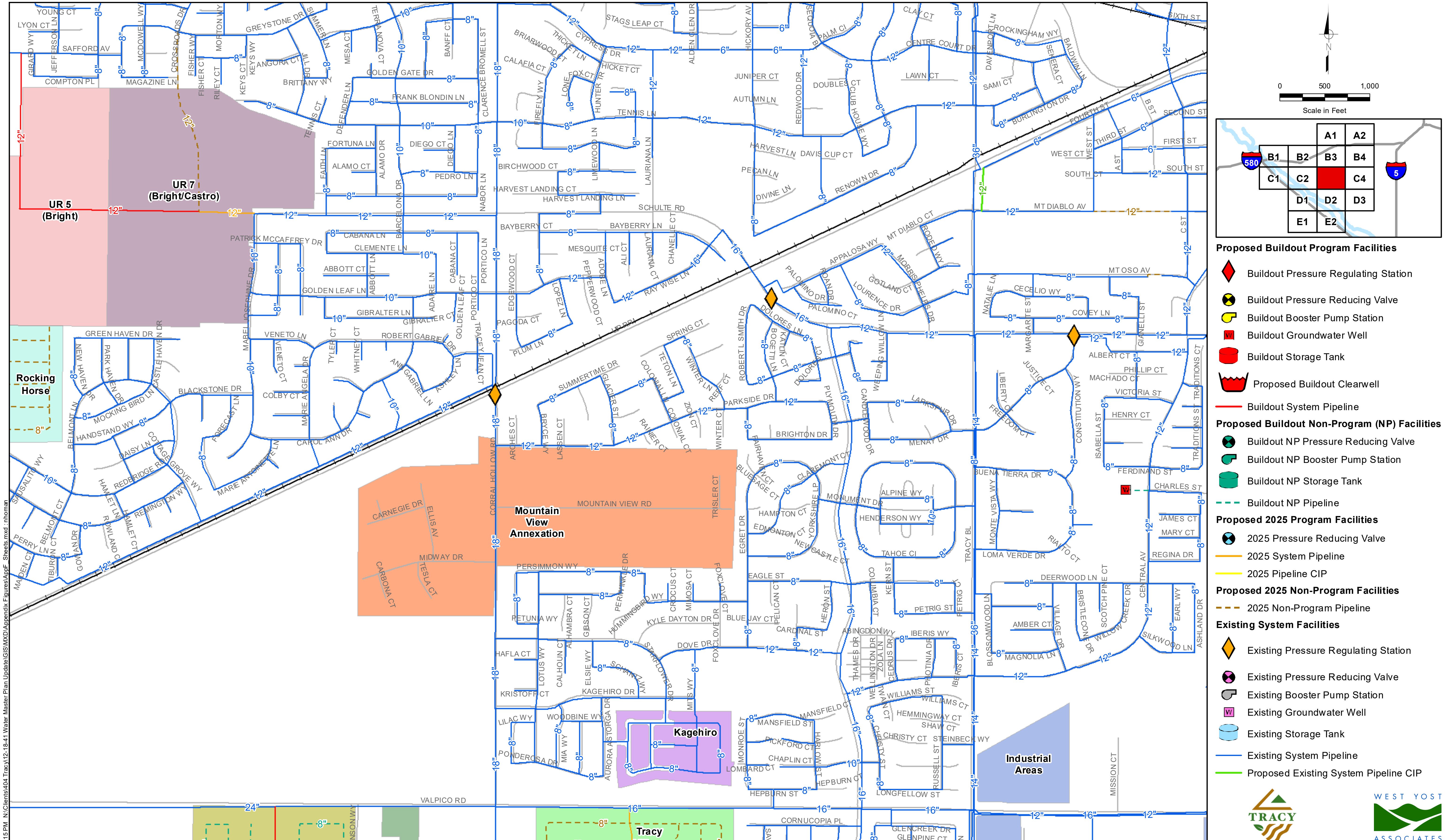


Figure F-C3

City of Tracy
Water System Master Plan Update

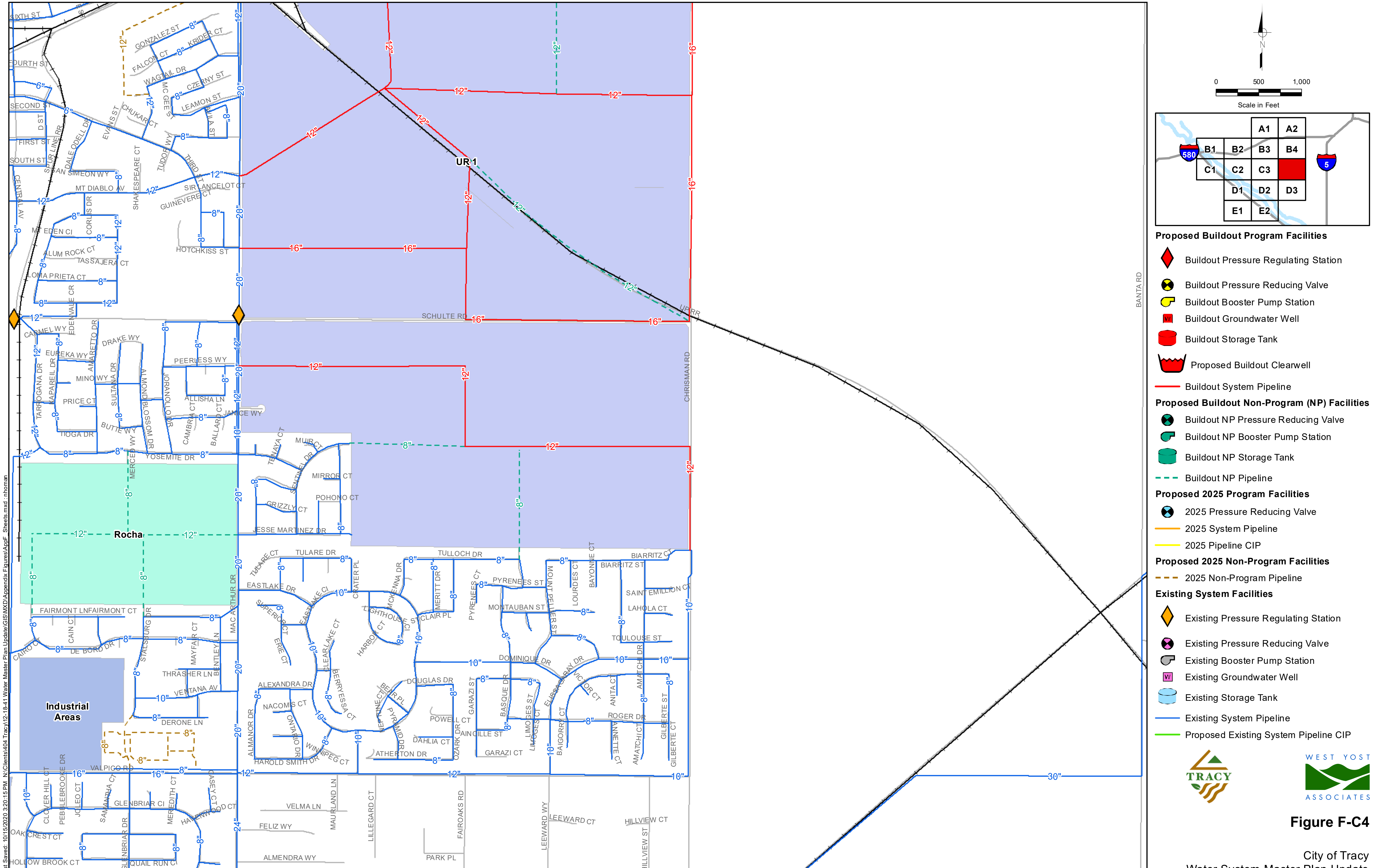
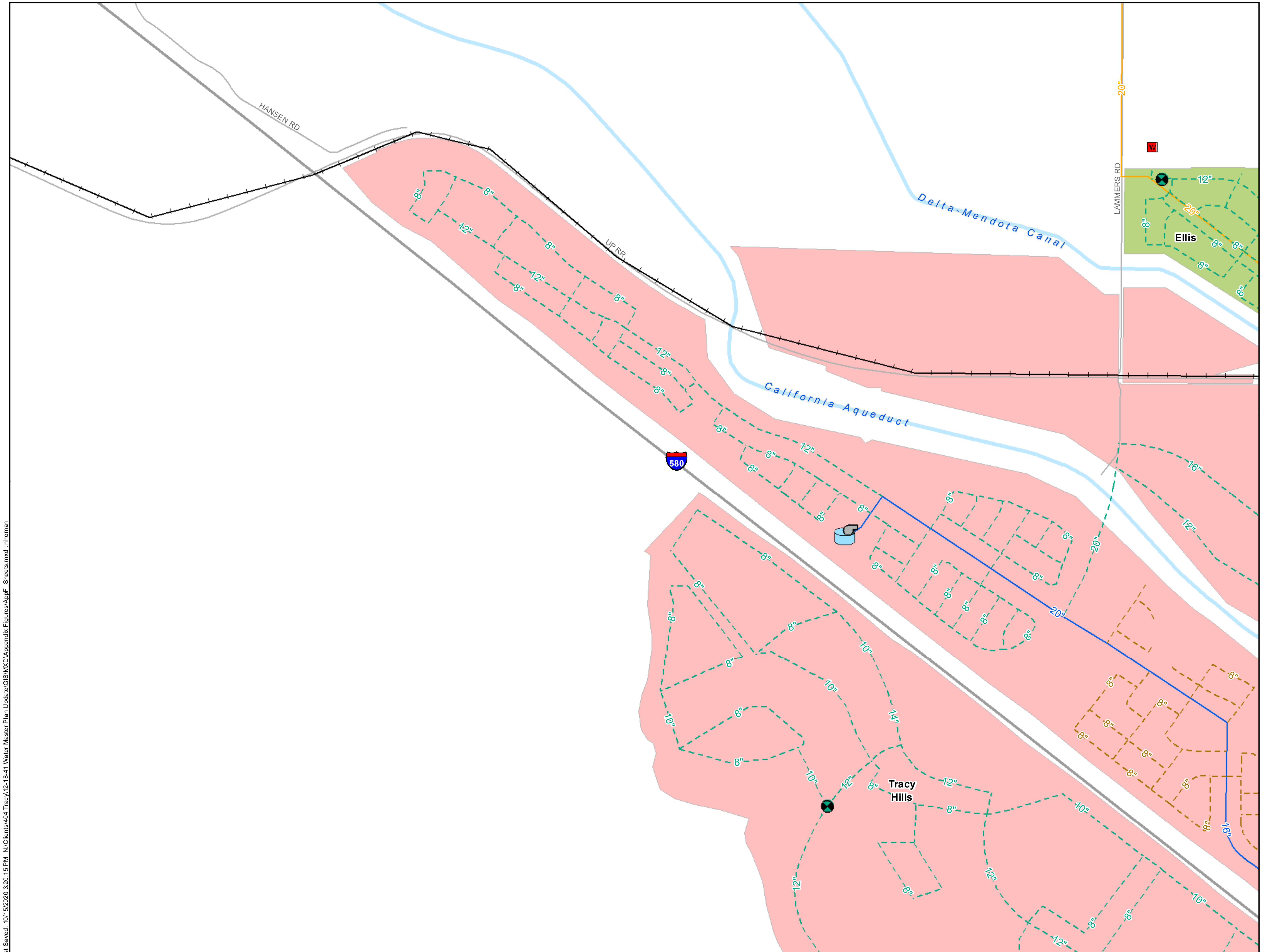


Figure F-C4

City of Tracy
Water System Master Plan Update



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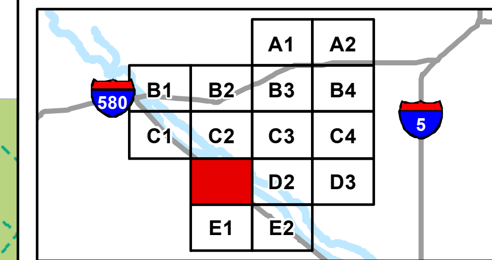
Scale in Feet



Proposed Buildout Program Facilities

- Buildout Pressure Regulating Station
- Buildout Pressure Reducing Valve
- Buildout Booster Pump Station
- Buildout Groundwater Well
- Buildout Storage Tank
- Proposed Buildout Clearwell
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities

- Buildout NP Pressure Reducing Valve
- Buildout NP Booster Pump Station
- Buildout NP Storage Tank
- Buildout NP Pipeline

Proposed 2025 Program Facilities

- 2025 Pressure Reducing Valve
- 2025 System Pipeline
- 2025 Pipeline CIP

Proposed 2025 Non-Program Facilities

- 2025 Non-Program Pipeline

Existing System Facilities

- Existing Pressure Regulating Station
- Existing Pressure Reducing Valve
- Existing Booster Pump Station
- Existing Groundwater Well
- Existing Storage Tank
- Existing System Pipeline
- Proposed Existing System Pipeline CIP

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Figure F-D1

City of Tracy
Water System Master Plan Update

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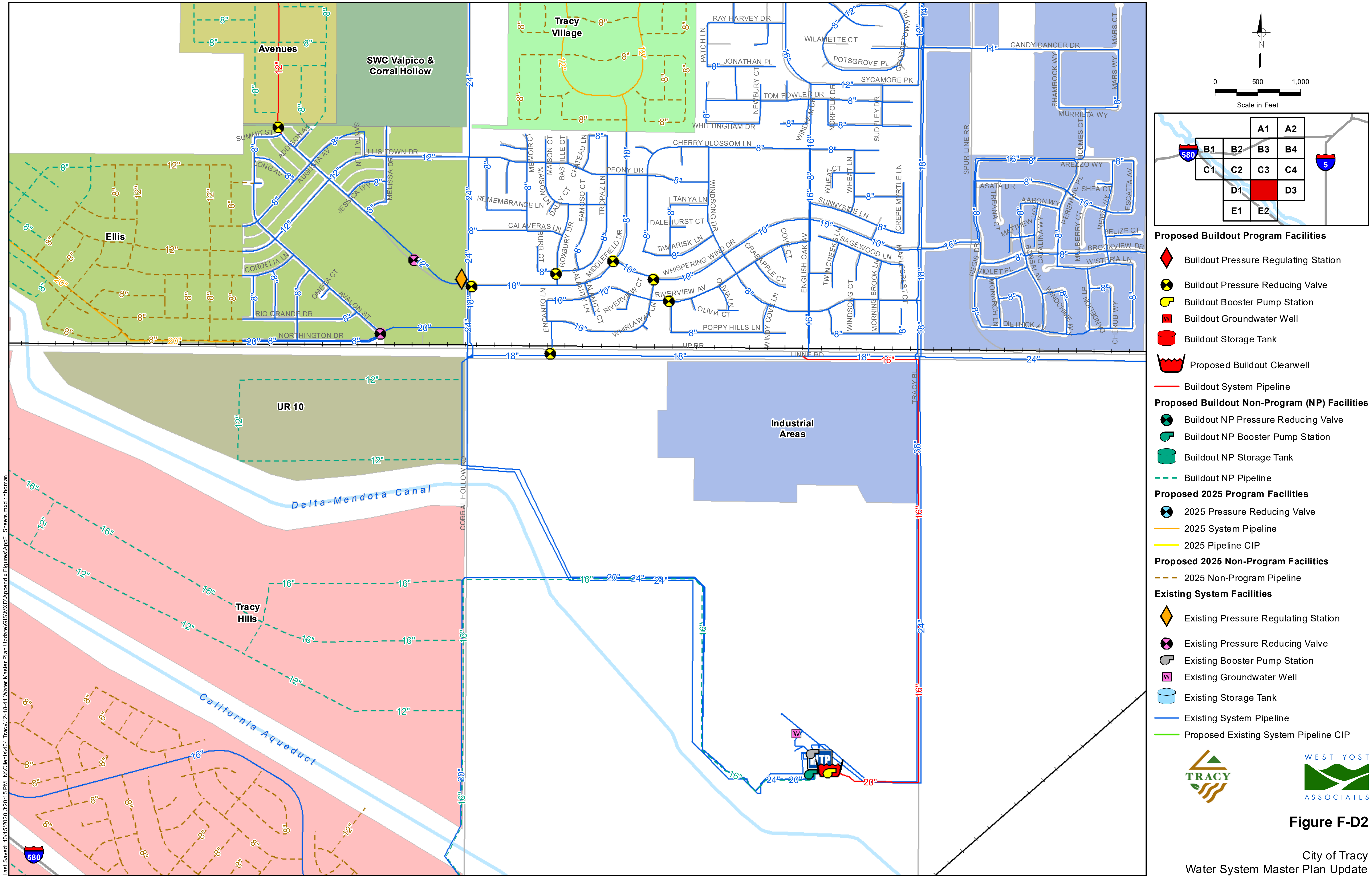

Figure F-D2

City of Tracy
Water System Master Plan Update

Proposed Buildout Program Facilities

- Buildout Pressure Regulating Station
- Buildout Pressure Reducing Valve
- Buildout Booster Pump Station
- Buildout Groundwater Well
- Buildout Storage Tank
- Proposed Buildout Clearwell
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities

- Buildout NP Pressure Reducing Valve
- Buildout NP Booster Pump Station
- Buildout NP Storage Tank
- Buildout NP Pipeline

Proposed 2025 Program Facilities

- 2025 Pressure Reducing Valve
- 2025 System Pipeline
- 2025 Pipeline CIP

Proposed 2025 Non-Program Facilities

- 2025 Non-Program Pipeline

Existing System Facilities

- Existing Pressure Regulating Station
- Existing Pressure Reducing Valve
- Existing Booster Pump Station
- Existing Groundwater Well
- Existing Storage Tank
- Existing System Pipeline
- Proposed Existing System Pipeline CIP

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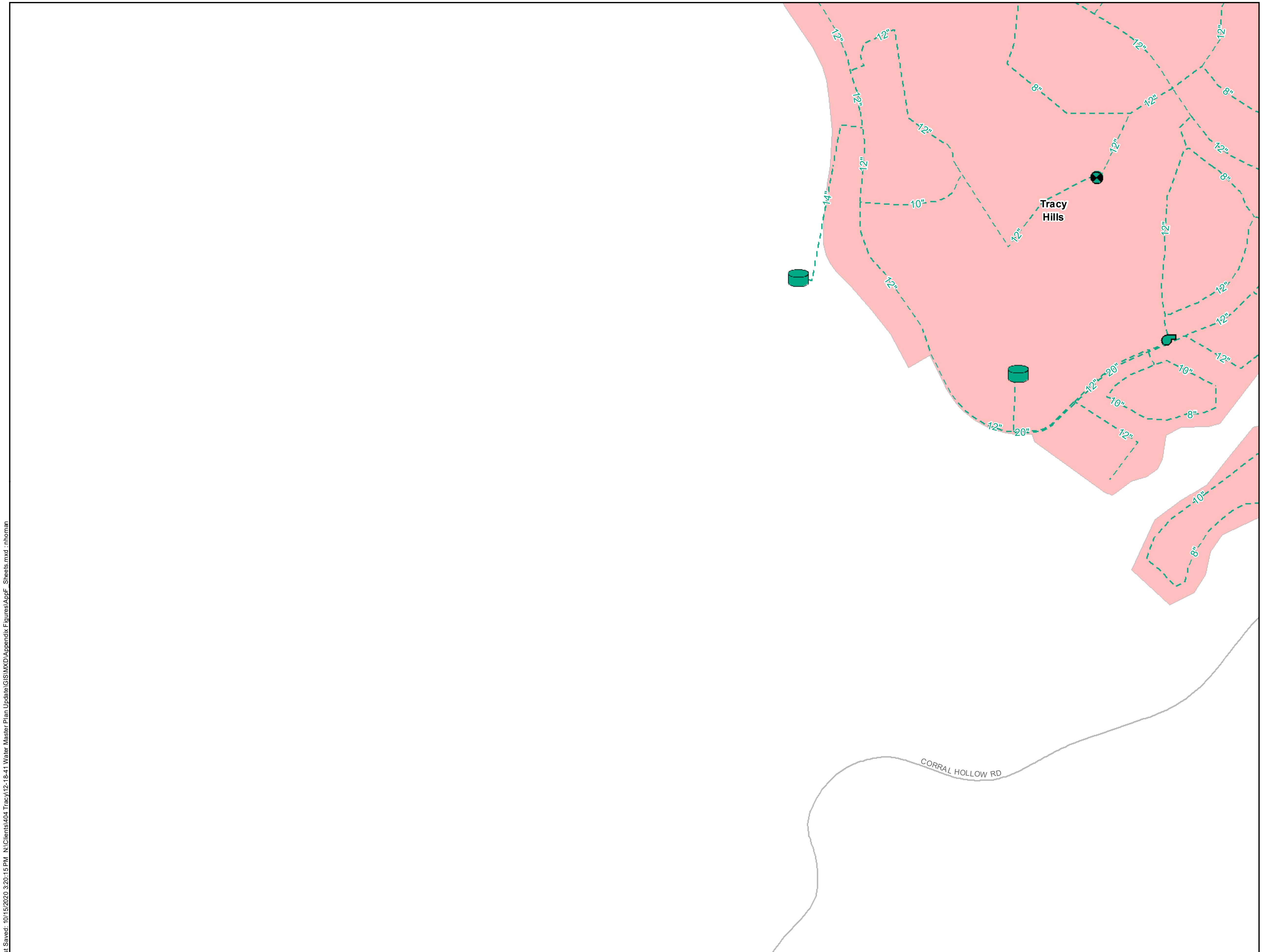
Figure F-D3

City of Tracy
Water System Master Plan Update



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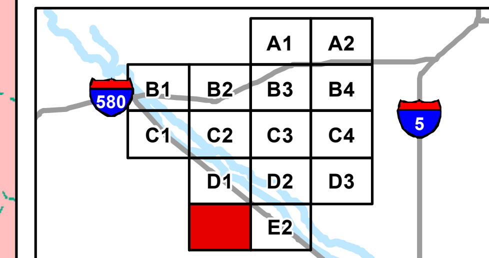
Scale in Feet



Proposed Buildout Program Facilities

- Buildout Pressure Regulating Station
- Buildout Pressure Reducing Valve
- Buildout Booster Pump Station
- Buildout Groundwater Well
- Buildout Storage Tank
- Proposed Buildout Clearwell
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities

- Buildout NP Pressure Reducing Valve
- Buildout NP Booster Pump Station
- Buildout NP Storage Tank
- Buildout NP Pipeline

Proposed 2025 Program Facilities

- 2025 Pressure Reducing Valve
- 2025 System Pipeline
- 2025 Pipeline CIP

Proposed 2025 Non-Program Facilities

- 2025 Non-Program Pipeline

Existing System Facilities

- Existing Pressure Regulating Station
- Existing Pressure Reducing Valve
- Existing Booster Pump Station
- Existing Groundwater Well
- Existing Storage Tank
- Existing System Pipeline
- Proposed Existing System Pipeline CIP

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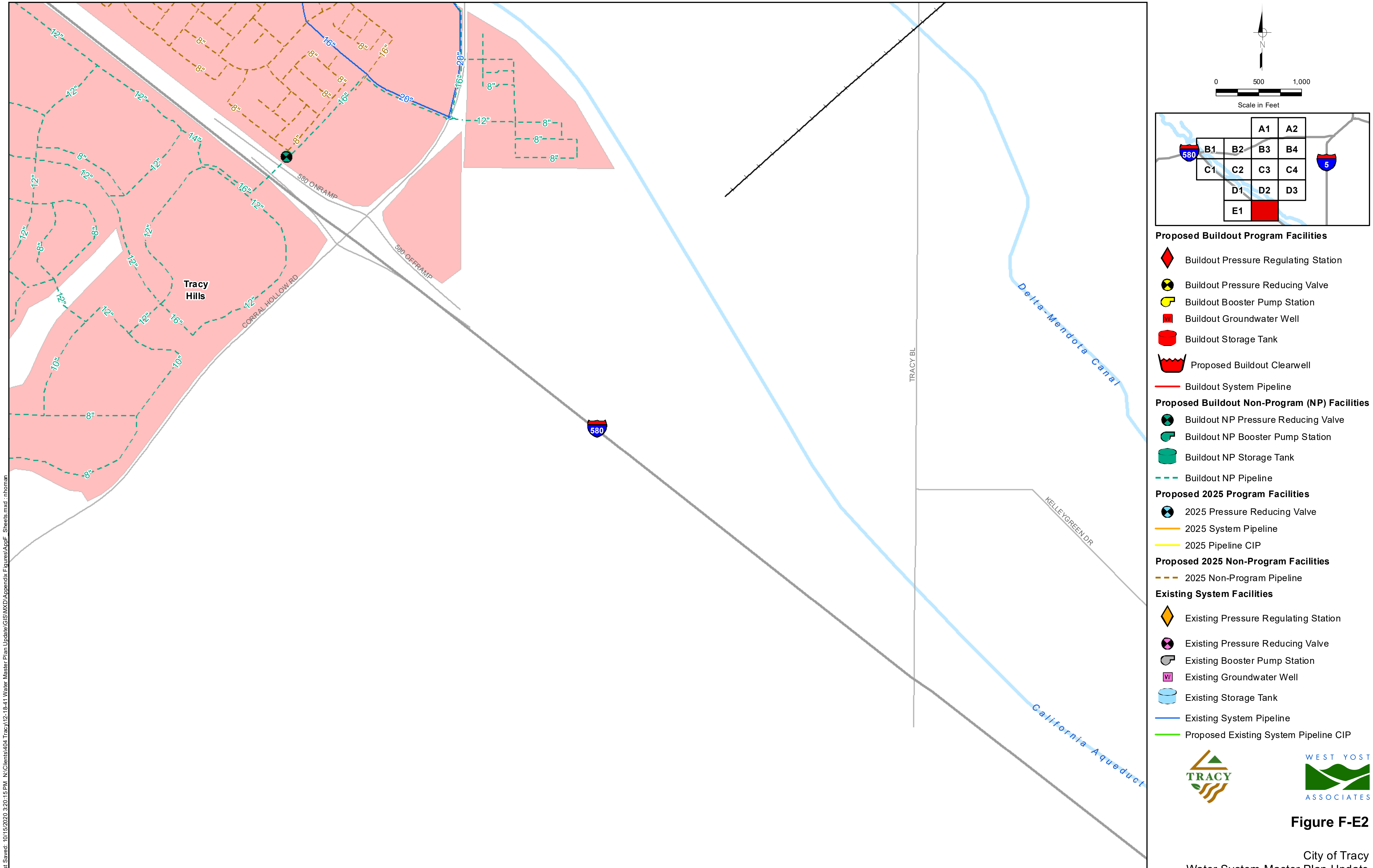
Figure F-E1

City of Tracy
Water System Master Plan Update



Proposed Buildout Program Facilities

- Buildout Pressure Regulating Station
- Buildout Pressure Reducing Valve
- Buildout Booster Pump Station
- Buildout Groundwater Well
- Buildout Storage Tank
- Proposed Buildout Clearwell
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities

- Buildout NP Pressure Reducing Valve
- Buildout NP Booster Pump Station
- Buildout NP Storage Tank
- Buildout NP Pipeline

Proposed 2025 Program Facilities

- 2025 Pressure Reducing Valve
- 2025 System Pipeline
- 2025 Pipeline CIP

Proposed 2025 Non-Program Facilities

- 2025 Non-Program Pipeline

Existing System Facilities

- Existing Pressure Regulating Station
- Existing Pressure Reducing Valve
- Existing Booster Pump Station
- Existing Groundwater Well
- Existing Storage Tank
- Existing System Pipeline
- Proposed Existing System Pipeline CIP

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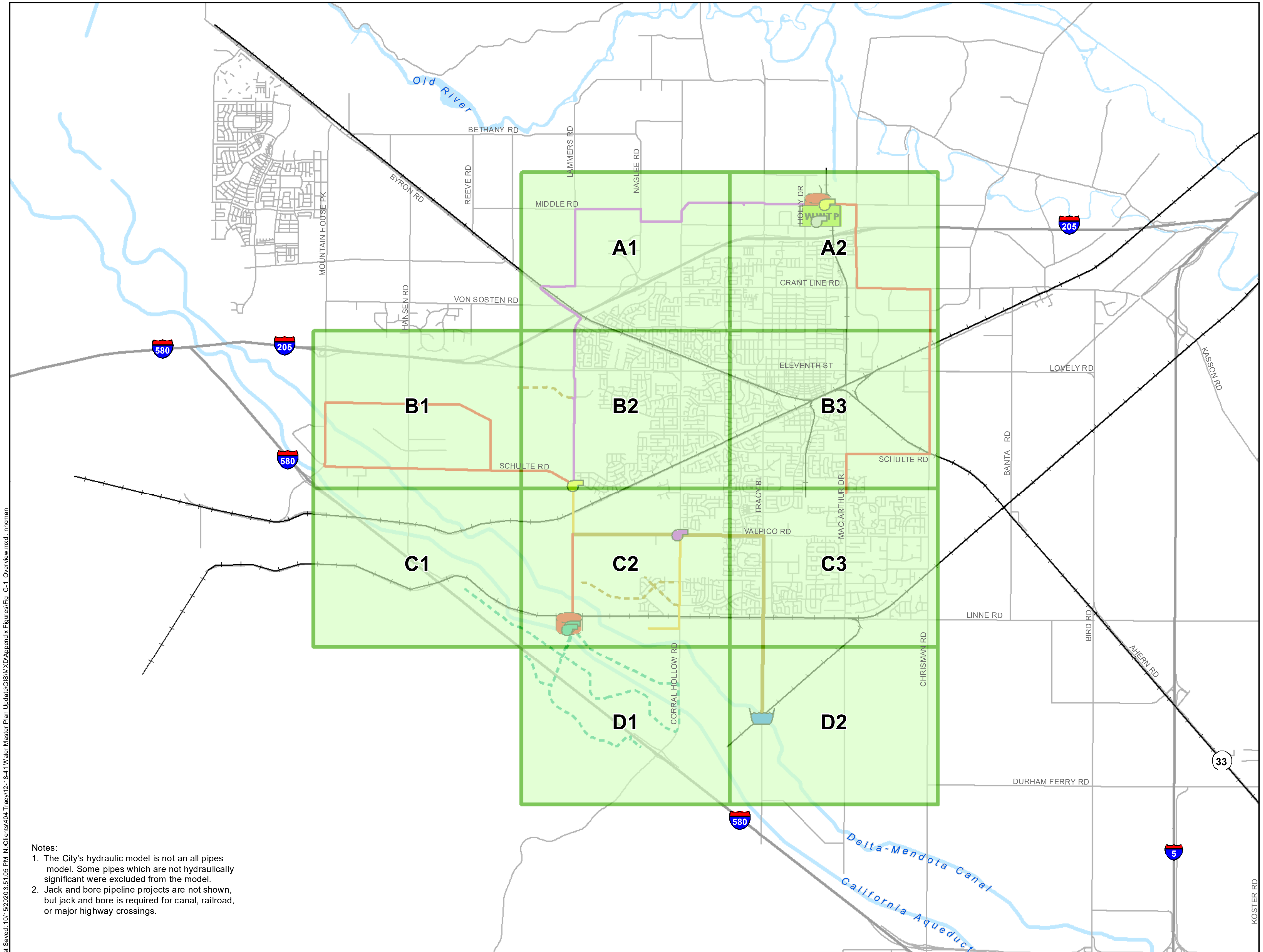
Figure F-E2

City of Tracy
Water System Master Plan Update

APPENDIX G

Proposed Future Recycled Water System Facility Improvements



Notes:
1. The City's hydraulic model is not an all pipes model. Some pipes which are not hydraulically significant were excluded from the model.
2. Jack and bore pipeline projects are not shown, but jack and bore is required for canal, railroad, or major highway crossings.

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N

0 3,000 6,000

Scale in Feet

Symbology

Proposed Buildout Program Facilities

- Buildout Booster Pump Station
- Buildout Storage Tank
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities

- Buildout NP Booster Pump Station
- Buildout NP Pipeline

Proposed 2025 Program Facilities

- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta-Mendota Canal Pipeline
- Delta-Mendota Canal Discharge Point

Proposed 2025 Non-Program Facilities

- 2025 Non-Program Pipeline

Existing System Facilities

- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing System Pipeline

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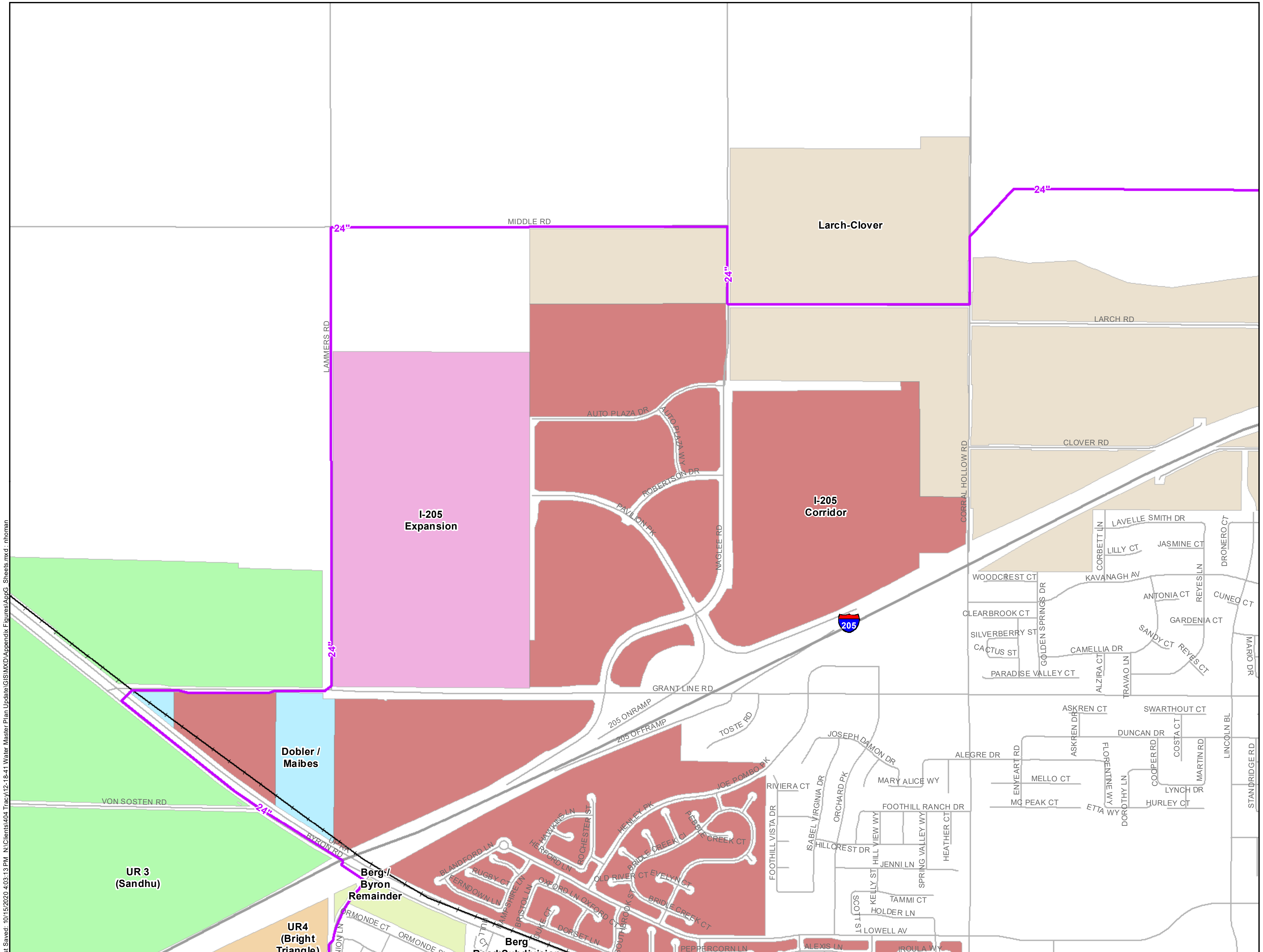
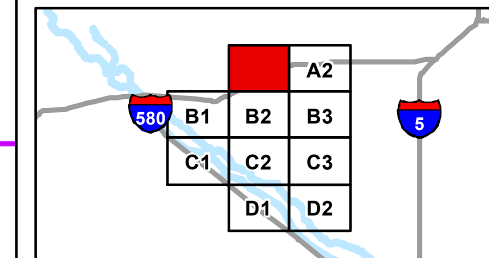
Figure G-1

Proposed Future Recycled Water System Facility Improvements

City of Tracy
Water System Master Plan Update





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Scale in Feet

Symbology

Proposed Buildout Program Facilities
- Buildout Booster Pump Station
- Buildout Storage Tank
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities
- Buildout NP Booster Pump Station
- Buildout NP Pipeline

Proposed 2025 Program Facilities
- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta-Mendota Canal Pipeline
- Delta-Mendota Canal Discharge Point

Proposed 2025 Non-Program Facilities
- 2025 Non-Program Pipeline

Existing System Facilities
- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing System Pipeline

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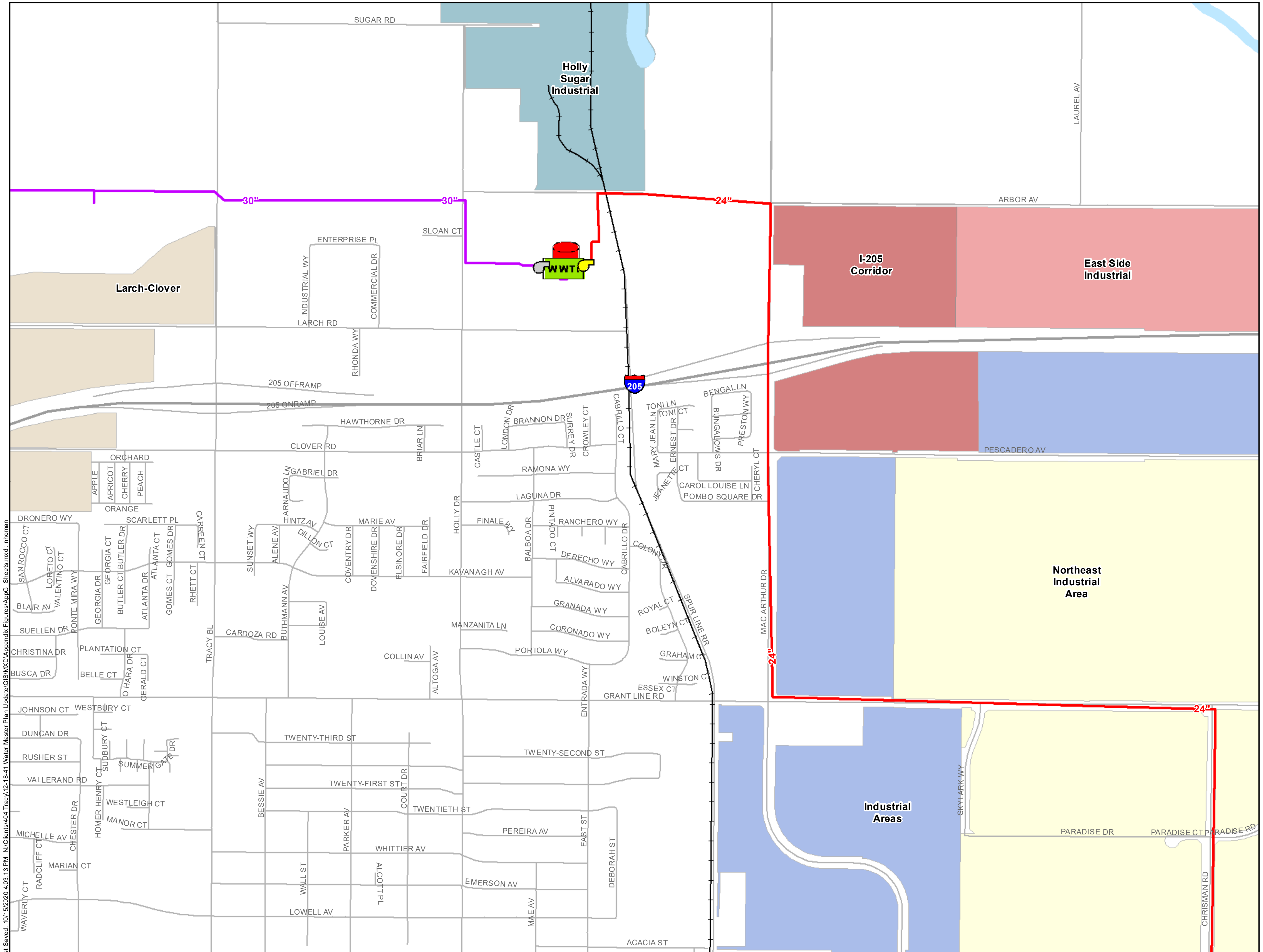
Figure G-A1

City of Tracy
Water System Master Plan Update



N

0 500 1,000

Scale in Feet

A1 | B1 | B2 | B3 | C1 | C2 | C3 | D1 | D2

580 | 5

Symbology

Proposed Buildout Program Facilities
- Buildout Booster Pump Station
- Buildout Storage Tank
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities
- Buildout NP Booster Pump Station
- Buildout NP Pipeline

Proposed 2025 Program Facilities
- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta-Mendota Canal Pipeline
- Delta-Mendota Canal Discharge Point

Proposed 2025 Non-Program Facilities
- 2025 Non-Program Pipeline

Existing System Facilities
- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing System Pipeline

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Figure G-A2

City of Tracy
Water System Master Plan Update

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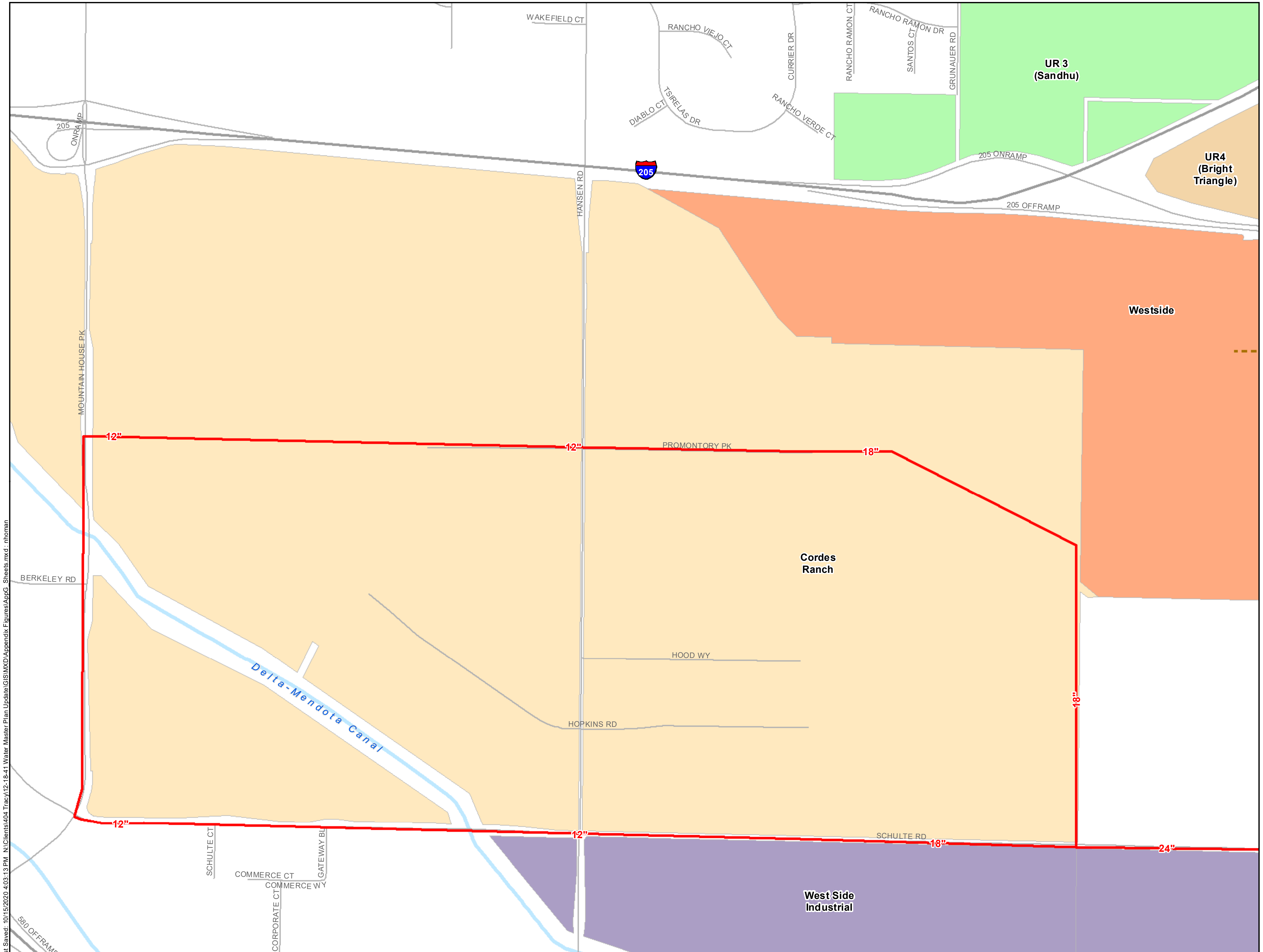

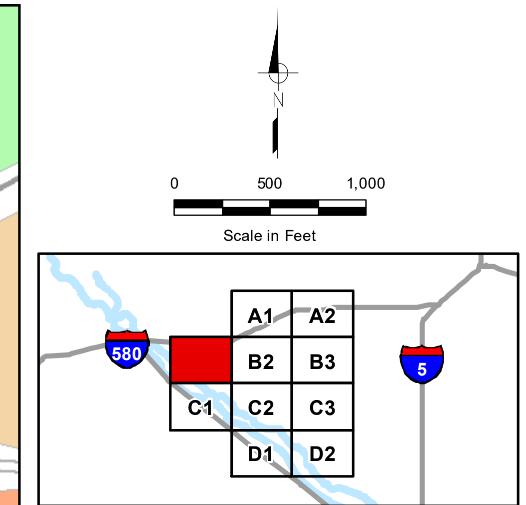

Symbology

Proposed Buildout Program Facilities
- Buildout Booster Pump Station
- Buildout Storage Tank
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities
- Buildout NP Booster Pump Station
- Buildout NP Pipeline

Proposed 2025 Program Facilities
- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta-Mendota Canal Pipeline
- Delta-Mendota Canal Discharge Point

Proposed 2025 Non-Program Facilities
- 2025 Non-Program Pipeline

Existing System Facilities
- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing System Pipeline

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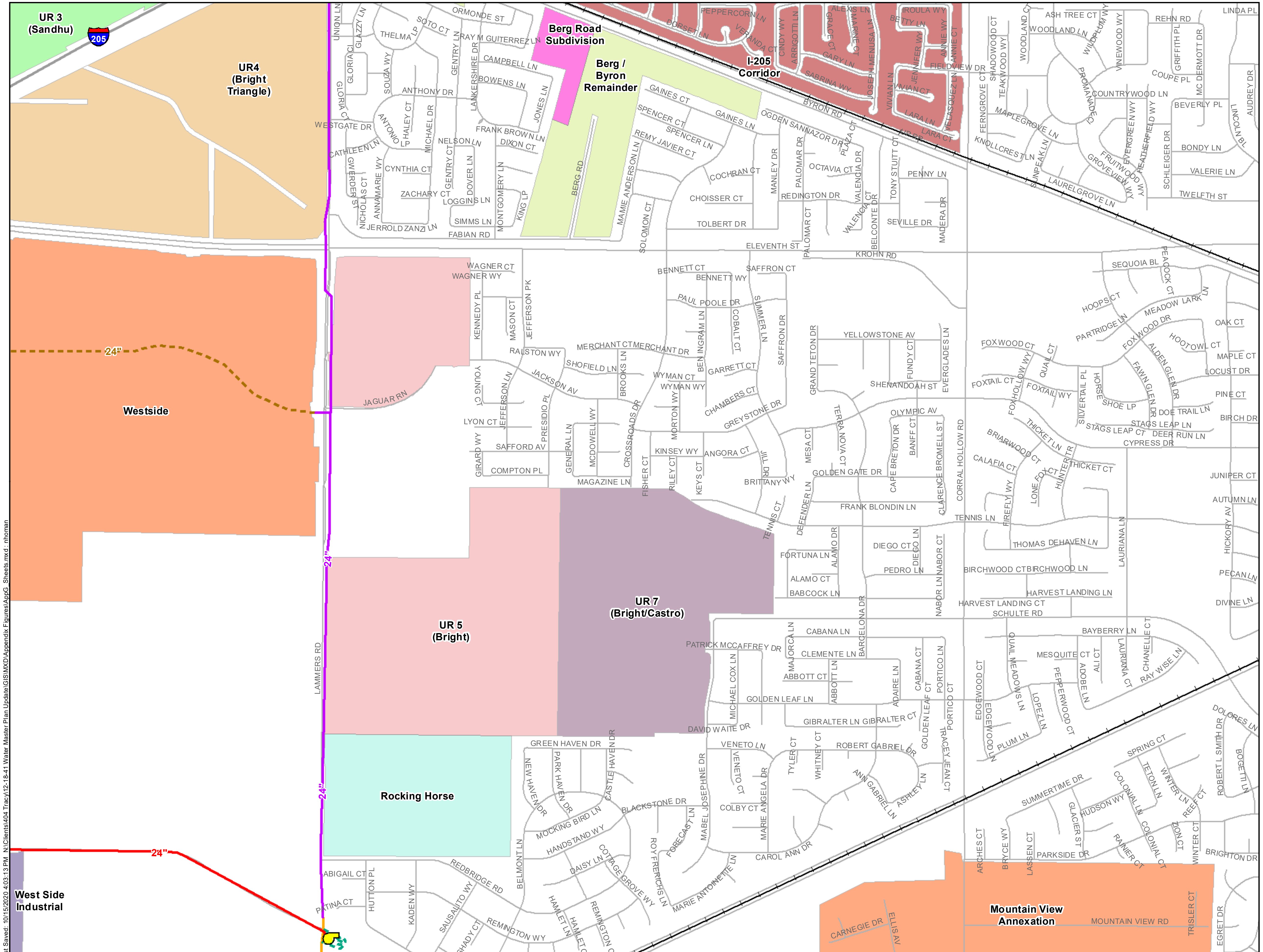
Figure G-B1

City of Tracy
Water System Master Plan Update



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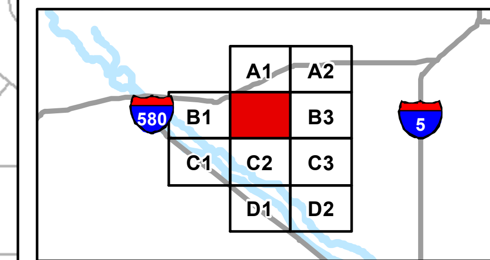

Symbology

Proposed Buildout Program Facilities
- Buildout Booster Pump Station
- Buildout Storage Tank
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities
- Buildout NP Booster Pump Station
- Buildout NP Pipeline

Proposed 2025 Program Facilities
- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta-Mendota Canal Pipeline
- Delta-Mendota Canal Discharge Point

Proposed 2025 Non-Program Facilities
- 2025 Non-Program Pipeline

Existing System Facilities
- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing System Pipeline

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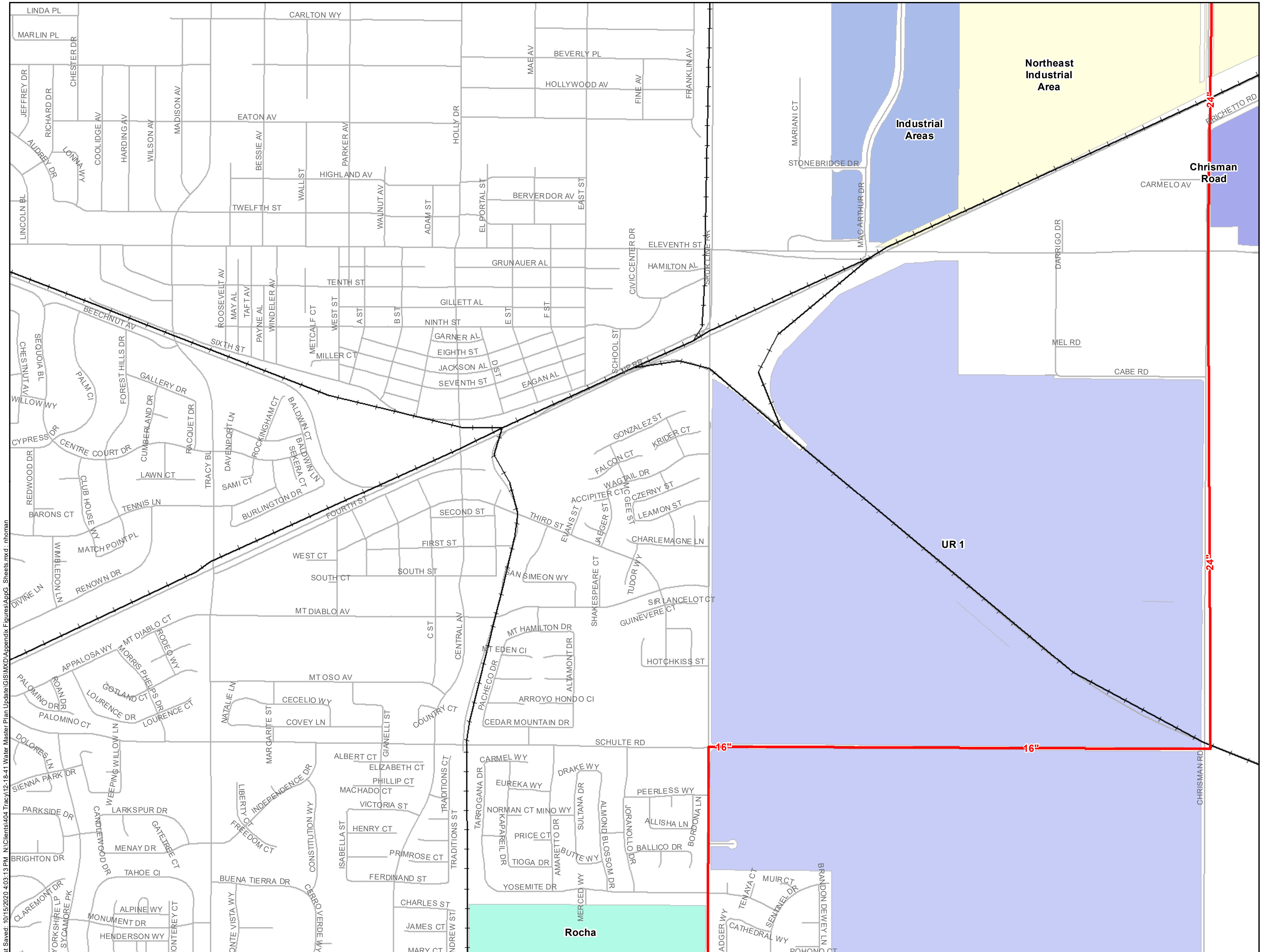
Figure G-B2

City of Tracy
Water System Master Plan Update



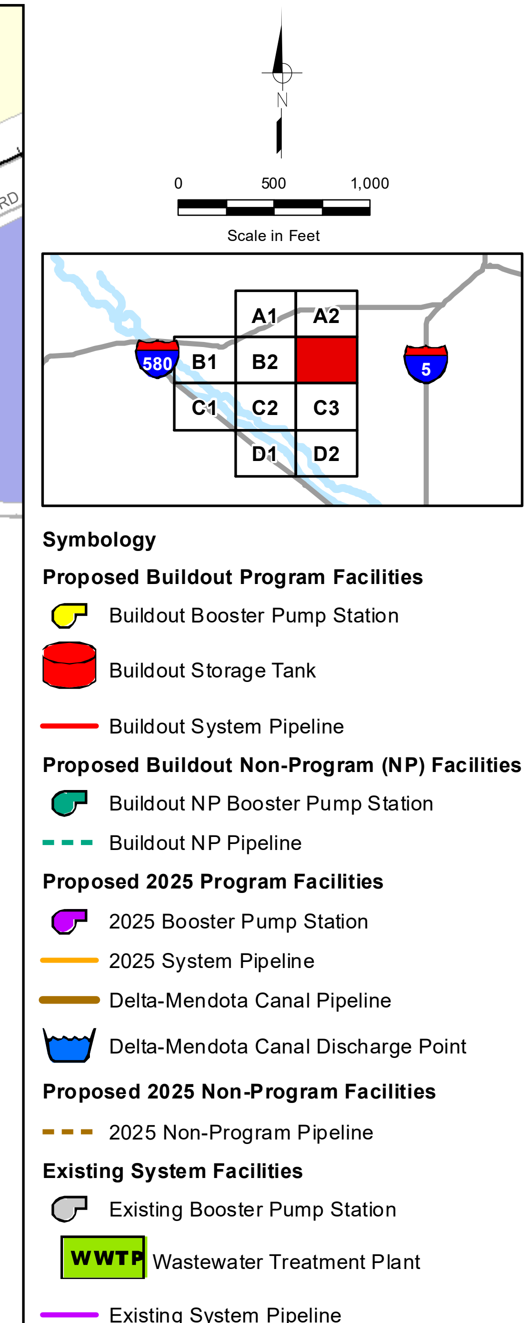


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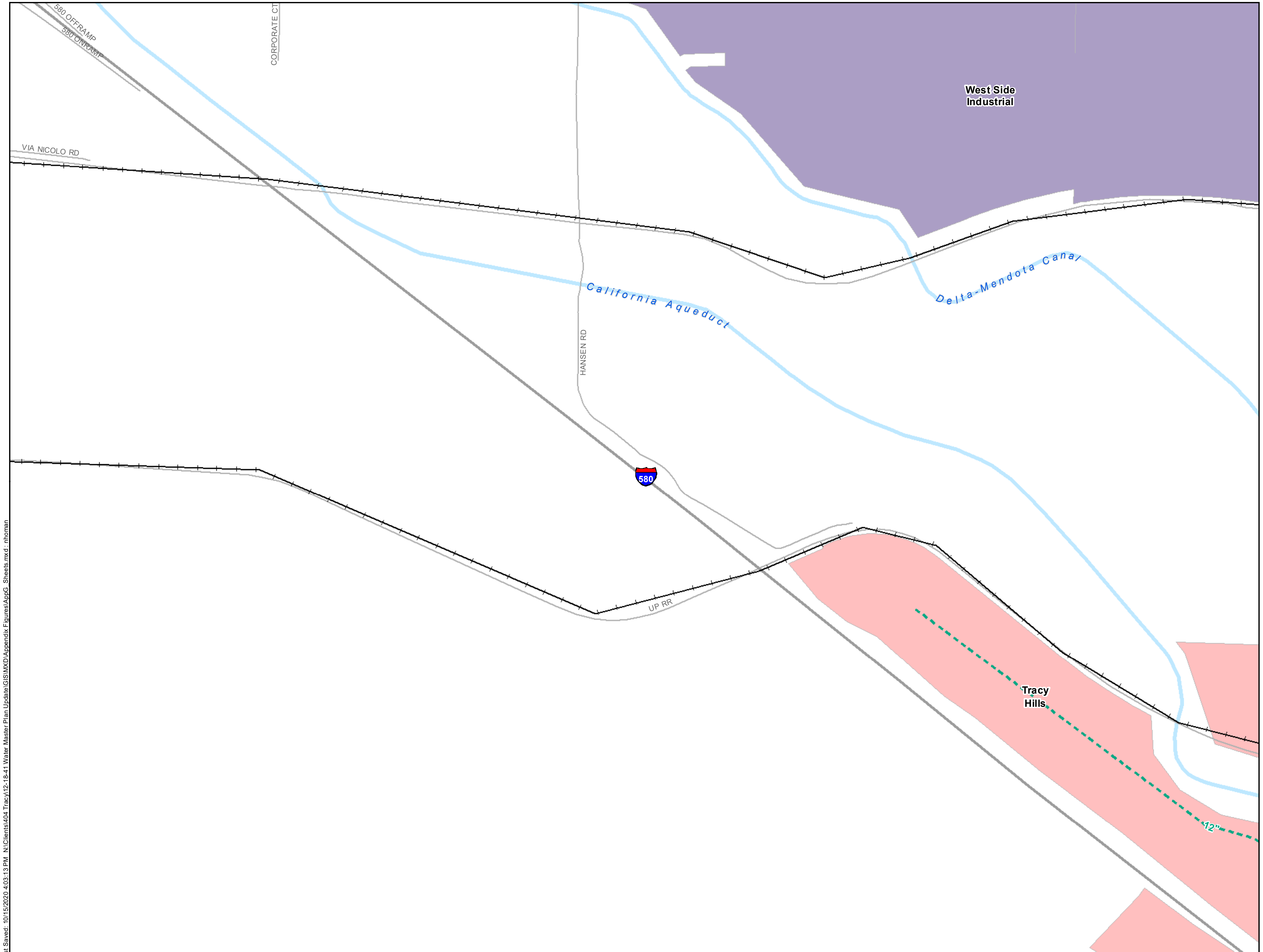
Figure G-B3

City of Tracy
Water System Master Plan Update



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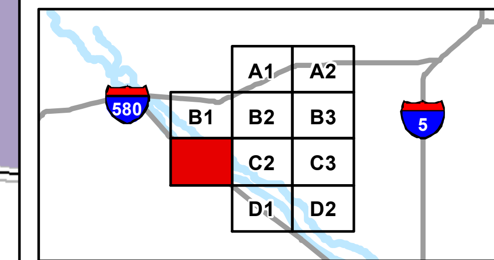
Scale in Feet



Symbology

Proposed Buildout Program Facilities
- Buildout Booster Pump Station
- Buildout Storage Tank
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities
- Buildout NP Booster Pump Station
- Buildout NP Pipeline

Proposed 2025 Program Facilities
- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta-Mendota Canal Pipeline
- Delta-Mendota Canal Discharge Point

Proposed 2025 Non-Program Facilities
- 2025 Non-Program Pipeline

Existing System Facilities
- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing System Pipeline

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Figure G-C1

City of Tracy
Water System Master Plan Update

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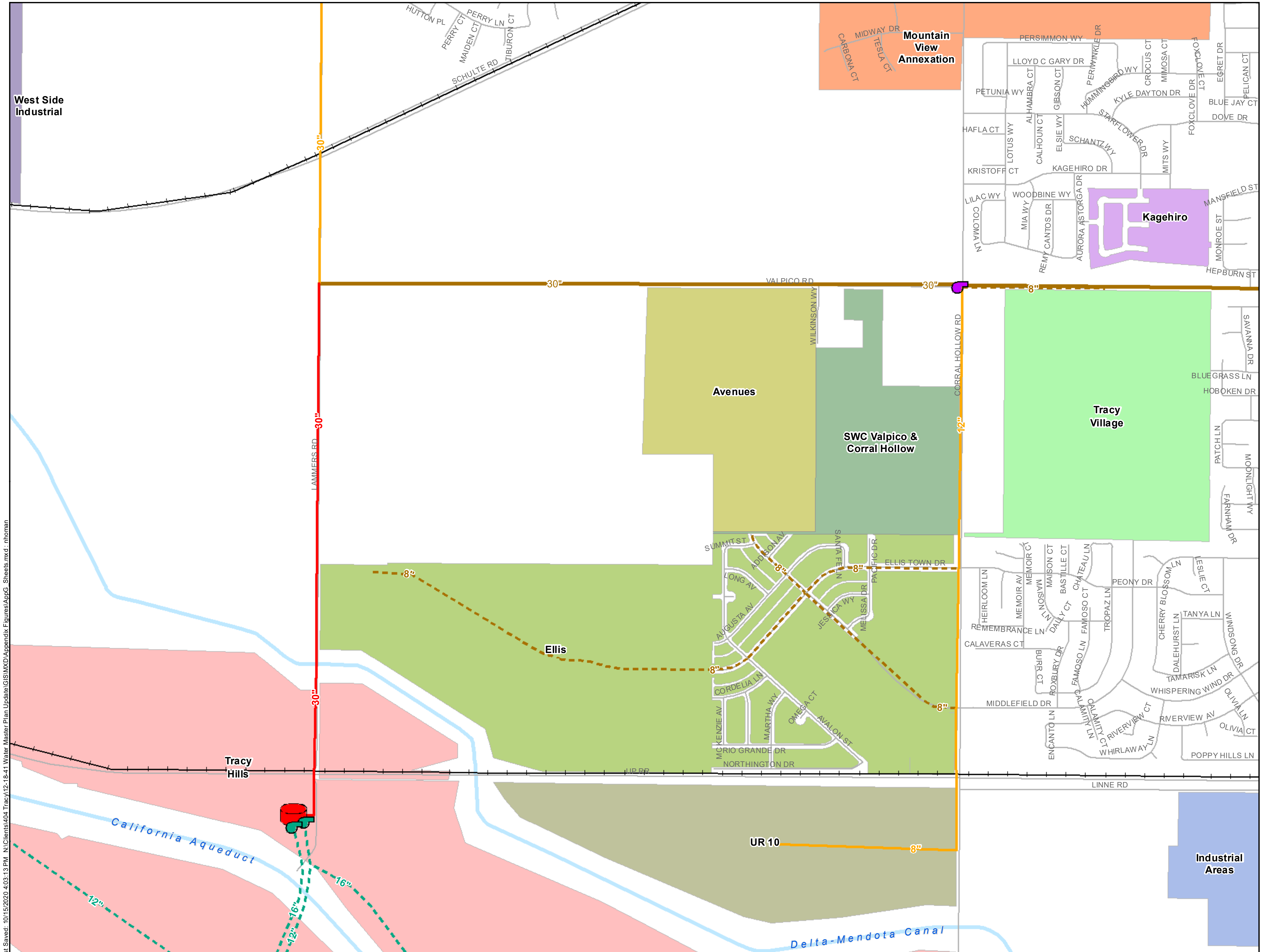

0 500 1,000
Scale in Feet

A1 A2
B1 B2 B3
C1 C3
D1 D2
580
5

Symbology

Proposed Buildout Program Facilities
- Buildout Booster Pump Station
- Buildout Storage Tank
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities
- Buildout NP Booster Pump Station
- Buildout NP Pipeline

Proposed 2025 Program Facilities
- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta-Mendota Canal Pipeline
- Delta-Mendota Canal Discharge Point

Proposed 2025 Non-Program Facilities
- 2025 Non-Program Pipeline

Existing System Facilities
- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing System Pipeline

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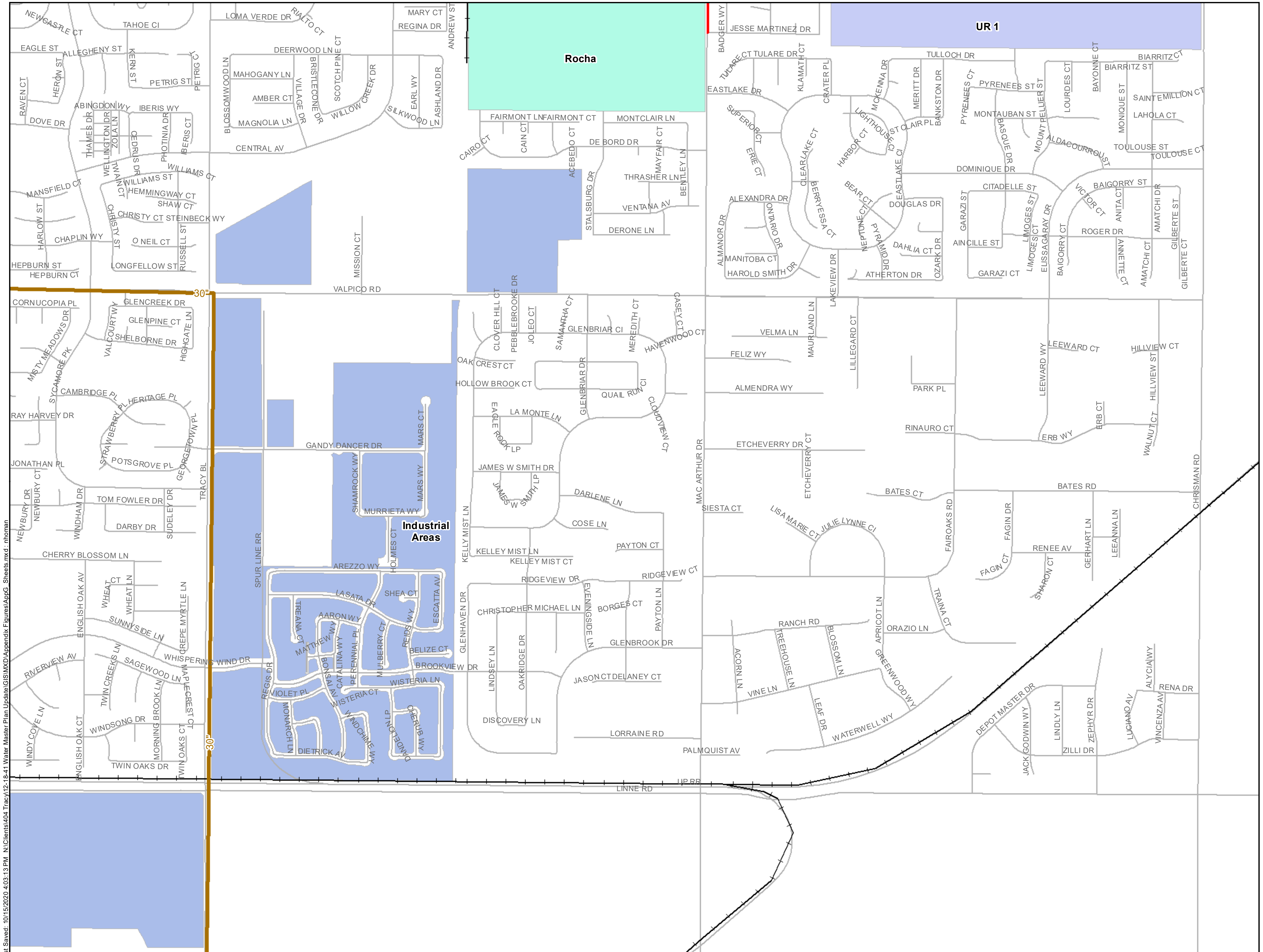
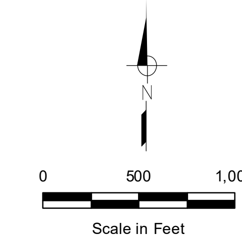
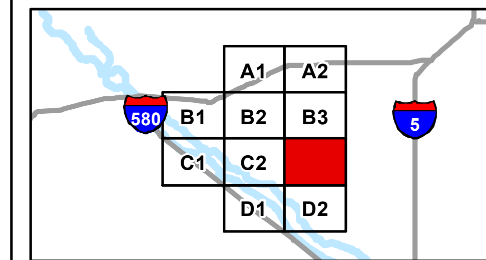
Figure G-C2

City of Tracy
Water System Master Plan Update







Symbology

Proposed Buildout Program Facilities
- Buildout Booster Pump Station
- Buildout Storage Tank
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities
- Buildout NP Booster Pump Station
- Buildout NP Pipeline

Proposed 2025 Program Facilities
- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta-Mendota Canal Pipeline
- Delta-Mendota Canal Discharge Point

Proposed 2025 Non-Program Facilities
- 2025 Non-Program Pipeline

Existing System Facilities
- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing System Pipeline

TRACY

WEST YOST ASSOCIATES

Figure G-C3

City of Tracy
Water System Master Plan Update

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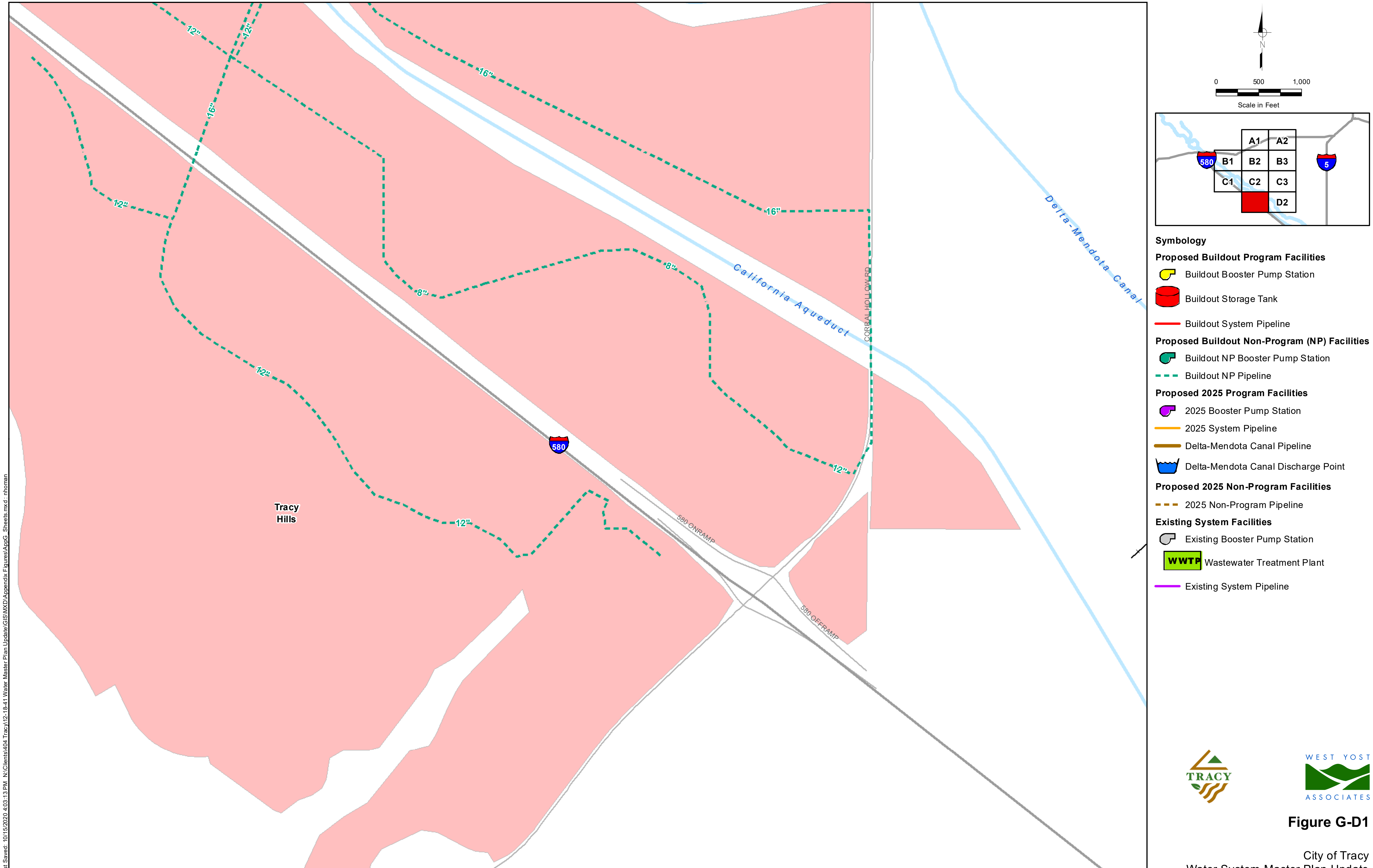
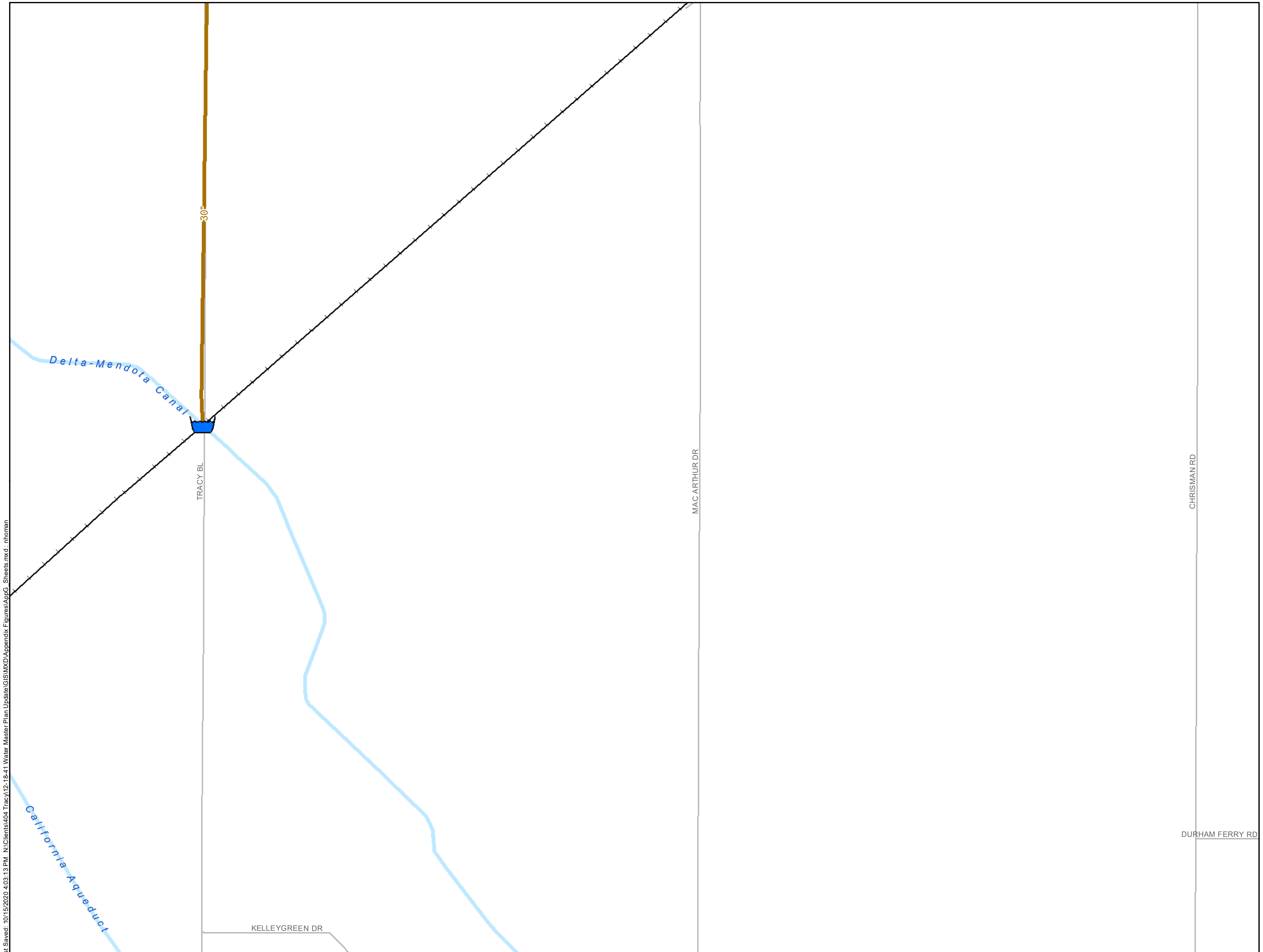


Figure G-D1

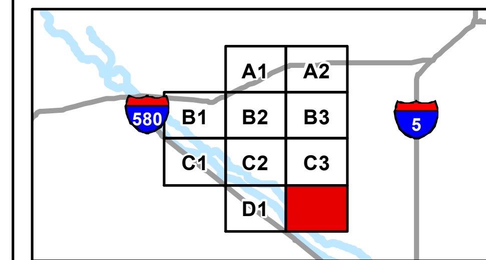
City of Tracy
Water System Master Plan Update



N

0 500 1,000

Scale in Feet



Symbology

Proposed Buildout Program Facilities

- Buildout Booster Pump Station
- Buildout Storage Tank
- Buildout System Pipeline

Proposed Buildout Non-Program (NP) Facilities

- Buildout NP Booster Pump Station
- Buildout NP Pipeline

Proposed 2025 Program Facilities

- 2025 Booster Pump Station
- 2025 System Pipeline
- Delta-Mendota Canal Pipeline
- Delta-Mendota Canal Discharge Point

Proposed 2025 Non-Program Facilities

- 2025 Non-Program Pipeline

Existing System Facilities

- Existing Booster Pump Station
- WWTP Wastewater Treatment Plant
- Existing System Pipeline

Figure G-D2

City of Tracy
Water System Master Plan Update

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