WEST YOST ASSOCIATES
Consulting Engineers

MEMORANDUM

DATE: April 30, 2018

Project No.: 404-12-17-34
SENT VIA: EMAIL

TO: Mr. Al Gali, City of Tracy

CC: Mr. Robert Armijo, City of Tracy
Mr. Nanda Gottiparthy, SNG & Associates, Inc.

FROM: Nathaniel Homan, EIT #155070
Amy Kwong, PE, RCE #C73213

REVIEWED BY: Elizabeth Drayer, PE, RCE #C46872

SUBJECT: Hydraulic Evaluation of Avenues Specific Plan

This memorandum summarizes the findings and conclusions of West Yost Associates' (West Yost) technical evaluation of the ability of the City of Tracy's (City) existing potable water distribution system to meet the required minimum pressures and flows for the proposed Avenues Specific Plan development (Project). The Project area is currently located outside the existing City limits, but within the City's Sphere of Influence (SOI). Figure 1 illustrates the location of the Project.

This memorandum is submitted in accordance with West Yost's February 2017 Scope of Services. The following sections summarize our findings and conclusions:

- Project Description
- Estimated Water Demand
- Treatment, Storage and Pumping Capacity Evaluation
- Summary of Hydraulic Evaluation Conclusions and Recommendations

Because it is not part of this scope, this evaluation does not include review of water supply availability for the Project.

PROJECT DESCRIPTION

The Project area is located outside the City limits, but within the City's SOI and includes approximately 95 acres of undeveloped land located south of Valpico Road and west of Corral Hollow Road. The Project is proposed to consist of up to approximately 480 low density residential units and a four (4) acre park. The Project streets and water mains will connect to the Ellis Specific Plan (ESP) Phase 1 development located just south of the Project. However, the City's potable water system will be separated between the Project and the ESP by a Pressure Reducing Valve

(PRV) because the higher service elevations in the ESP will need to be served by the City-side Pressure Zone 3 (Zone 3) while the lower service elevations within the Project can be served from Pressure Zone 2 (Zone 2).

ESTIMATED WATER DEMAND

Water demands for the Project were calculated using unit water use factors adopted in the 2012 Citywide Water System Master Plan (2012 Master Plan). Table 1 summarizes the Project's proposed dwelling units, water use factors, and projected annual water use. The estimated total water demand for the Project is approximately 269 acre-feet per year (af/yr).

It is possible that recycled water would be used to irrigate the park and special landscape areas within the Project. However, recycled water infrastructure will need to be constructed to deliver recycled water supplies to the Project. Until such recycled water infrastructure is constructed, potable water supplies may be used in the interim to meet non-potable water demands within the Project area. Therefore, for this evaluation, potable water was assumed to be used to meet all Project demands.

Table 1. Estimated Annual Water Demand for the Project

Land Use Designation	Total Area, gross acres[a]	Dwelling Units, du[b]	Unit Potable Water Use Factors[c]		Annual Potable Water Use, af/yr
			gpd/du	af/ac/yr	
Residential - Low Density		480	429		231
Parks and Special Landscape Areas	4.6			4.0	18
UAFW[d]					20
				Total	**269**

(a) From Avenue Specific Plan Tentative Map", (Carlson, Barbee & Gibson, Inc., July 29, 2016). Refer to Attachment 1 for details.
(b) Based on the maximum number of residential units from the Avenues Specific Plan, (City of Tracy, February 2016).
(c) Water use factors are from the 2012 Citywide Water System Master Plan (West Yost Associates, December 2012).
(d) Unaccounted-for water (UAFW) is equal to 7.5 percent, consistent with the 2012 Citywide Water System Master Plan.

Table 2 tabulates the projected average day, maximum day, and peak hour water demands for the Project. As shown in Table 2, the projected average day demand for the Project is approximately 167 gallons per minute (gpm). Maximum day demand and peak hour demand were calculated using the City's adopted peaking factors (from the 2012 Master Plan) of 2.0 and 3.4 times the average day demand, respectively, resulting in a maximum day demand of about 334 gpm and a peak hour demand of about 568 gpm.

Table 2. Estimated Average Day, Maximum Day, and Peak Hour Water Demands for the Project[a]

Average Day Demand		Maximum Day Demand[b]		Peak Hour Demand[c]	
gpm	mgd	gpm	mgd	gpm	mgd
167	0.24	334	0.48	568	0.82

(a) Based on estimated annual water demand presented in Table 1.
(b) Maximum day demand is 2.0 times the average day demand, per the 2012 Citywide Water System Master Plan.
(c) Peak hour demand is 3.4 times the average day demand, per the 2012 Citywide Water System Master Plan.

TREATMENT, STORAGE, AND PUMPING CAPACITY EVALUATION

The City's system performance and operational criteria recommends that sufficient treated surface water supplies should be available to meet a maximum day demand condition. The proposed Project increases the City's overall maximum day demand by approximately 0.48 mgd. Based on the City's available surface water treatment capacity[1], there is currently sufficient treatment capacity to adequately serve the Project.

The storage requirement for the City's potable water system consists of three storage components as listed below:

- **Operational Storage**: 30 percent of a maximum day demand;
- **Emergency Storage**: Two times an average day demand; and
- **Fire Flow Storage**: The required fire flow rate multiplied by the associated fire flow duration period, as required by the City's Fire Department.

For the proposed Project, the fire flow storage component would be shared with other existing and proposed developments served by Zones 1 and 2. The required operational and emergency storage components for the Project are 0.14 MG and 0.48 MG, respectively. Based on the City's available storage capacity and emergency storage credit[2] in Zones 1 and 2, there is currently sufficient storage capacity to adequately serve the Project.

The pumping capacity requirement for the City's potable water system is to have sufficient firm pumping capacity to meet the greater of either a maximum day demand with two simultaneous fire flow events or a peak hour demand. The proposed Project increases the City's overall maximum day demand and peak hour demand by approximately 334 gpm and 568 gpm, respectively. Based on the City's available pumping capacity[3] in Zones 1 and 2, there is currently sufficient pumping capacity to adequately serve the Project.

It is anticipated that potable water demands will decrease once the City's recycled water system is developed and operational. The conversion of the City's potable irrigation water demands to

[1] Refer to Section *7.4.2.1 Surface Water Treatment Capacity* of the 2012 Master Plan for additional details.
[2] Refer to Section *7.4.2.2 Water Storage Capacity* of the 2012 Master Plan for additional details.
[3] Refer to Section *7.4.2.3 Pumping Capacity* of the 2012 Master Plan for additional details.

recycled water demands will increase the amount of treatment, storage, and pumping capacity available to meet additional potable water demands.

SUMMARY OF HYDRAULIC EVALUATION CONCLUSIONS AND RECOMMENDATIONS

Planning and modeling criteria used to evaluate the Project are based on the system performance and operational criteria developed in the 2012 Master Plan and are provided in Attachment 2 for reference. The following hydraulic evaluation assumes that the recently constructed Cordes Tank and Booster Pump Station (BPS) are operational.

Current Operations Scenario

The preliminary plans[4] for the Project provided to West Yost propose new 8-inch and 12-inch diameter pipelines to provide potable water service within the Project area, with one connection to the existing 24-inch diameter pipeline on Valpico Road, and one connection to the 12-inch diameter pipeline currently under construction in Summit Drive as part of ESP Phase 1. The Project will be served solely from Zone 2 under normal operating conditions. As discussed above, a PRV will be installed at the connection to ESP Phase 1, which is served from Zone 3. Under emergency conditions, such as in the event of a fire within the Project area, this PRV can activate to allow the Project to be supplied from Zone 3. Figure 2 illustrates the locations of the proposed Project infrastructure, other planned infrastructure, and the existing potable water system. Figure 3 shows the proposed Project pipelines.

The City's existing potable water distribution system model was first updated to include proposed changes to the configuration of the City-side Zone 3 pump station[5] and the addition of the new Pressure Regulating Station (PRS) located at the intersection of Summit Drive and Corral Hollow Road (PRS #7). The model was then modified to include the proposed infrastructure and water demands from the Project. This updated hydraulic model was then used to simulate peak hour demand and maximum day demand plus fire flow conditions to determine the impacts to the existing water system from the proposed Project.

Figure 4 shows that system pressures during a peak hour demand condition are above the required minimum pressure of 40 psi, and all pipelines are under the maximum pipeline velocity of 8 fps at the Project site. During a peak hour demand condition, the pressures at the Project site were estimated to be approximately 46 to 58 psi.

Figure 5 shows the required fire flow at locations evaluated for fire flow within the Project. The minimum fire flow requirement for single family residential units within the Project is 1,500 gpm, and the minimum fire flow requirement for the park is 4,500 gpm. Figure 6 presents the available fire flow capacity simulated during a maximum day demand condition at each evaluated location. While residential fire flow demands can be adequately supplied from the single connection to Valpico Road, it is necessary to allow supply from Zone 3 through the PRV from ESP Phase 1 to meet fire flow requirements at the park. All locations within the Project meet or exceed the recommended fire flow requirements under the evaluated conditions.

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[4] *"Avenue Specific Plan Tentative Map,"* Carlson, Barbee & Gibson, Inc., dated July 29, 2016. Refer to Attachment 1.

[5] "City-side PZ3 Pump Station on Clearwell #2," West Yost Associates, August 2017.

Alternative Operations Scenario

An alternative operations scenario in which the Cordes Tank and BPS are connected to the ESP to form a contiguous Zone 3 was also evaluated. The proposed alternative operations scenario would provide the IPC development with a direct connection to the City's existing John Jones Water Treatment Plant (JJWTP) without the construction of the proposed 20-inch diameter transmission pipeline previously recommended in the 2012 Master Plan. In this scenario, existing transmission mains on Hansen Road, Schulte Road, and Lammers Road would be re-zoned from Zone 2 to Zone 3, and a new Zone 3 transmission main would be constructed from the intersection of Lammers Road and Valpico Road to the west side of the ESP. A previous TM prepared by West Yost describes the alternative operations in more detail including the recommended capital improvements in the event of re-zoning (refer to Attachment 3). The alternative operations scenario developed for this Project assumes all of the previously recommended improvements will be constructed. Figure 7 illustrates the locations of the proposed Project infrastructure, other planned infrastructure, and the existing water system under the alternative operations scenario.

Figure 8 shows that system pressures during a peak hour demand condition under the alternative operations scenario are above the required minimum pressure of 40 psi, and all pipelines are under the maximum pipeline velocity of 8 fps at the Project site. During a peak hour demand condition, the pressures at the Project site were estimated to be approximately 46 to 59 psi.

Figure 9 presents the available fire flow capacity simulated during a maximum day demand condition at each evaluated location under the alternative operations scenario. Similar to the results from the current operations scenario, residential fire flow demands can be adequately supplied from the single connection to Valpico Road, but it would be necessary to allow supply from Zone 3 through the PRV from ESP Phase 1 to meet fire flow requirements at the park. All locations within the Project meet or exceed the recommended fire flow requirements under the evaluated conditions.

It should be noted that results from the alternative operations scenario are very similar to the current operations scenario because it was assumed that all of the previously recommended improvements for alternative operations as documented in Attachment 3 have been constructed.

Hydraulic Evaluation Summary

In conclusion, the proposed Project pipelines are sufficient to supply peak hour demand and maximum day demand plus fire flow demand to the Project under both evaluated operations scenarios. It should be noted that the proposed PRV connection with ESP Phase 1 located at the southern end of the Project is required to provide adequate fire flow supply to the park.

The hydraulic evaluation performed for the Project is based on the various assumptions stated above. If any of these items are changed or modified in any way, other than as described in this memorandum, additional hydraulic evaluation will be required.

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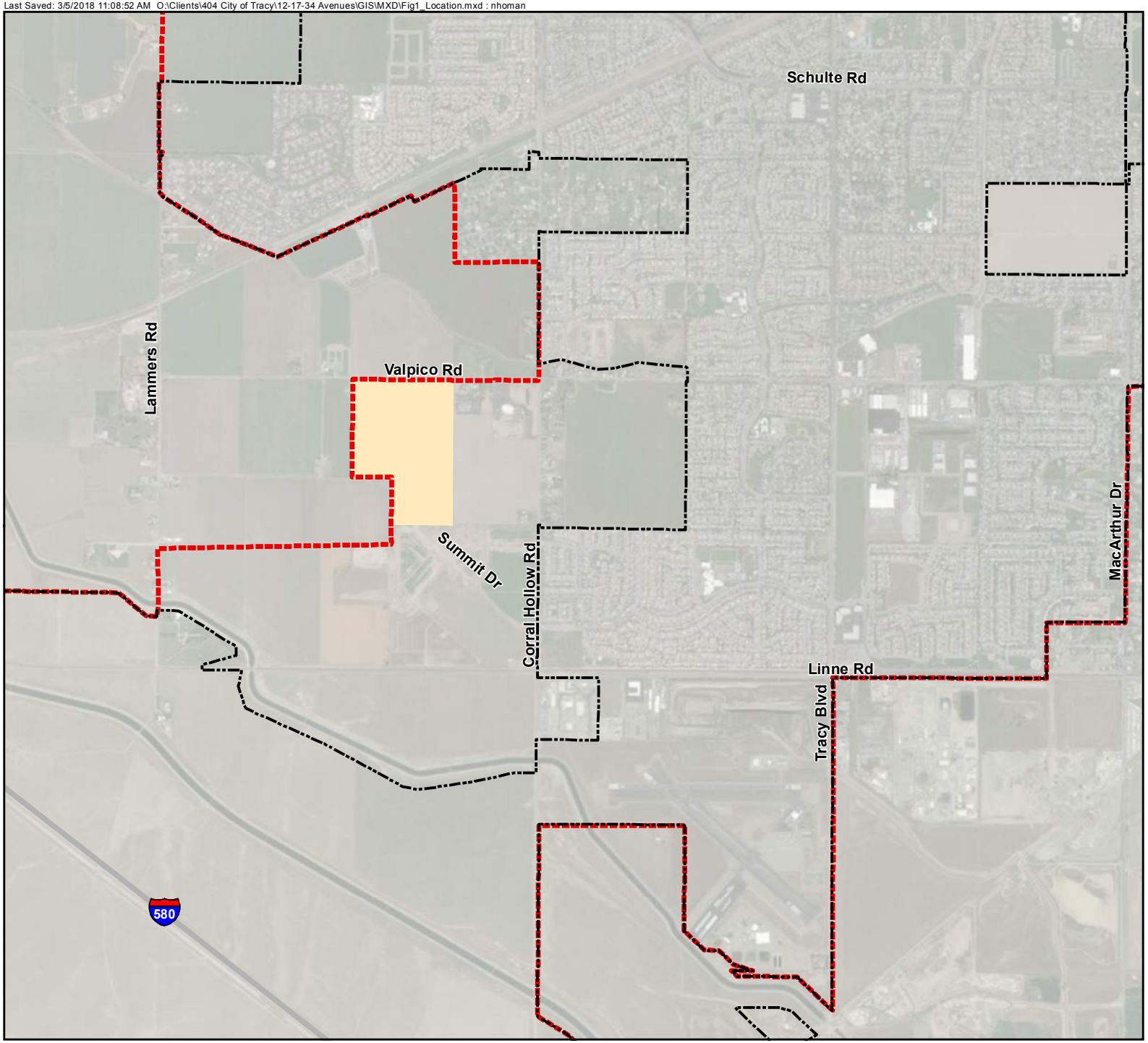

N

0 1,250 2,500

Scale in Feet

Symbology

- Avenues Specific Plan
- City Limit
- Sphere of Influence

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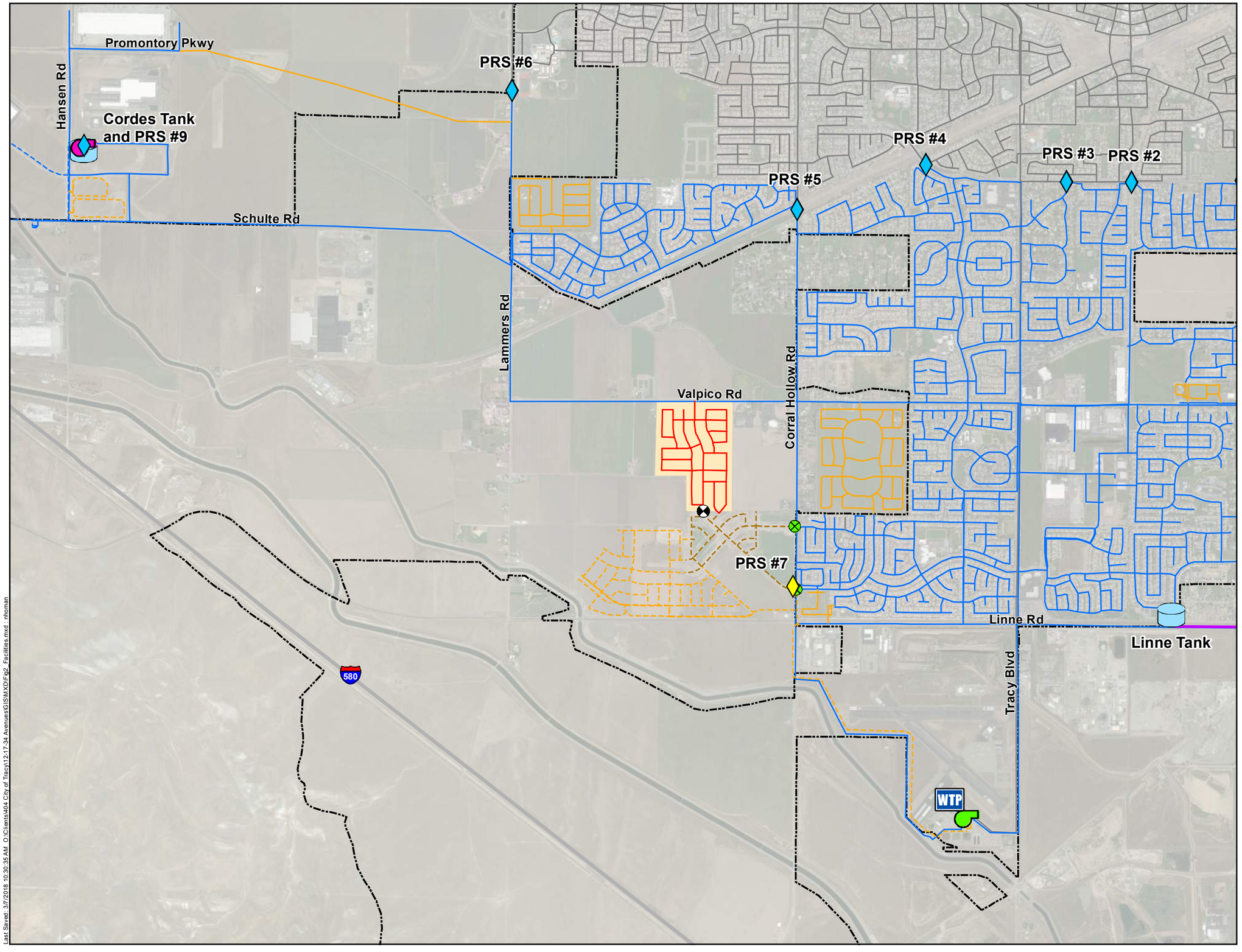
Figure 1

Project Location

City of Tracy
Hydraulic Evaluation of
Avenues Specific Plan



Symbology

- Proposed Pressure Reducing Valve
- Previously Proposed Check Valve

Pressure Regulating Station

- Under Construction
- Existing
- Existing Tank
- John Jones Water Treatment Plant
- City-side Zone 3 Pump Station
- Cordes Booster Pump Station

Proposed Pipeline

- Zone 2

ESP Phase 1 Pipeline (under construction)

- Zone 3

Planned Pipeline

- Zone 2
- Zone 3

Existing Pipeline

- Zone 1
- Zone 2
- Zone 3
- SSJID Pipeline
- Avenues Specific Plan
- City Limit

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Figure 2

Current Operations: Proposed Water System Facilities Layout

City of Tracy
Hydraulic Evaluation of
Avenues Specific Plan

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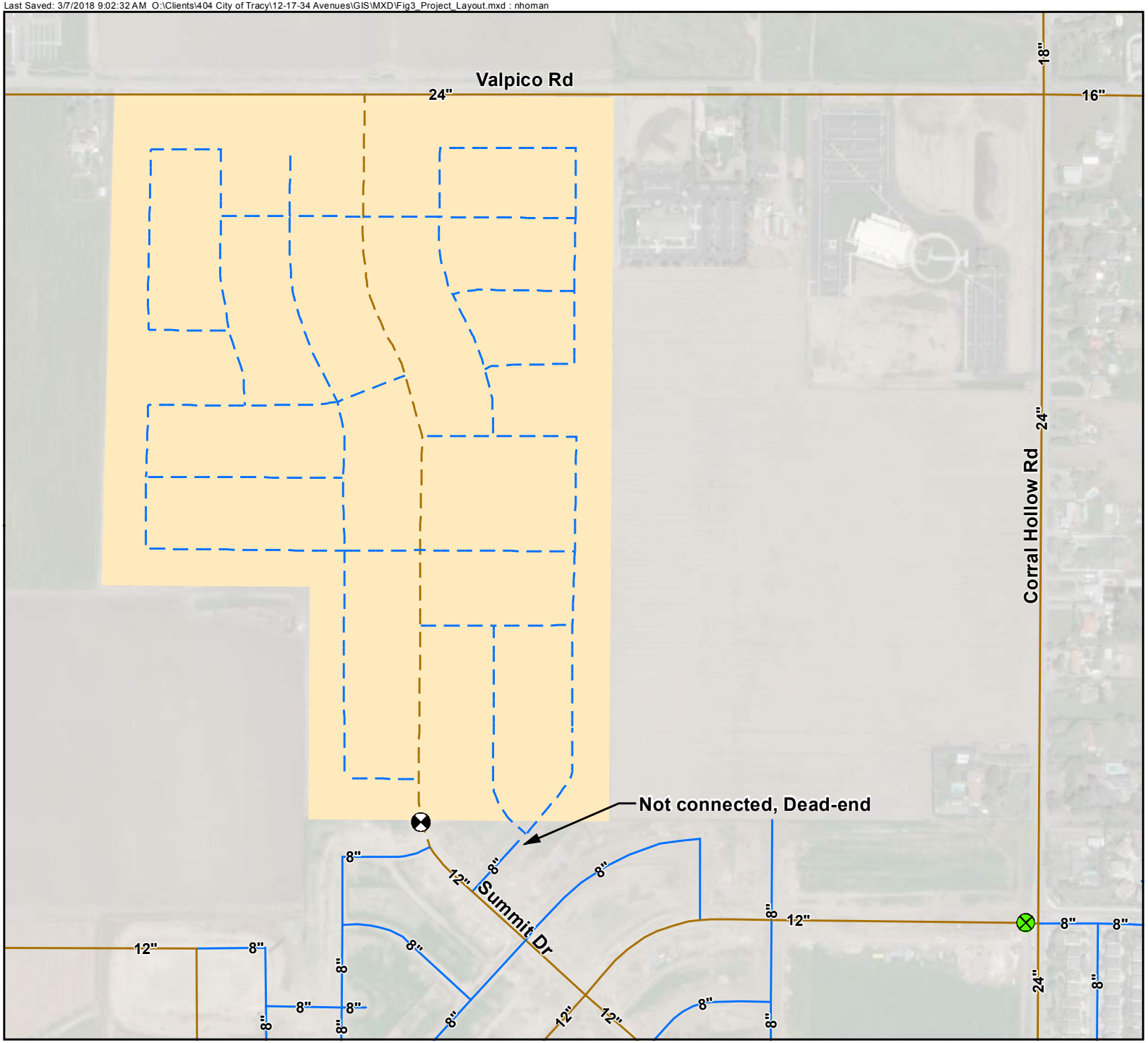

N

0 250 500

Scale in Feet

Symbology

Proposed Pressure Reducing Valve

Previously Proposed Check Valve

Proposed Pipeline Diameter

8-inch

12-inch

Existing and Under Construction Pipeline Diameter

10-inch and smaller

12-inch and greater

Avenues Specific Plan

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Figure 3

Proposed Pipeline Layout

City of Tracy
Hydraulic Evaluation of
Avenues Specific Plan

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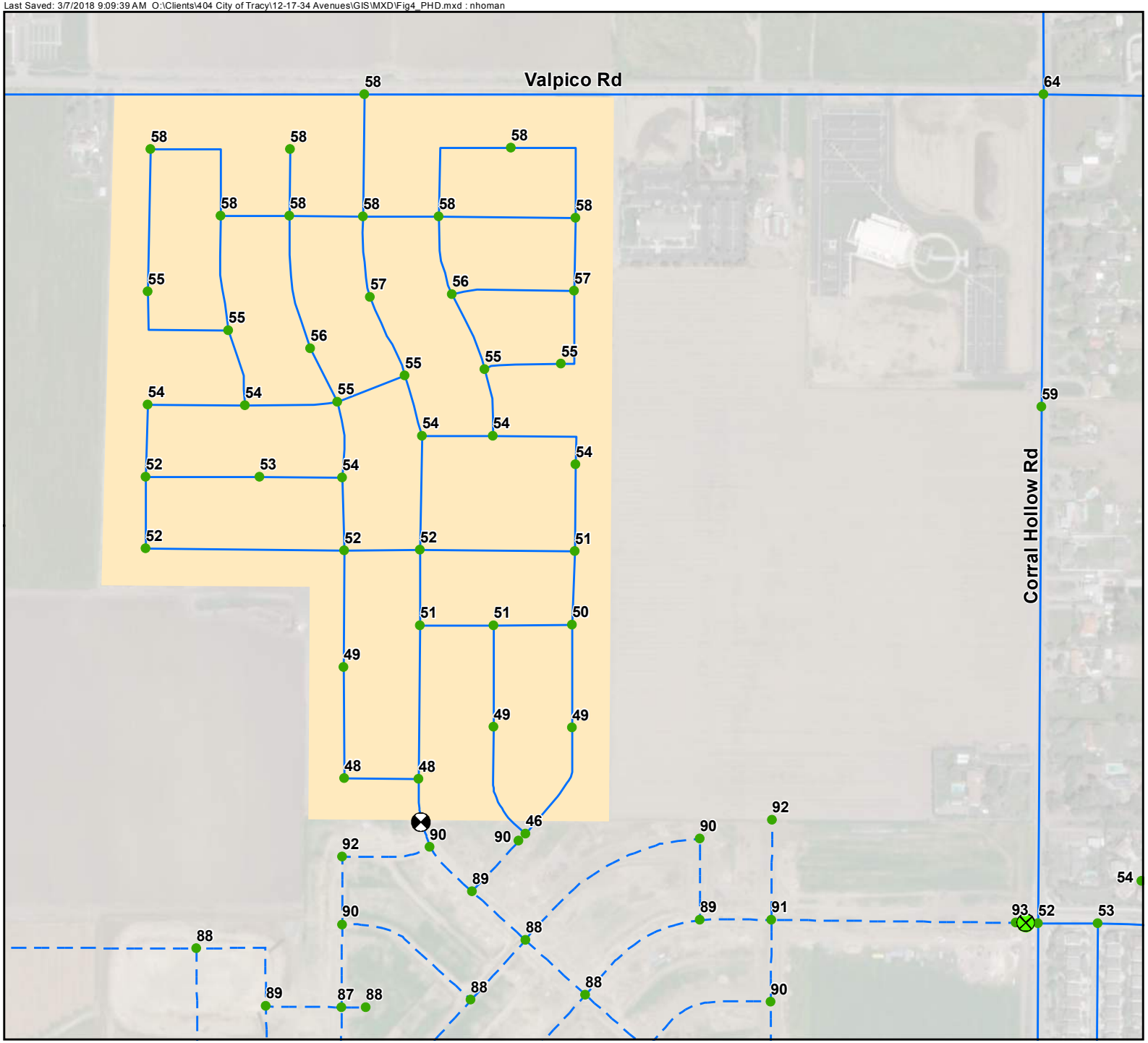

N

0 250 500

Scale in Feet

Symbology

- Proposed Pressure Reducing Valve
- Previously Proposed Check Valve

Junction Pressure

- Less than 40 psi
- Greater than or equal to 40 psi

Zone 2 Pipeline Velocity

- Less than or equal to 8 fps
- Greater than 8 fps

Zone 3 Pipeline Velocity

- Less than or equal to 8 fps
- Greater than 8 fps
- Avenues Specific Plan

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Figure 4

Current Operations: Peak Hour Results

City of Tracy
Hydraulic Evaluation of
Avenues Specific Plan

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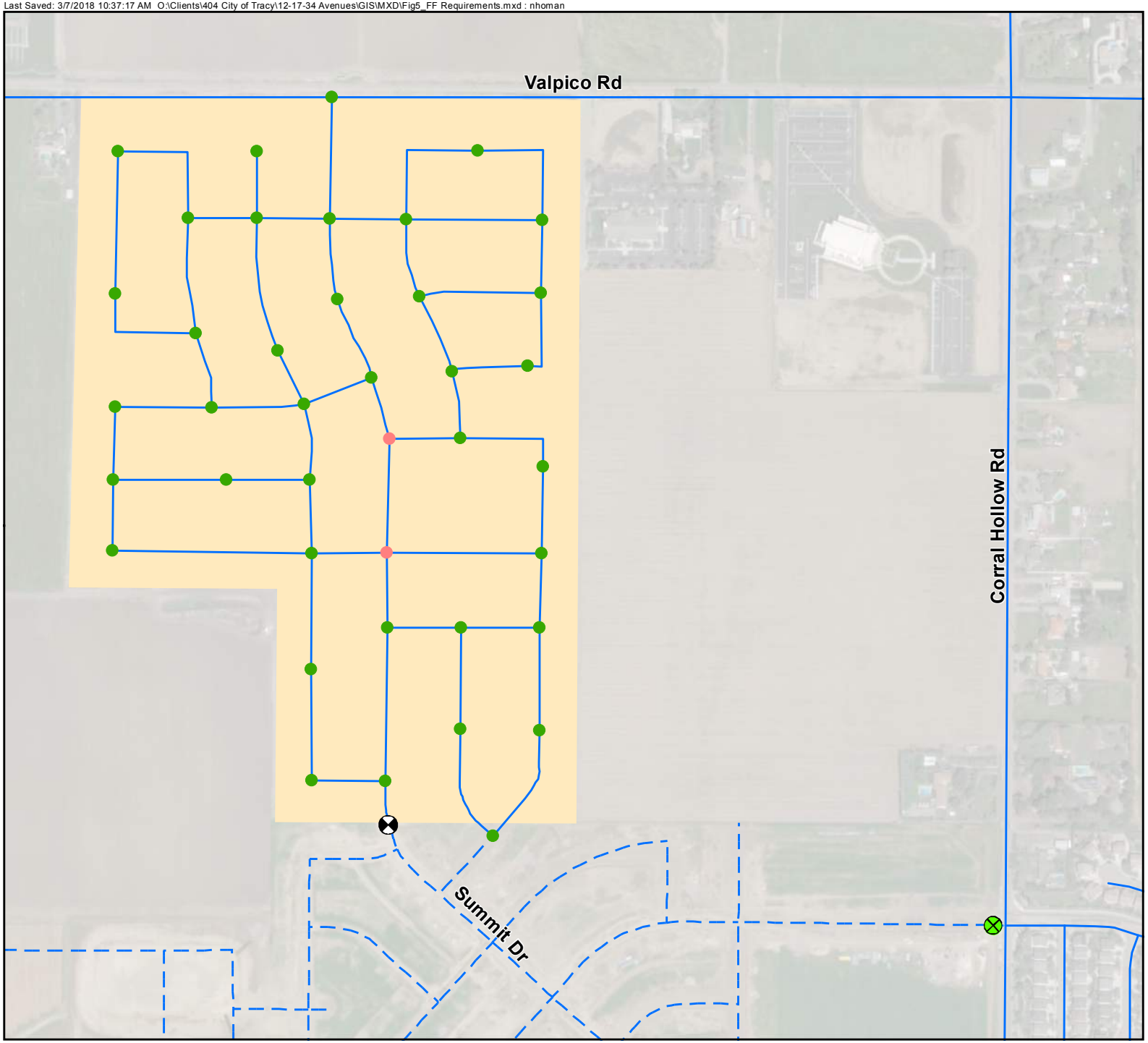

N

0 250 500

Scale in Feet

Symbology

- Proposed Pressure Reducing Valve
- Previously Proposed Check Valve

Fire Flow Requirement

- 1,500 gpm
- 4,500 gpm
- Zone 2 Pipeline
- Zone 3 Pipeline
- Avenues Specific Plan

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Figure 5

Fire Flow Requirements

City of Tracy
Hydraulic Evaluation of
Avenues Specific Plan

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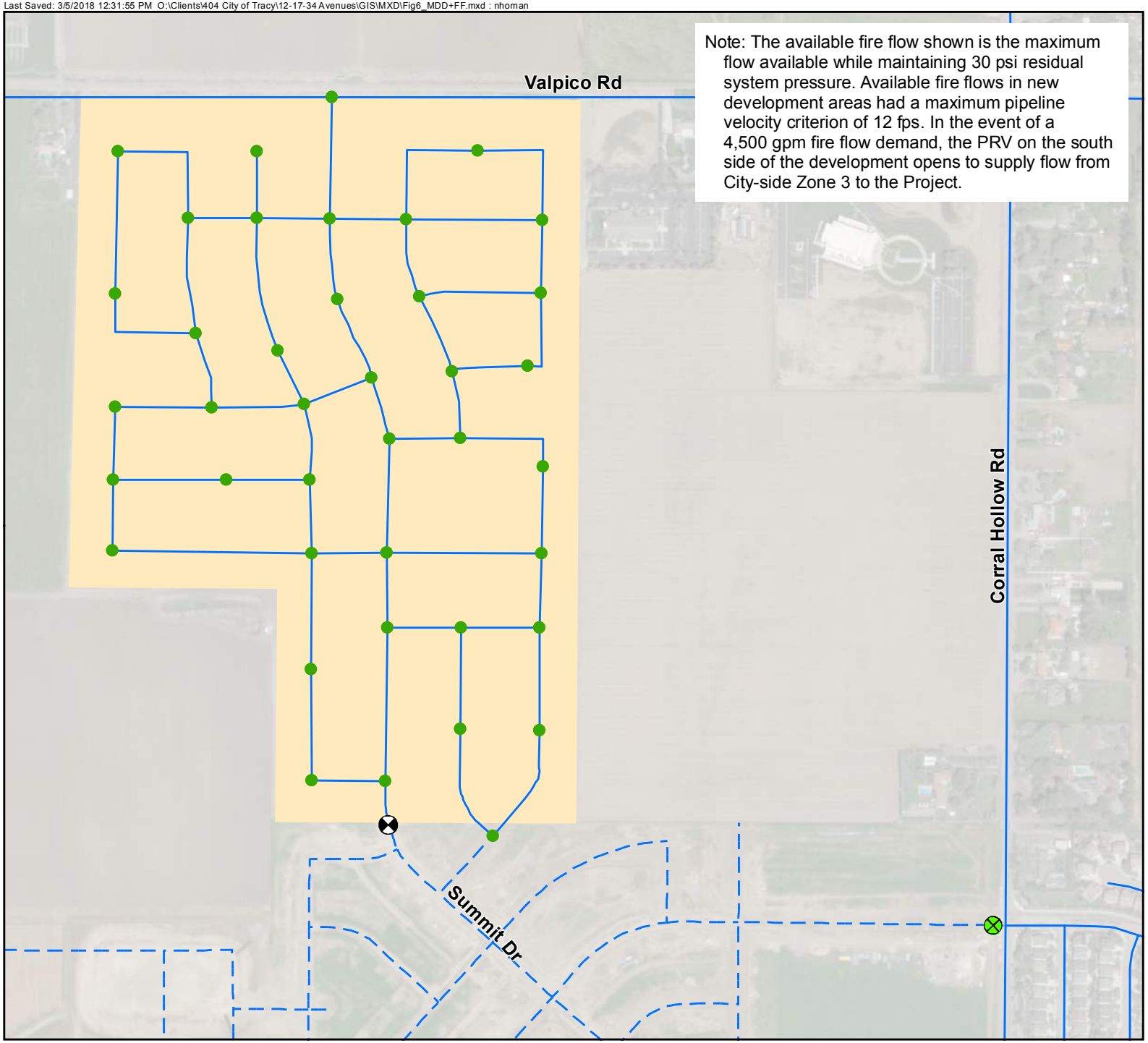

Note: The available fire flow shown is the maximum flow available while maintaining 30 psi residual system pressure. Available fire flows in new development areas had a maximum pipeline velocity criterion of 12 fps. In the event of a 4,500 gpm fire flow demand, the PRV on the south side of the development opens to supply flow from City-side Zone 3 to the Project.

N

0 250 500

Scale in Feet

Symbology

- Proposed Pressure Reducing Valve
- Previously Proposed Check Valve

Available Fire Flow (see note)

- Does Not Meet Fire Flow Requirements
- Meets Fire Flow Requirements
- Zone 2 Pipeline
- Zone 3 Pipeline
- Avenues Specific Plan

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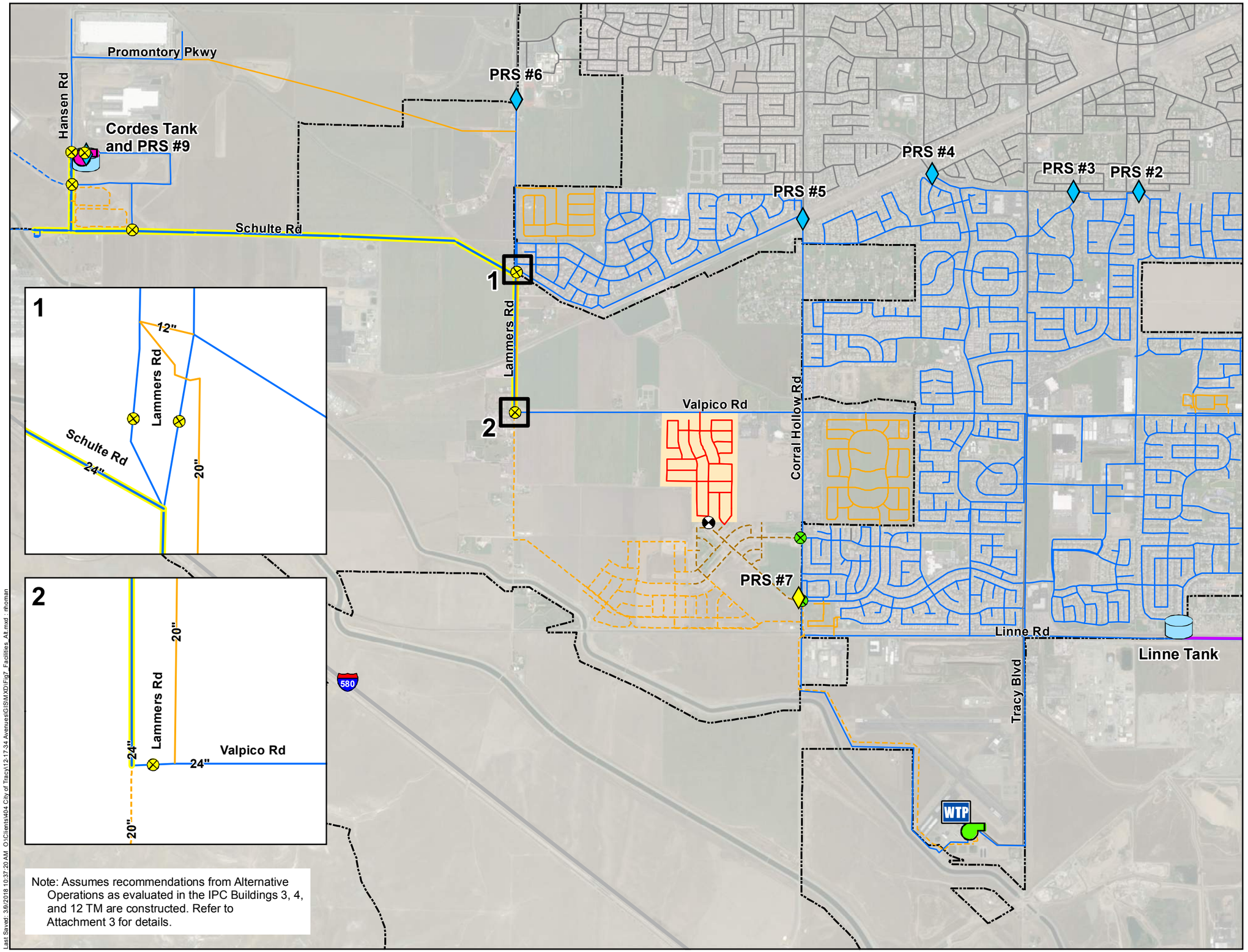
Figure 6

Current Operations: Fire Flow Results

City of Tracy
Hydraulic Evaluation of
Avenues Specific Plan



Note: Assumes recommendations from Alternative Operations as evaluated in the IPC Buildings 3, 4, and 12 TM are constructed. Refer to Attachment 3 for details.

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N

0 1,000 2,000

Scale in Feet

Symbology

- Valve Closed for Alternative Operations
- Proposed Pressure Reducing Valve
- Previously Proposed Check Valve

Pressure Regulating Station

- Under Construction
- Existing
- Existing Tank
- John Jones Water Treatment Plant
- City-side Zone 3 Pump Station
- Cordes Booster Pump Station

Proposed Pipeline

- Zone 2

ESP Phase 1 Pipeline (under construction)

- Zone 3

Planned Pipeline

- Zone 2
- Zone 3

Existing Pipeline

- Zone 1
- Zone 2
- Zone 3
- Rezoned from Zone 2 to Zone 3
- SSJID Pipeline
- Avenues Specific Plan
- City Limit

TRACY

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Figure 7

Alternative Operations: Proposed Water System Facilities Layout

City of Tracy
Hydraulic Evaluation of
Avenues Specific Plan

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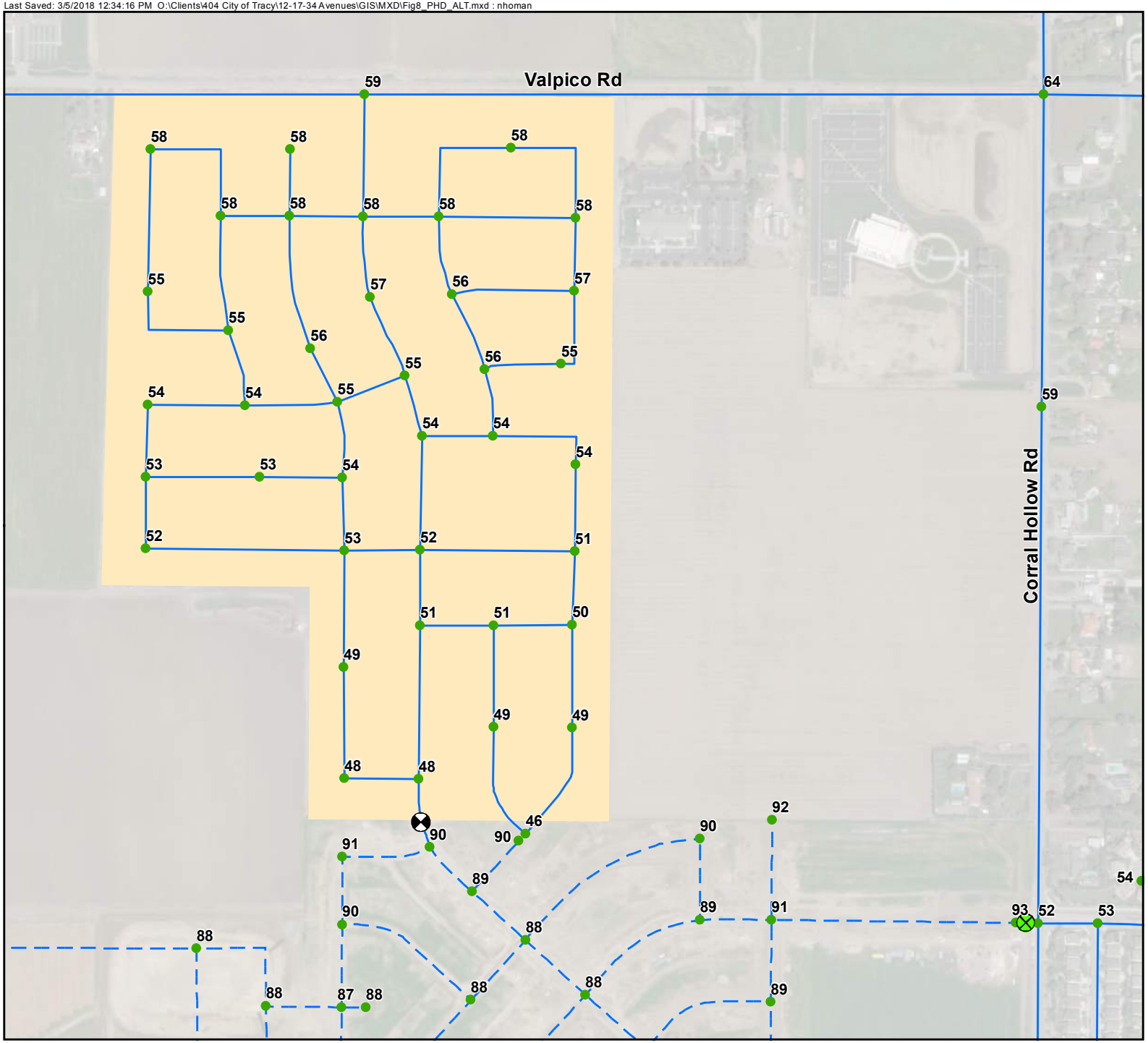

N

0 250 500

Scale in Feet

Symbology

- Proposed Pressure Reducing Valve
- Previously Proposed Check Valve

Junction Pressure

- Less than 40 psi
- Greater than or equal to 40 psi

Zone 2 Pipeline Velocity

- Less than or equal to 8 fps
- Greater than 8 fps

Zone 3 Pipeline Velocity

- Less than or equal to 8 fps
- Greater than 8 fps
- Avenues Specific Plan

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Figure 8

Alternative Operations: Peak Hour Results

City of Tracy
Hydraulic Evaluation of
Avenues Specific Plan

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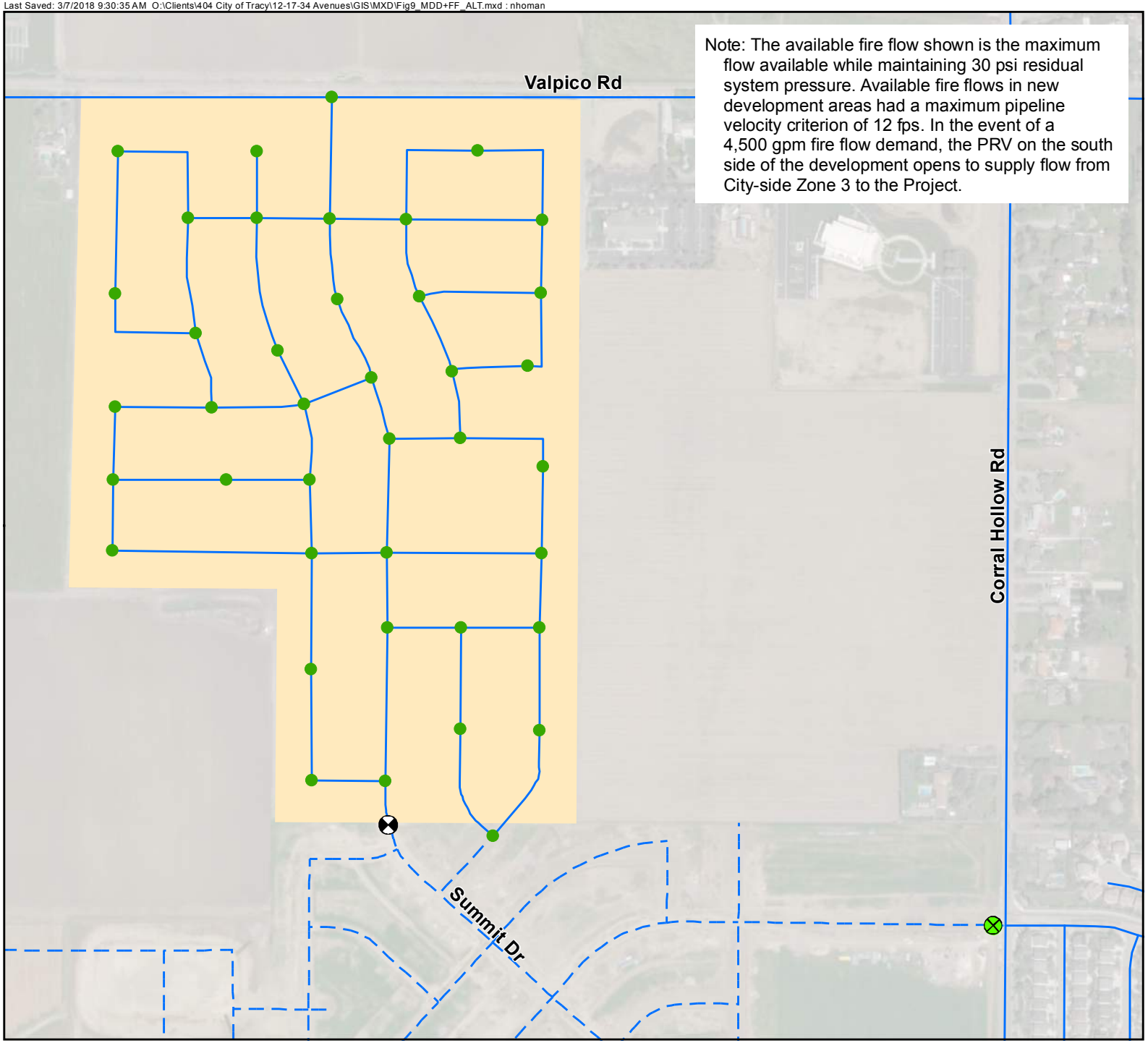

Note: The available fire flow shown is the maximum flow available while maintaining 30 psi residual system pressure. Available fire flows in new development areas had a maximum pipeline velocity criterion of 12 fps. In the event of a 4,500 gpm fire flow demand, the PRV on the south side of the development opens to supply flow from City-side Zone 3 to the Project.

N

0 250 500

Scale in Feet

Symbology

- Proposed Pressure Reducing Valve
- Previously Proposed Check Valve

Available Fire Flow (see note)

- Does Not Meet Fire Flow Requirements
- Meets Fire Flow Requirements

Zone 2 Pipeline

- Zone 2 Pipeline

Zone 3 Pipeline

- Zone 3 Pipeline
- Avenues Specific Plan

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Figure 9

Alternative Operations: Fire Flow Results

City of Tracy
Hydraulic Evaluation of
Avenues Specific Plan

ATTACHMENT 1

Avenue Specific Plan Tentative Map Utility Plan, July 2016

PARCEL 'B'
VALPICO ROAD
FUTURE RECYCLED WATER BY OTHERS
12"SS INV 105.1
PARCEL 'C'
2,475 LF 12"SS @ S=0.004
STORM DRAIN TO DETENTION BASIN 3A
CORRAL HOLLOW ROAD
CONNECT TO EX SSMH BY CH2MHILL EX 21"SS INV 94.3± 10"SS INV 95.0±
SUMMIT DRIVE
HUDSON APN 240-140-04
YON APN 240-140-07
CHURCH OF JESUS CHRIST OF LDS APN 240-140-28
RINAURO APN 240-140-03
RAMCHANDANI APN 240-140-29
RAMCHANDANI APN 240-140-10
PARCEL 'A'
STREET 1
STREET 2
STREET 3
STREET 4
STREET 6
STREET 7
STREET 10
STREET 11
STREET 12
STREET 13
STREET 14
LANE 2
LANE 3
SEE SHEET TM08

CITY OF TRACY

APPROVED FOR CONSTRUCTION SUBJECT TO THE DATA SHOWN CITY OF TRACY AND THE UNDERSIGNED ARE NOT RESPONSIBLE FOR ERRORS AND/OR OMISSIONS THAT MAY EXIST IN PRINTS OR THESE PLANS.

ROBERT ARNOLD — CITY ENGINEER — DATE

TRACY — Think Inside the Triangle

Carlson, Barbee & Gibson, Inc.
CIVIL ENGINEERS • SURVEYORS • PLANNERS
2633 CAMINO RAMON, SUITE 350
SAN RAMON, CALIFORNIA 94583
TEL (925) 866-0322
FAX (925) 866-8575

REVISIONS			
SYMBOL	DATE	DESCRIPTION	APPROVED

DESIGNED BY: CMA
DRAWN BY: MF
CHECKED BY: CGM
SCALE: AS SHOWN

UTILITY PLAN

TRACT 3883
TENTATIVE MAP
AVENUE SPECIFIC PLAN
TRACY, CALIFORNIA

0' 100' 300' 400'
SCALE: 1" = 100'
DATE: JULY 29, 2016

SHEET TM07
OF 8 SHEETS

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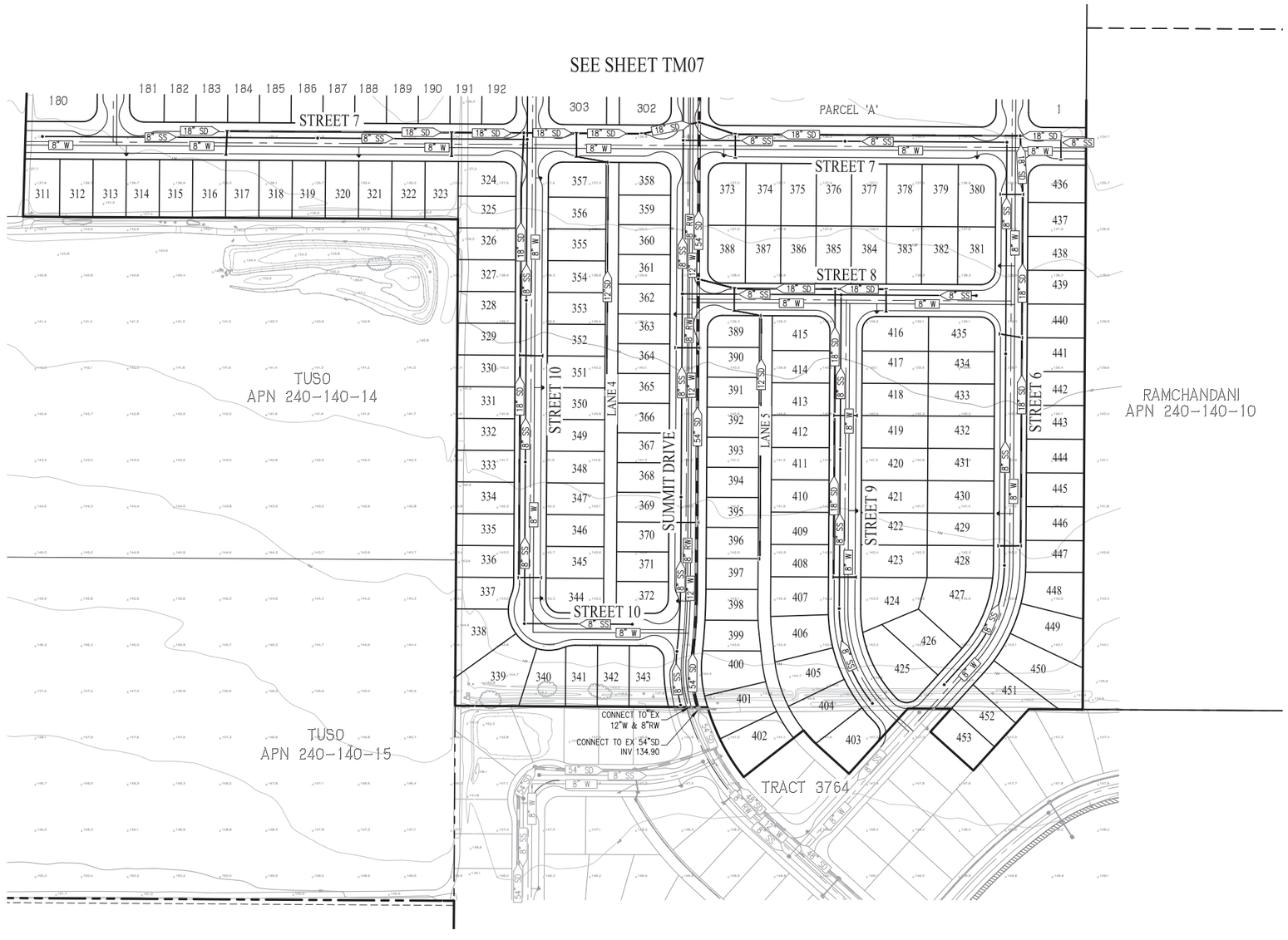

CITY OF TRACY

APPROVED FOR CONSTRUCTION SUBJECT TO THE DATA SHOWN CITY OF TRACY AND THE UNDERSIGNED ARE NOT RESPONSIBLE FOR ERRORS AND/OR OMISSIONS THAT MAY EXIST IN PRINTS OR THESE PLANS

ROBERT ARNOLD — CITY ENGINEER — DATE

TRACY — Think Inside the Triangle

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SAN RAMON, CALIFORNIA 94583
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REVISIONS

SYMBOL	DATE	DESCRIPTION	APPROVED

DESIGNED BY: CMA
DRAWN BY: MF
CHECKED BY: CBM
SCALE: AS SHOWN

UTILITY PLAN

TRACT 3883
TENTATIVE MAP
AVENUE SPECIFIC PLAN
TRACY, CALIFORNIA

0' 100' 300' 400'
SCALE: 1" = 100'

DATE: JULY 29, 2016

SHEET TM08 OF 8 SHEETS

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ATTACHMENT 2

Planning and Modeling Criteria
(2012 Citywide Water System Master Plan)

Planning and modeling criteria used to evaluate the proposed Project 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 Project 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 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.
- Any new, 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 gpm (Single Family Residential land use) or 4,500 gpm (Institutional land use, including Parks and Public Facilities, assuming fully sprinklered buildings) during a maximum day demand condition.
- 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, and Tracy Village Specific Plan. 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, and Project Hawk/IPC.

ATTACHMENT 3

Hydraulic Evaluation of International Park of Commerce (IPC)
Buildings 3, 4, and 12, May 2017

WEST YOST ASSOCIATES
Consulting Engineers

TECHNICAL MEMORANDUM

DATE: May 18, 2017

Project No: 404-12-16-28
SENT VIA: EMAIL

TO: Cris Mina, City of Tracy

CC: Robert Armijo, City of Tracy
Nanda Gottiparthy, SNG & Associates, Inc.

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SUBJECT: Hydraulic Evaluation of International Park of Commerce (IPC) Buildings 3, 4, and 12

This Technical Memorandum (TM) summarizes the findings and conclusions of West Yost Associates' (West Yost) technical evaluation of the ability of the City of Tracy's (City) existing water distribution system to meet the required minimum pressures and flows for the proposed International Park of Commerce (IPC) Buildings 3, 4, and 12 development (Project) located inside the existing City limits. Figure 1 illustrates the location of the proposed Project within the boundary of the entire IPC development (formerly Cordes Ranch). This TM also provides a discussion of some of the water quality concerns that are currently present at the IPC development (i.e., low chlorine residuals due to low water demands and large diameter pipelines), as well as proposed follow-up actions and potential mitigation strategies to improve water quality in the near-term timeframe when potable water demands will remain low until additional buildings are constructed and occupied and potable water demands increase.

Because it is not part of this scope, this evaluation does not include review of water supply availability or water treatment plant capacity for the proposed Project. This TM is submitted in accordance with West Yost's May 2016 scope of work for engineering services to the City.

The following sections summarize our findings and conclusions:

- Project Description
- Estimated Water Demand for the Project
- Storage and Pumping Capacity Evaluation
- Planning and Modeling Criteria

- Hydraulic Evaluation Findings
- Summary of Hydraulic Evaluation Conclusions and Recommendations
- Current Water Quality Concerns and Proposed Mitigation Strategies

PROJECT DESCRIPTION

The entire IPC development is approximately 1,800 acres and is generally bounded on the north by Interstate 205, on the south by Old Schulte Road, on the west by Mountain House Parkway, and on the east by Pavillion Parkway. Currently, there are three existing buildings in the IPC development (FedEx, Medline, and Amazon (also known as Building 1)). In addition, a fourth building is under development (Smuckers (also known as Building 6 or Hawk)) with a building permit issued on January 12, 2016.

This proposed Project consists of three industrial buildings that are located within the IPC development and are approximately 71 acres combined. Buildings 3 and 4 are approximately 31 acres, and Building 12 is approximately 40 acres.[1] All of the land within the Project area is currently undeveloped. Building permits for Buildings 3 and 4 were issued on October 26, 2016, and a development application for Building 12 was received on January 27, 2017. The Project will initially require potable water service from the Cordes Tank and Booster Pump Station (along with infrastructure constructed as part of the first three buildings[2]) in the City's Pressure Zone 3. However, once the pipeline improvements from the Smuckers[3] development are constructed, as shown on Figure 2, then Building 12 (along with FedEx and Medline) will be served directly from the City's Pressure Zone 2. Water service for Buildings 3 and 4, Amazon, Smuckers, and the existing Patterson Pass Business Park (PPBP) will remain in the City's Pressure Zone 3.

Project Proponents also requested West Yost to evaluate an alternative water system operation where the existing 24-inch diameter pipelines on Old Schulte Road and South Lammers Road, which are currently serving the City's Pressure Zone 2, would be converted (re-zoned) to serve the City's Pressure Zone 3. This proposed alternative operation would provide the IPC development with a direct connection to the City's existing John Jones Water Treatment Plant (JJWTP) without the construction of the proposed 20-inch diameter transmission pipeline previously recommended in the 2012 Citywide Water System Master Plan (2012 Master Plan). The evaluation results and recommendations for this proposed alternative water system operation are discussed further below.

The utility plans for the Project's proposed domestic water service and fire service connections are currently being developed so the proposed on-site pipeline alignments and sizes for the Project have not yet been finalized. Therefore, this hydraulic evaluation does not include the on-site pipelines and only determines if the City's existing water system (including proposed near-term improvements) is adequate to serve the proposed Project. It should be noted that the proposed

[1] Refer to Attachment 1. Storage Analysis for Post Hawk Development in Cordes Ranch Specific Plan Area TM developed by WJM Consulting & Engineering, dated July 13, 2016.

[2] Based on Cordes Ranch Phases 1A, 1B, 1C, 1D, and 2 improvement plan drawings received by West Yost in May 2016.

[3] IPC Development Project Hawk Water Distribution System Hydraulic Network Analysis TM developed by Black Water Consulting Engineers, Inc., dated April 19, 2016.

on-site domestic, irrigation, and fire service pipelines for the Project will need to be sized based on the recommended potable water system performance and operational criteria defined in the 2012 Master Plan. Based on the 2012 Master Plan, pipelines located in Industrial land use areas would need to be at least 12-inches in diameter.

ESTIMATED WATER DEMAND FOR THE PROJECT

As part of the hydraulic evaluation, water demands were estimated for the Project. Water demands were calculated using the unit water use factors adopted in the 2012 Master Plan. Table 1 summarizes the Project's gross area, potable water use area, landscaped area, water use factors, and projected annual potable domestic and irrigation water use. The estimated potable water use for the Project is approximately 145 acre-feet per year (af/yr).

Table 1. Estimated Annual Water Demand for the Project

Land Use Designation	Total Area, gross acres[(a)]	Potable Water Use Area, acres[(b)]	Landscaped Area, acres[(c)]	Unit Potable Water Use Factors, af/ac/yr[(d)]	Annual Potable Water Use, af/yr
Industrial	71.4	60.7		1.5	91
Irrigation Demand			10.7	4.0	43
UAFW[(e)]					11
Total	**71.4**	**60.7**	**10.7**		**145**

(a) Data provided in TM (Storage Analysis for Post Hawk Development in Cordes Ranch Specific Plan Area) developed by WJM Consulting & Engineering, dated July 13, 2016.
(b) Consistent with assumptions in the 2012 Master Plan; 85 percent of gross acres are assumed to use potable water.
(c) Consistent with assumptions in the 2012 Master Plan; 15 percent of gross acres are assumed to be landscaped. Potable water is assumed to be used for irrigation demands because the City's recycled water system has not yet been constructed.
(d) Based on 2012 Master Plan, dated December 2012.
(e) Unaccounted-for water (UAFW) is equal to 7.5 percent.

Table 2 tabulates the projected average day, maximum day, and peak hour water demands for the Project. As shown in Table 2, the projected average day demand for the Project is approximately 90 gallons per minute (gpm). Maximum day demand and peak hour demand were calculated using the City's adopted peaking factors (from the 2012 Master Plan) of 2.0 and 3.4 times the average day demand, respectively, resulting in a maximum day demand of about 180 gpm and a peak hour demand of about 305 gpm.

Table 2. Estimated Average Day, Maximum Day, and Peak Hour Water Demands for the Project[(a)]

Average Day Demand		Maximum Day Demand[(b)]		Peak Hour Demand[(c)]	
gpm	mgd	gpm	mgd	gpm	mgd
89.8	0.13	179.6	0.26	305.3	0.44

(a) Based on estimated annual water demand presented in Table 1.
(b) Maximum day demand is 2.0 times the average day demand, per the 2012 Master Plan.
(c) Peak hour demand is 3.4 times the average day demand, per the 2012 Master Plan.

STORAGE AND PUMPING CAPACITY EVALUATION

Storage and pumping capacity was evaluated previously for the FedEx, Medline, Amazon, and Smuckers buildings as documented in the following TMs, which are included for reference as Attachments 2 and 3, respectively.

- Cordes Ranch Specific Plan Water System Reanalysis – Infrastructure Requirements for First Buildings and Phase 1, West Yost Associates, July 30, 2014
- IPC Development Project Hawk Water Distribution System Hydraulic Network Analysis, Black Water Consulting Engineers, Inc. (Black Water), April 19, 2016

The following sections provide the results from the storage and pumping capacity evaluation for the Project.

Storage Capacity

The primary purpose for the 2.0 million gallon (MG) Cordes Tank is to provide storage for the City's Pressure Zone 3. The Cordes Tank provides (1) operational and fire flow storage for the IPC development and the existing Patterson Pass Business Park, and (2) emergency storage for the IPC development only.[4] Based on the most recent hydraulic evaluation performed for the Smuckers development, approximately 22,000 gallons of storage capacity remains in the Cordes Tank for future development. With this limited amount of storage capacity available, this Project would trigger additional storage in the City's Pressure Zone 3 as confirmed in the calculations presented in Table 3.

Table 3 indicates that there would be a storage capacity deficit in the Cordes Tank of approximately 314,000 gallons with the construction of the proposed Project. Additional storage could be provided by an Aquifer Storage and Recovery (ASR) well and/or the new Clearwell #3 at the JJWTP, which would also require design and construction of the 20-inch diameter transmission pipeline from Clearwell #3, as well as the permanent City-side Pressure Zone 3 Booster Pump Station (BPS) at the JJWTP. However, due to the proposed 16-inch diameter pipeline connection to Pressure Zone 2 that was previously recommended in the hydraulic evaluation for the Smuckers development, IPC buildings that are located in the City's Pressure Zone 2 (i.e., FedEx, Medline, and Building 12) will then be directly connected to the storage tanks located in the City's existing water system (i.e., Linne, Clearwell #2, etc.) when the proposed 16-inch diameter pipeline connection is operational. Therefore, if the City allows the IPC buildings that are located in Pressure Zone 2 to essentially "borrow" storage capacity from the City's existing water system in the interim, then the storage requirement for these buildings will no longer be required from the Cordes Tank. This interim use of the City's available storage capacity surplus in Pressure Zones 1 and 2 could continue until future storage improvements are required to meet additional water demands (e.g., Clearwell #3, additional storage in Zone 1 or Zone 2, etc.).

[4] Limited storage for the Patterson Pass Business Park is currently provided by a water storage tank located within the PPBP.

Table 3. Summary of Storage Volume Required for the IPC Development Without Proposed 16-inch Diameter Pipeline Connection to Pressure Zone 2 at Lammers Road

Development	Required Storage Capacity, gallons			Total, gallons
	Operational[a]	Emergency[b]	Fire Flow[c]	
PPBP, FedEx, Medline, and Amazon[d]	573,486	355,908	960,000	2,314,151
Smuckers[e]	20,434	68,112		
Buildings 3, 4, and 12[f]	77,587	258,624		
Total Storage Required				**2,314,151**
Cordes Tank Capacity				**2,000,000**
Storage Capacity Surplus or Deficit				**(314,151)**

[a] Equal to 30 percent of a maximum day demand.

[b] Equal to two times the average day demand.

[c] Based on storage required for an Industrial land use fire flow (4,000 gpm for 4 hours; excludes volume associated with 500 gpm sprinkler flow). The fire flow storage capacity requirement is the same for all the buildings in the IPC development and can also be shared between these buildings.

[d] Excludes landscape irrigation demands from FedEx, Medline and Amazon. Also excludes emergency storage required for the existing occupied portion of Patterson Pass Business Park. Source: "*Water Demand Calculations for Cordes Ranch Storage Tank and Pump Station*," WJM Consulting and Engineering, July 7, 2014.

[e] Source: "*IPC Development Project Hawk Water Distribution System Hydraulic Network Analysis*," Black Water Consulting Engineers, Inc., April 19, 2016.

[f] Calculated based on water demands presented in Table 2.

Calculations from the 2012 Master Plan indicated that there was a 1.8 MG storage capacity surplus[5] in Pressure Zones 1 and 2; however, more recent calculations that account for proposed developments that have been identified since the completion of the 2012 Master Plan indicate that the storage capacity surplus in Pressure Zones 1 and 2 has decreased to approximately 1.3 MG[6]. This storage capacity surplus in Pressure Zones 1 and 2 would be sufficient to meet the storage requirement for FedEx, Medline, and Building 12.

With the proposed 16-inch diameter pipeline connection to Pressure Zone 2, Table 4 indicates that there is now a storage capacity surplus of approximately 275,000 gallons in the Cordes Tank if the City allows the interim use of its available existing water system storage capacity surplus in Pressure Zones 1 and 2 to meet the water demands for the IPC buildings that are located in the City's Pressure Zone 2 (i.e., FedEx, Medline, and Building 12). As noted above, the interim use of the City's available storage capacity surplus in Pressure Zones 1 and 2 could continue until future storage improvements are required to meet additional water demands.

[5] Refer to Table 7-9 in the 2012 Citywide Water System Master Plan.

[6] Refer to Attachment 4. Based on updated storage calculations developed by West Yost and provided in an email to City staff on July 5, 2016.

Table 4. Summary of Storage Volume Required for the IPC Development With Proposed 16-inch Diameter Pipeline Connection to Pressure Zone 2 at Lammers Road

Development	Required Storage Capacity, gallons			Total, gallons
	Operational[a]	Emergency[b]	Fire Flow[c]	
PPBP and Amazon[d]	481,038	47,748	960,000	1,725,220
Smuckers[e]	20,434	68,112		
Buildings 3 and 4[f]	34,128	113,760		
Total Storage Required				**1,725,220**
Cordes Tank Capacity				**2,000,000**
Storage Capacity Surplus or Deficit				**274,780**

[a] Equal to 30 percent of a maximum day demand.

[b] Equal to two times the average day demand.

[c] Based on storage required for an Industrial fire flow (4,000 gpm for 4 hours; excludes volume associated with 500 gpm sprinkler flow). The fire flow storage capacity requirement is the same for all the buildings in the IPC development and can also be shared between these buildings.

[d] Assumes FedEx and Medline will be served directly from Pressure Zone 2 via the proposed 16-inch diameter pipeline connection at Lammers Road. Excludes landscape irrigation demands from Amazon. Also excludes emergency storage required for the existing occupied portion of Patterson Pass Business Park. Source: "*Water Demand Calculations for Cordes Ranch Storage Tank and Pump Station*," WJM Consulting and Engineering, July 7, 2014.

[e] Source: "*IPC Development Project Hawk Water Distribution System Hydraulic Network Analysis*," Black Water Consulting Engineers, Inc., April 19, 2016.

[f] Assumes Building 12 will be served directly from Pressure Zone 2 via the proposed 16-inch diameter pipeline connection at Lammers Road. The projected water demand from Building 12 is equal to 81 af/yr or 50.3 gpm.

Pumping Capacity

The Cordes BPS is designed to meet the pumping capacity requirement of Phase 1 water demands from the IPC development.[7] The firm pumping capacity of the Cordes BPS is equal to 6,150 gpm.[8] Firm pumping capacity assumes that the largest booster pump at the Cordes BPS would be offline.

Table 5 indicates that there is sufficient firm pumping capacity at the Cordes BPS to meet the pumping capacity requirement for the proposed Project.

[7] Cordes Ranch Specific Plan Water System Reanalysis – Infrastructure Requirements for First Buildings and Phase 1 TM developed by West Yost Associates, dated July 30, 2014.

[8] Based on Cordes Ranch Phases 1 and 2 improvement plan drawings received by West Yost in May 2016.

Table 5. Summary of Firm Pumping Capacity Required for the IPC Development Without Proposed 16-inch Diameter Pipeline Connection to Pressure Zone 2 at Lammers Road

Pumping Requirement	Development	Firm Pumping Capacity, gpm[a]
Fire Flow	All buildings in IPC[b]	4,500
Maximum Day Demand	PPBP[c]	558
	FedEx, Medline, and Amazon[d]	247
	Smuckers[e]	47
	Buildings 3, 4, and 12[f]	180
Total Firm Pumping Capacity Required		**5,532**
Cordes BPS Firm Pumping Capacity[g]		**6,150**
Firm Pumping Capacity Surplus or Deficit		**618**

[a] Firm pumping capacity assumes that the largest booster pump at the Cordes BPS would be offline.
[b] Based on the fire flow requirement for Industrial land use and assuming fully sprinklered buildings.
[c] Source: Table 7-7, 2012 Citywide Water System Master Plan.
[d] Source: "*Water Demand Calculations for Cordes Ranch Storage Tank and Pump Station*," WJM Consulting and Engineering, July 7, 2014.
[e] Source: "*IPC Development Project Hawk Water Distribution System Hydraulic Network Analysis*," Black Water Consulting Engineers, Inc., April 19, 2016.
[f] Refer to Table 2.
[g] Based on Cordes Ranch Phases 1 and 2 improvement plan drawings received by West Yost in May 2016.

Similar to the storage capacity evaluation, the firm pumping capacity surplus at the Cordes BPS would also be increased if the City allows the interim use of its available existing water system pumping capacity surplus in Pressure Zones 1 and 2 to meet the water demands for the IPC buildings that are located in the City's Pressure Zone 2 (i.e., FedEx, Medline, and Building 12). The maximum day and peak hour water demands from FedEx, Medline, and Building 12 are equal to 315 gpm and 535 gpm, respectively. The existing firm pumping capacity surplus in Pressure Zones 1 and 2 would be sufficient to meet the firm pumping capacity requirement for FedEx, Medline, and Building 12.[9] Similar to the interim use of the City's available storage capacity surplus, the interim use of the City's available firm pumping capacity surplus in Pressure Zones 1 and 2 could continue until future pumping improvements are required to meet additional water demands (e.g., Zone 2 BPS upgrade or additional pumping capacity at new storage tanks located in Zone 1 or Zone 2).

PLANNING AND MODELING CRITERIA

Planning and modeling criteria used to evaluate the proposed Project are based on the system performance and operational criteria developed in the 2012 Master Plan. The criteria used to evaluate the existing water system and the proposed pipelines for the Project are listed as follows:

[9] Refer to Table 7-12 in the 2012 Master Plan.

- 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 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.
- Any new, required pipelines, will be modeled with a roughness coefficient (C-factor) of 130.
- Available fire flow demand must meet a minimum flow of 4,500 gpm (Industrial land use, assuming fully sprinklered buildings) during a maximum day demand condition.
- The 2012 Master Plan hydraulic model of the City's water distribution system was used as the basis for evaluation.[10] 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).

HYDRAULIC EVALUATION FINDINGS

The City's existing water distribution model was first modified to include the proposed water demands for the Project. This updated hydraulic model was then used to simulate peak hour demand and maximum day demand plus fire flow conditions to determine the impacts to the existing water system from the proposed Project. As discussed above, the Project will first be evaluated under (1) current water system operations with the proposed 16-inch diameter pipeline connection to Pressure Zone 2 and (2) proposed alternative water system operations where the City's existing 24-inch diameter pipelines on Old Schulte Road and South Lammers Road, which are currently

[10] 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, and Ellis Specific Plan Phase 2 - The Gardens. 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, and Project Hawk/IPC.

serving the City's Pressure Zone 2, would be re-zoned to serve the City's Pressure Zone 3. Results from these hydraulic evaluations are discussed below.

Current Water System Operations

The current water system operations will be based on the water system improvements previously proposed for FedEx, Medline, Amazon, and Smuckers (refer to Figure 2 for locations of improvements). The current water system operations assume that FedEx, Medline, and Building 12 will be served directly from the City's Pressure Zone 2 based on the recommendations from Black Water's hydraulic evaluation of the Smuckers development.

Findings from Peak Hour Demand Evaluation

Based on West Yost's analysis, the proposed pipelines in the IPC development serving the Project are adequate to meet the required minimum pressure and maximum pipeline velocity during a peak hour demand condition. Figure 3 shows that system pressures during a peak hour demand condition are above the required minimum pressure of 40 psi, and all pipelines are under the maximum pipeline velocity of 8 fps at the Project site. There are a few locations in the City's Pressure Zone 2 on Old Schulte Road and Hansen Road where the pressures are below 40 psi (refer to junctions in red) due to the topography (elevations are above the normal service range); however, service connections are not anticipated at these locations. During a peak hour demand condition, the pressures at the Project site were estimated to be approximately 50 to 75 psi (75 psi by Buildings 3 and 4 in Zone 3; 50 psi by Building 12 in Zone 2).

Findings from Maximum Day Demand plus Fire Flow Evaluation

Figure 4 presents the available fire flow capacity simulated during a maximum day demand condition at each evaluated location and indicates that all locations (i.e., junctions shown in green) meet the recommended fire flow requirement. The minimum fire flow requirement for the Industrial buildings in the IPC development is 4,500 gpm. The available fire flow capacity at the simulated fire flow locations in the IPC development ranges between approximately 4,600 to 6,400 gpm. It should be noted that supply from PRS #9 was required to support the fire flow requirements for the IPC development located in the City's Pressure Zone 2.

Proposed Alternative Water System Operations

In order to re-zone the City's existing 24-inch diameter pipelines on Old Schulte Road and South Lammers Road, the proposed alternative water system operations would also require that the infrastructure previously recommended for the Ellis Specific Plan Phases 1 and 2 be constructed and operational. A summary of the recommended infrastructure for Ellis Specific Plan Phases 1 and 2 is provided in the Draft TM prepared by West Yost for the Hydraulic Evaluation of Ellis Specific Plan Phase 2 – The Gardens (dated December 9, 2016). More specifically, the following key infrastructure recommended for the Ellis Specific Plan Phases 1 and 2 would be required, as shown in green on Figure 5A, for the proposed alternative water system operations:

- Interim City-side Zone 3 booster pump station[11] at existing Clearwell #2 at the JJWTP (this facility will essentially be the first phase of the permanent City-side Zone 3 booster pump station; future additional pumping capacity will be required for the permanent City-side Zone 3 booster pump station once it is determined that there will be insufficient pumping capacity at the interim City-side Zone 3 booster pump station to adequately serve City-side Zone 3);
- 24-inch and 20-inch diameter pipelines from the interim City-side Zone 3 booster pump station at the JJWTP to the intersection of Corral Hollow Road and Linne Road;
- 20-inch diameter pipeline from north of the intersection of Corral Hollow Road and Linne Road to the west side of Ellis Specific Plan (South Lammers Road); and
- Two 12-inch diameter check valve connections with to the City's Pressure Zone 2.

The supply for the Ellis Specific Plan Phase 1 development is based on the assumption that the interim City-side Zone 3 booster pump station would be constructed and operational. If this assumption changes then the alternative water system operations plan proposed by Project Proponents would need to be revised and further evaluated. It should also be noted that the City-side Zone 3 interim booster pump station was not intended to serve the IPC development. However, based on the proposed alternative water system operations, the interim[12] City-side Zone 3 booster pump station could be used to fill the Cordes Tank during low water demand periods[13] while the normal and peak water demands in the City's Pressure Zone 3 (including the Ellis Specific Plan) would be served by the Cordes Tank and BPS.

In addition to the infrastructure required from the Ellis Specific Plan development discussed above, the following water system improvements would also need to be constructed to support the proposed alternative water system operations as shown in Figure 5A (thick green and orange lines):

- 2,100 ft of 20-inch diameter pipeline in the Ellis Specific Plan (extension to South Lammers Road);
- 3,025 ft of 20-inch diameter pipeline in South Lammers Road to connect the Ellis Specific Plan to the existing re-zoned 24-inch diameter pipelines; and
- 345 ft of 16-inch diameter pipeline in Hood Way (near the Cordes Tank and BPS) to loop the Pressure Zone 2 pipelines in the IPC development.

Figure 5A also indicates that several valves in the City's existing water system and the IPC development would need to be closed to properly isolate the individual pressure zones due to the

[11] Design total dynamic head (TDH) of 245 ft and design flow of 1,225 gpm.

[12] Additional pumping capacity will be required for the permanent City-side Zone 3 booster pump station once it is determined that there will be insufficient pumping capacity at the interim City-side Zone 3 booster pump station to adequately serve City-side Zone 3.

[13] Based on the projected operational storage requirement of 535,600 gallons (refer to Table 4) and the design flow of the interim City-side Zone 3 booster pump (1,225 gpm), it would take approximately seven (7) hours to replenish the operational storage in the Cordes Tank.

proposed alternative water system operations. Figure 5B provides the detailed locations of the closed valves required for the proposed alternative operations.

Findings from Peak Hour Demand Evaluation

Based on West Yost's analysis, the proposed alternative water system operations are adequate to meet the required minimum pressure and maximum pipeline velocity during a peak hour demand condition. Figure 6 shows that system pressures during a peak hour demand condition are above the required minimum pressure of 40 psi, and all pipelines are under the maximum pipeline velocity of 8 fps at the Project site. There are a few locations in the City's Pressure Zone 2 on Hansen Road, Hopkins Road, and Bud Lyons Way where the pressures are below 40 psi (refer to junctions in red) due to the topography (elevations are above the normal service range); however, service connections are not anticipated at these locations. It should be noted that the pressures simulated on the existing 24-inch diameter pipelines that are proposed for re-zoning into Pressure Zone 3 are significantly higher with pressures close to 120 psi near the intersection of Old Schulte Road and South Lammers Road. During a peak hour demand condition, the pressures at the Project site were estimated to be about the same as the pressures simulated under current operations (i.e., 75 psi by Buildings 3 and 4 in Zone 3; 50 psi by Building 12 in Zone 2).

Findings from Maximum Day Demand plus Fire Flow Evaluation

Figure 7 presents the available fire flow capacity simulated during a maximum day demand condition at each evaluated location and indicates that several locations (i.e., junctions shown in red) no longer meet the recommended fire flow requirement under the proposed alternative operations. The minimum fire flow requirement for the Industrial buildings in the IPC development is 4,500 gpm, and the available fire flow capacity at the simulated fire flow locations in the IPC development ranges between approximately 1,900 to 5,800 gpm. It should be noted that significant supply from PRS #9 was required to support the fire flow requirements for the IPC development located in the City's Pressure Zone 2.

The reduced available fire flow capacity in Pressure Zone 2 is due to the reduction in the hydraulic capacity/supply to Pressure Zone 2 that is caused by the re-zoning of the existing 24-inch diameter pipelines on Old Schulte Road and South Lammers Road to serve the City's Pressure Zone 3. To mitigate the simulated fire flow deficiencies, the following improvements are recommended as shown on Figure 8. However, it should be noted that these improvements would not mitigate the fire flow deficiencies in areas served by the City's Pressure Zone 2 where the topography is above 150 ft mean sea level (msl). Therefore, fire flow for service connections located above 150 ft msl should be supplied from the City's Pressure Zone 3.

- 3,440 ft of 20-inch diameter pipeline in South Lammers Road to connect the existing 24-inch diameter pipeline in Valpico Road with the existing 20-inch diameter pipeline at the intersection of South Lammers Road and Old Schulte Road; and
- 50 ft of 12-inch diameter pipeline in South Lammers Road to connect the existing 12-inch diameter pipeline in Old Schulte Road with the existing 20-inch diameter pipeline at the intersection of South Lammers Road and Old Schulte Road.

In addition to improving the available fire flow capacity for the IPC development, these recommended improvements would also improve water quality for the existing 24-inch diameter pipeline on Valpico Road that would have been dead-ended under the proposed alternative water system operations.

Based on the significant amount of water system improvements required to support the proposed alternative water system operations, it appears that there would be a significant delay before the proposed alternative water system operations could be possible. In addition, as discussed above, the interim City-side Zone 3 booster pump station at the JJWTP has not yet been constructed. Therefore, due to the uncertainties in the timing and completion of the infrastructure required from Project Proponents and other developments to implement the proposed alternative water system operations, the City and Project Proponents should continue to evaluate the alignment for the proposed 20-inch diameter transmission pipeline previously recommended in the 2012 Master Plan.

SUMMARY OF HYDRAULIC EVALUATION CONCLUSIONS AND RECOMMENDATIONS

The following sections provide a summary of the conclusions and recommendations from the hydraulic evaluation discussed in detail above.

Current Water System Operations

The proposed Project facility and pipeline layout as detailed on Figure 2 is adequate to serve the proposed Project under current water system operations. It should be noted that the current operations assume that the IPC development would essentially borrow existing storage and pumping capacity from the City's Pressure Zones 1 and 2 until future improvements are required to meet additional water demands (e.g., Clearwell #3, additional storage and pumping capacity in Zone 1 or Zone 2, Zone 2 BPS upgrade, etc.). The current operations also assume that the Cordes Tank and BPS are operational. In summary, the following water system improvements are required to serve the proposed Project under current water system operations:

- Activation of PRS #9 (pressure setting of 93 psi upstream and 43 psi downstream[14]);
- Construction and operation of the proposed 16-inch diameter pipeline connection to Pressure Zone 2 (recommended from the Smuckers development hydraulic evaluation); and
- Construction of on-site pipelines to serve the Project (these have not been finalized in time for inclusion in this hydraulic evaluation, but should be sized based on the recommended potable water system performance and operational criteria defined in the 2012 Master Plan).

[14] Approximately equal to hydraulic grades of 363 ft upstream and 247 ft downstream.

Proposed Alternative Water System Operations

It should be noted that the proposed alternative operations assume that the IPC development would essentially borrow existing storage and pumping capacity from the City's Pressure Zones 1 and 2 until future improvements are required to meet additional water demands (e.g., Clearwell #3, additional storage and pumping capacity in Zone 1 or Zone 2, Zone 2 BPS upgrade, etc.). The proposed alternative operations also assume that the Cordes Tank and BPS are operational. In summary, the following water system improvements are required to serve the proposed Project under the proposed alternative water system operations as shown on Figures 5A and 8:

- Construction and operation of the proposed water system infrastructure recommended from the Ellis Specific Plan Phases 1 and 2 developments;
- Re-zoning of approximately 14,745 ft of existing 24-inch diameter pipelines on Old Schulte Road and South Lammers Road to serve the City's Pressure Zone 3 (requires the closure of seven valves as shown on Figure 5B);
- Construction of approximately 2,100 ft of 20-inch diameter pipeline in the Ellis Specific Plan (extension to South Lammers Road);
- Construction of approximately 3,025 ft of 20-inch diameter pipeline in South Lammers Road to connect the Ellis Specific Plan to the existing re-zoned 24-inch diameter pipelines;
- Construction of approximately 345 ft of 16-inch diameter pipeline in Hood Way (near the Cordes Tank and BPS) to loop the Pressure Zone 2 pipelines in the IPC development;
- Construction of approximately 3,440 ft of 20-inch diameter pipeline in South Lammers Road to connect the existing 24-inch diameter pipeline in Valpico Road with the existing 20-inch diameter pipeline at the intersection of South Lammers Road and Old Schulte Road;
- Construction of approximately 50 ft of 12-inch diameter pipeline in South Lammers Road to connect the existing 12-inch diameter pipeline in Old Schulte Road with the existing 20-inch diameter pipeline at the intersection of South Lammers Road and Old Schulte Road;
- Activation of PRS #9 (pressure setting of 93 psi upstream and 43 psi downstream[15]);
- Construction and operation of the proposed 16-inch diameter pipeline connection to Pressure Zone 2 (recommended from the Smuckers development hydraulic evaluation); and
- Construction of on-site pipelines to serve the Project (these have not been finalized in time for inclusion in this hydraulic evaluation, but should be sized based on the recommended potable water system performance and operational criteria defined in the 2012 Master Plan).

[15] Approximately equal to hydraulic grades of 363 ft upstream and 247 ft downstream.

These water system improvements required for the proposed alternative operations only provide an alternative to the construction of the proposed 20-inch diameter transmission pipeline previously recommended in the 2012 Master Plan and do not replace the need to construct the future Clearwell #3 and the permanent City-side Zone 3 booster pump station at the JJWTP.

As noted above, the supply for the Ellis Specific Plan Phase 1 development is based on the assumption that the interim City-side Zone 3 booster pump station[16] would be constructed and operational. If this assumption changes then the proposed alternative water system operations plan would need to be revised and further evaluated. Therefore, due to the uncertainties in the timing and completion of the infrastructure required from Project Proponents and other developments to implement the proposed alternative water system operations, the City and Project Proponents should continue to evaluate the alignment for the proposed 20-inch diameter transmission pipeline previously recommended in the 2012 Master Plan.

It should be noted that the proposed alternative operations could potentially impact future developments such as Gateway and Westside Industrial, which are located in the City's Pressure Zone 2, as they would no longer be able to connect directly to the existing 24-inch diameter pipeline in Old Schulte Road if this existing 24-inch diameter pipeline is re-zoned into the City's Pressure Zone 3 per the proposed alternative operations plan. Impacts to these future developments would need to be evaluated and addressed in future studies (e.g., update of the 2012 Master Plan).

General Conclusions and Recommendations

Project Proponents have stated that the recent reduction in water demands and peak water use factors, and the upcoming availability of recycled water supply, should allow the Cordes Tank and BPS to support additional development (i.e., water demands) in the IPC project area. However, the approach used in all hydraulic evaluations for the City's potable water system will be consistent with the methodologies adopted in the City's 2012 Master Plan until the City re-evaluates the adopted water use and peaking factors, as well as recycled water use implementation, in its upcoming Master Plan update project.

The hydraulic evaluation performed for the proposed Project is based on the various assumptions stated above. If any of these items are changed or modified in any way, other than as described in this TM, additional hydraulic evaluation will be required.

CURRENT WATER QUALITY CONCERNS AND PROPOSED MITIGATION STRATEGIES

The City has encountered low chlorine residuals at the IPC development due to low water demands and large diameter pipelines (stagnant water). The existing potable water pipelines have been sized for potable water demands from the full IPC development; however, only three buildings in the IPC development are currently occupied, which is the primary cause for the low water demands. In addition, the irrigation water demands from the IPC development are served through separate recycled water pipelines, which further reduces the water demand from the existing potable water

[16] A permanent City-side Zone 3 booster pump station will be required once it is determined that there will be insufficient pumping capacity at the interim City-side Zone 3 pump station to adequately serve City-side Zone 3.

pipelines. To resolve the low chlorine residual readings at the IPC development, City staff currently flush the existing potable water pipelines until the chlorine residuals increase to an acceptable level.

City staff requested West Yost to review and identify other possible mitigation strategies that could potentially improve water quality in the near-term timeframe when water demands will remain low until additional buildings are constructed and occupied and potable water demands increase. West Yost reviewed the City's plans for a new 16-inch diameter pipeline loop[17] as well as other potential mitigation strategies and have the following findings and proposed follow-up actions for City staff.

- The 16-inch diameter pipeline loop should help eliminate the stagnant water at the end of the existing Hopkins Road pipeline, but may not completely resolve the stagnant issues since the increases in flow rate and velocity through the proposed pipeline loop are low. Furthermore, the proposed pipeline loop would not significantly help with water quality if water use continues to be very low or intermittent.
- It may be possible to install a chlorine booster station to increase the chlorine residual; however, West Yost recommends that the City first better understand what is causing the decrease in chlorine residual at the IPC development before implementing a new chlorine booster station. The following steps are recommended:
  - — Review actual metered water use for the currently occupied buildings in the IPC development;
  - — Collect chlorine residual readings upstream of the affected location; and
  - — Determine the water quality and age of the treated source water.

It should be noted that the water quality concerns discussed above are not anticipated to continue in the future once additional buildings are occupied because potable water demands are projected to increase and water use should be more continuous.

[17] IPC Improvement Plans (16" Hopkins Road, 16" Promontory Parkway, and 16" International Parkway) provided by City staff on February 7, 2017.

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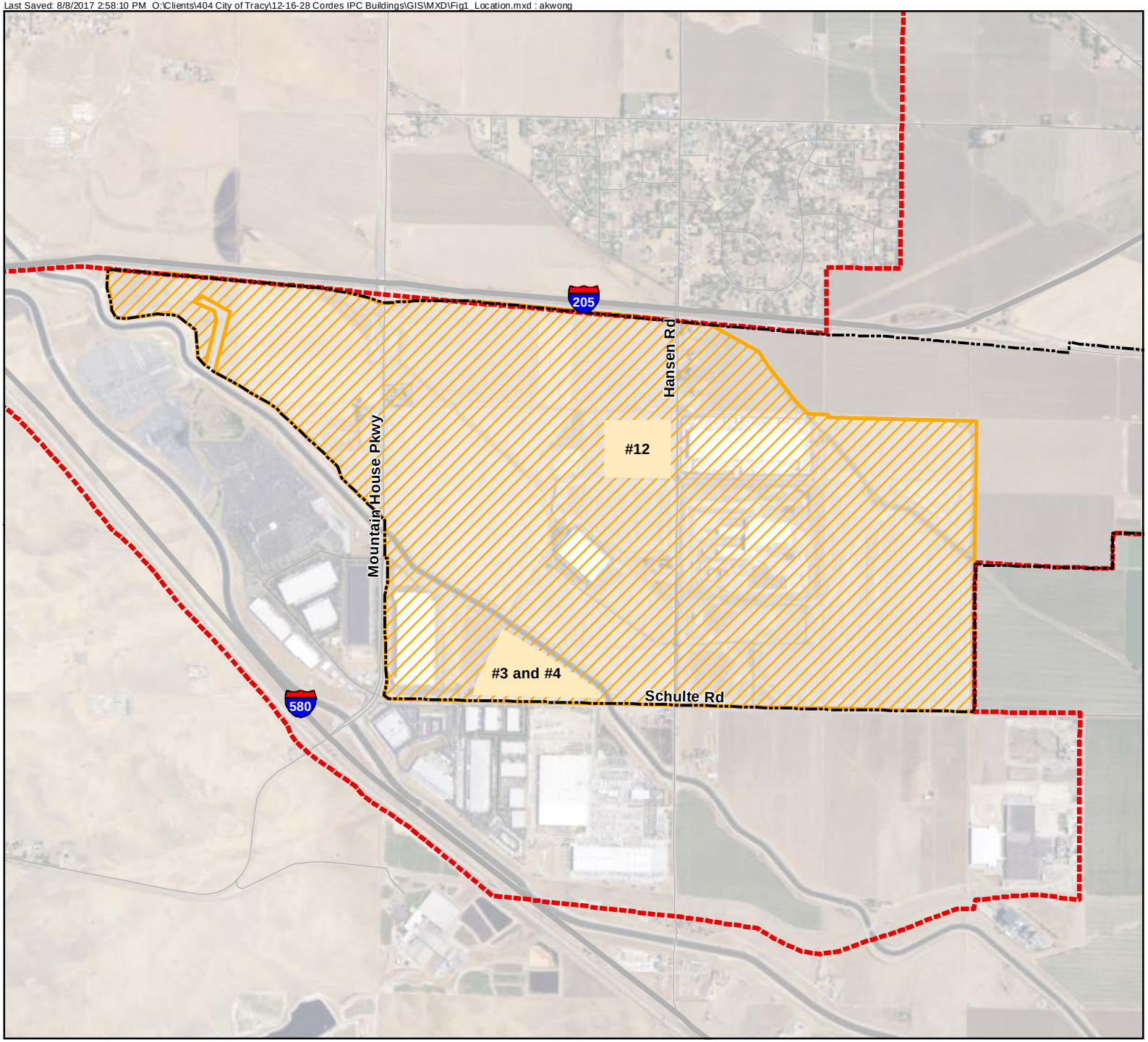

N

0 1,250 2,500

Scale in Feet

Symbology

- Proposed Project
- IPC Development
- City Limit
- Sphere of Influence

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Figure 1

Project Location

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12

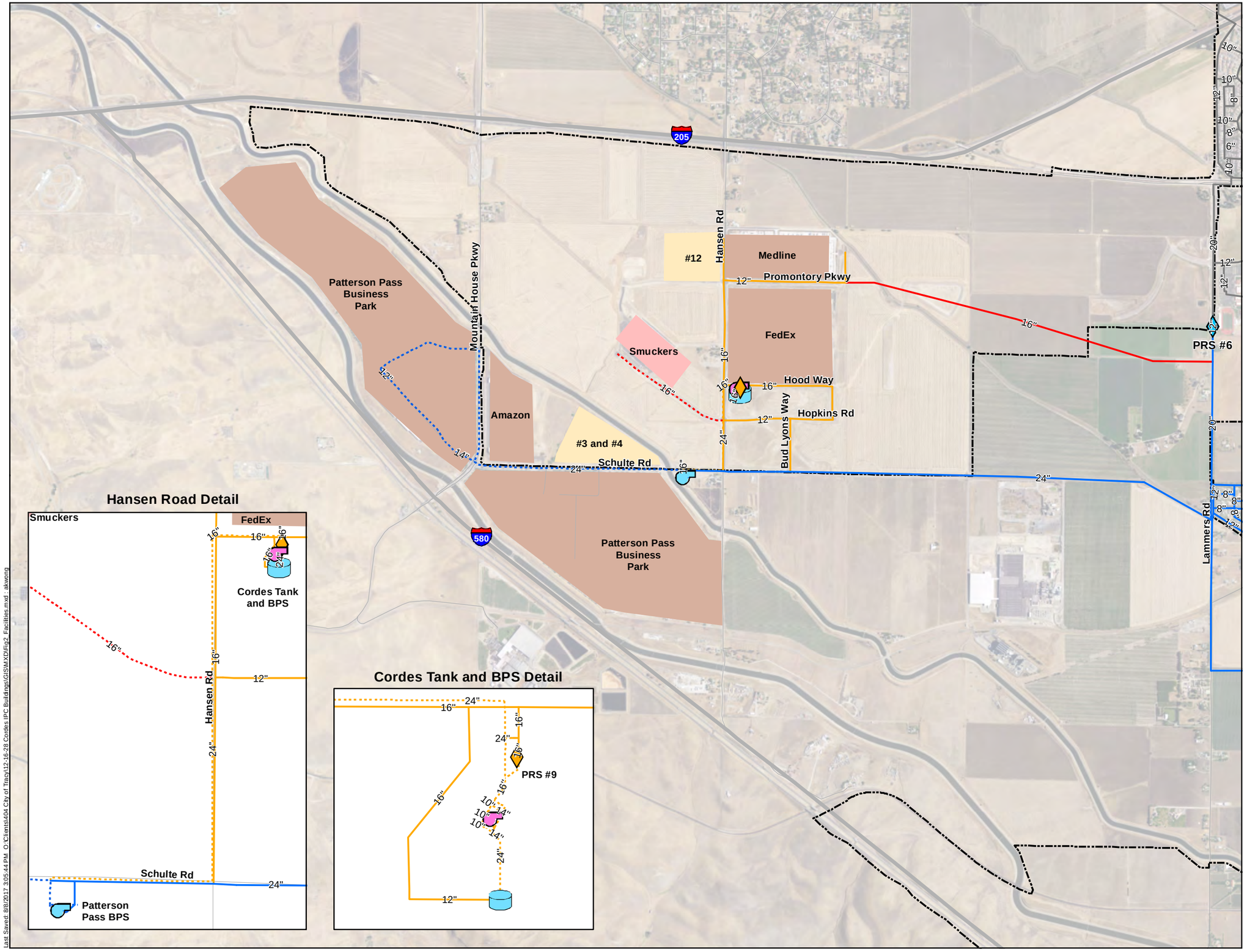

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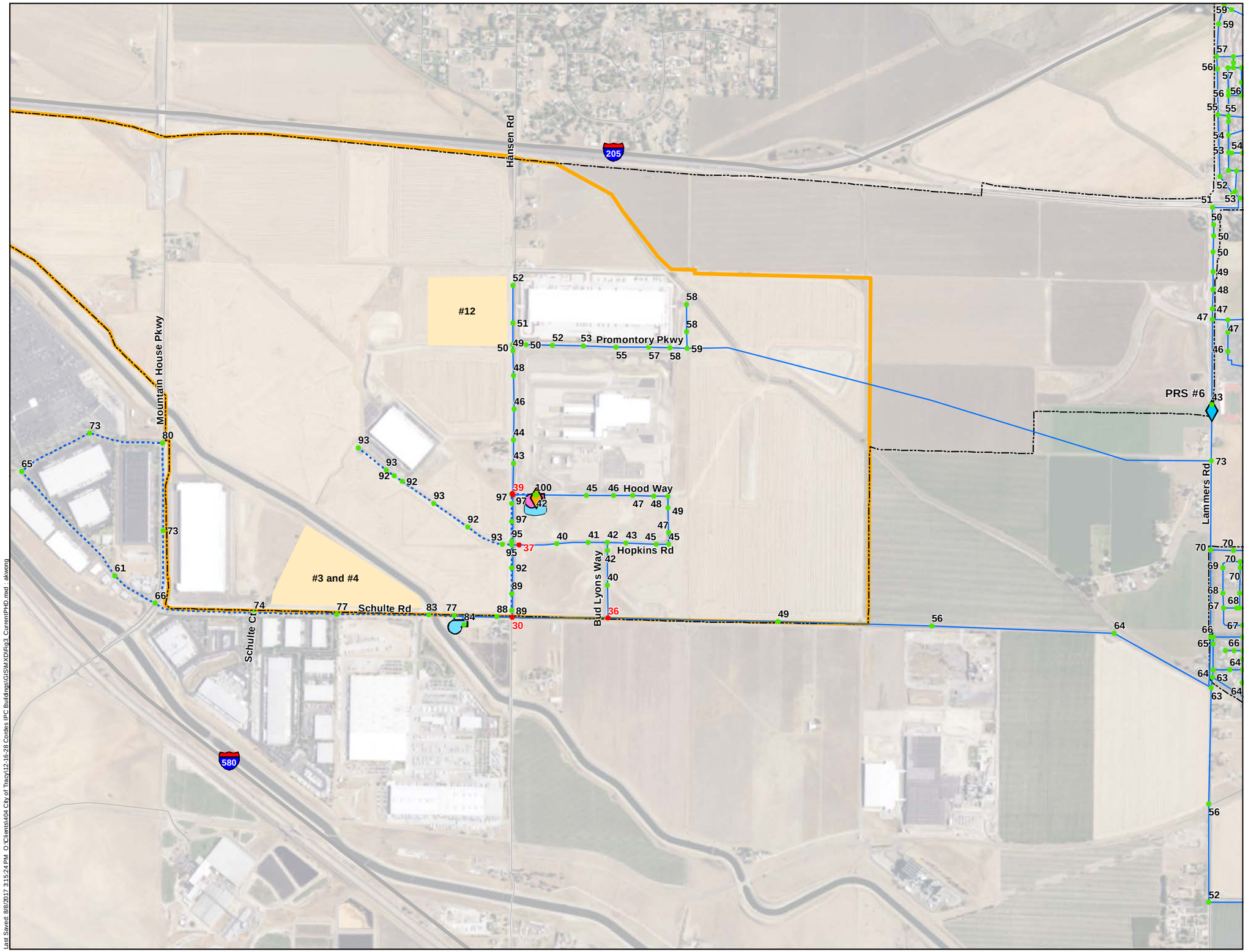
Figure 2

Water System Facilities Layout

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12



Symbology

Junction Pressure

- Less than 40 psi
- Greater than or equal to 40 psi

Zones 1 and 2 Pipeline Velocity

- Less than or equal to 8 fps
- Greater than 8 fps

Zone 3 Pipeline Velocity

- Less than or equal to 8 fps
- Greater than 8 fps

- Pressure Regulating Station #9
- Existing Pressure Regulating Station
- Cordes Booster Pump Station
- Existing Patterson Pass Booster Pump Station
- Cordes Tank
- Proposed Project
- IPC Development
- City Limit

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Figure 3

Peak Hour Results: Current Operations

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12

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Note: The available fire flow shown is the maximum flow available while maintaining 30 psi residual system pressure. Available fire flows in new development areas had a maximum pipeline velocity criterion of 12 fps. Flows are labeled in gpm.

N

0 700 1,400
Scale in Feet

Symbology

Available Fire Flow (see Note)

- Does Not Meet Fire Flow Requirement
- Meets Fire Flow Requirement
- Zones 1 and 2 Pipeline
- Zone 3 Pipeline
- Pressure Regulating Station #9
- Existing Pressure Regulating Station
- Cordes Booster Pump Station
- Existing Patterson Pass Booster Pump Station
- Cordes Tank
- Proposed Project
- IPC Development
- City Limit

#12

#3 and #4

Mountain House Pkwy

Hansen Rd

Promontory Pkwy

Hood Way

Hopkins Rd

Bud Lyons Way

Schulte Rd

Schulte Cir

Lammers Rd

PRS #6

205

580

5,673 4,652 6,047 5,372 6,173 5,777 5,678 5,823 6,061 6,154 5,871 5,754 5,988 6,099 5,990 6,007 6,133 6,357 6,357 6,405 6,357 6,357 6,416 6,445 6,257 6,202 6,406 6,192 6,102 6,022 6,384 5,959 6,362 5,194 5,639 5,834 6,357 5,035 5,475 5,432 5,598 5,774 6,331 6,302 6,283 5,491 5,750 5,275 5,922 5,678 6,041 6,282 6,239 6,298 6,214 6,215 6,260 7,846 8,223 8,756 8,931 3,688 3,929 3,764 3,905 4,271 4,217 9,432 9,416 3,865 7,174 4,880 9,354 7,588 9,286 7,140 9,048 5,901 9,716

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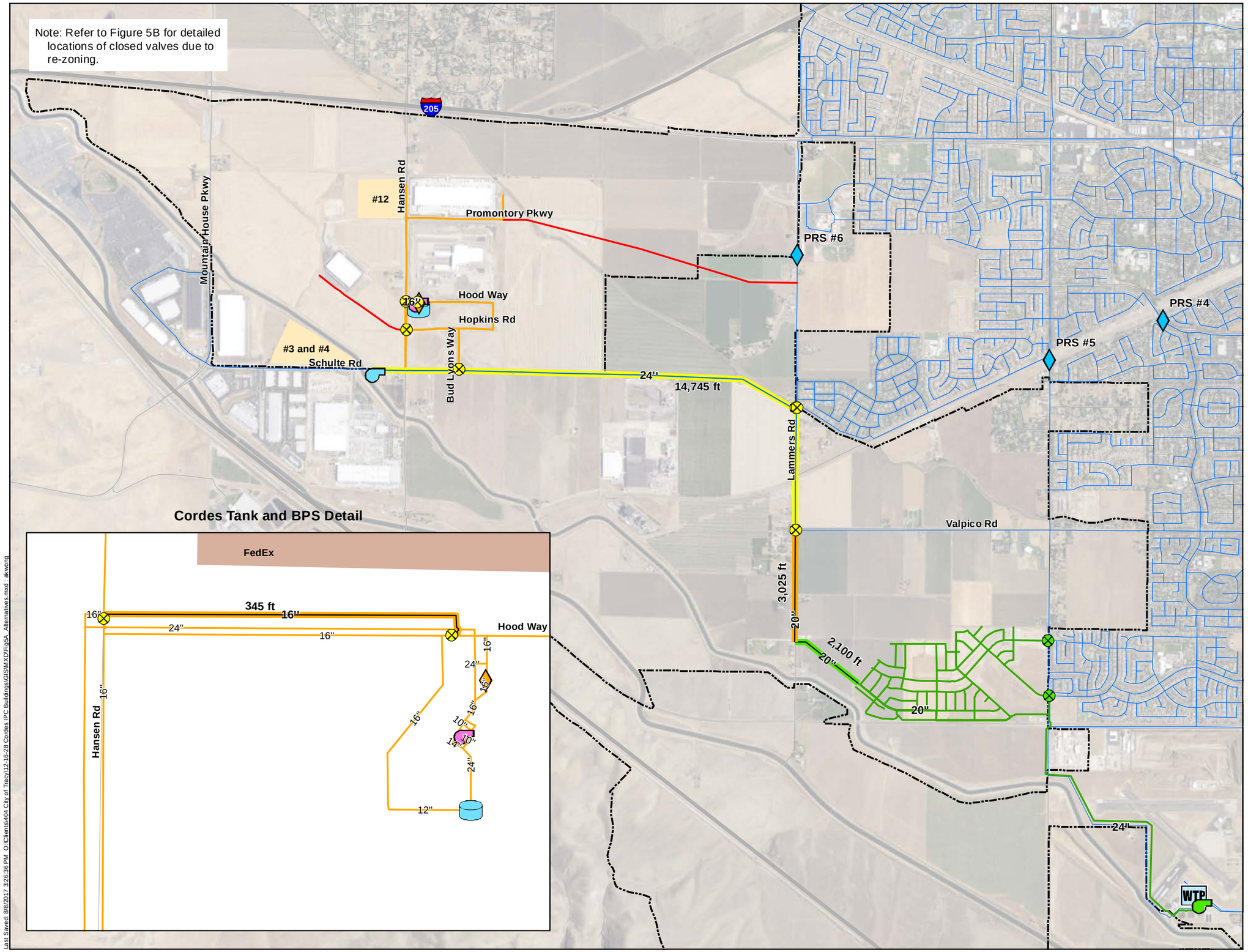
Figure 4

Available Fire Flow Results: Current Operations

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12

Note: Refer to Figure 5B for detailed locations of closed valves due to re-zoning.



N

0 1,250 2,500

Scale in Feet

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

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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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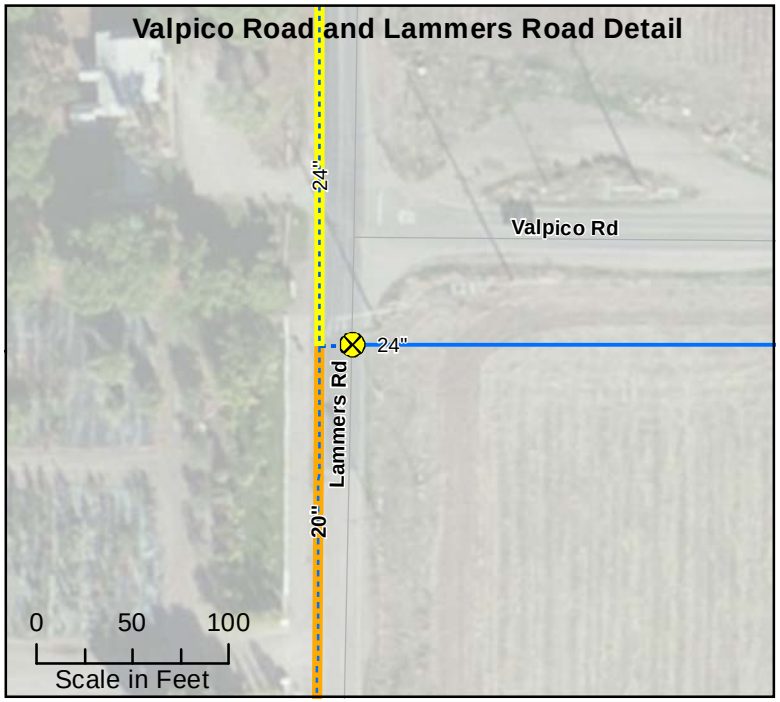

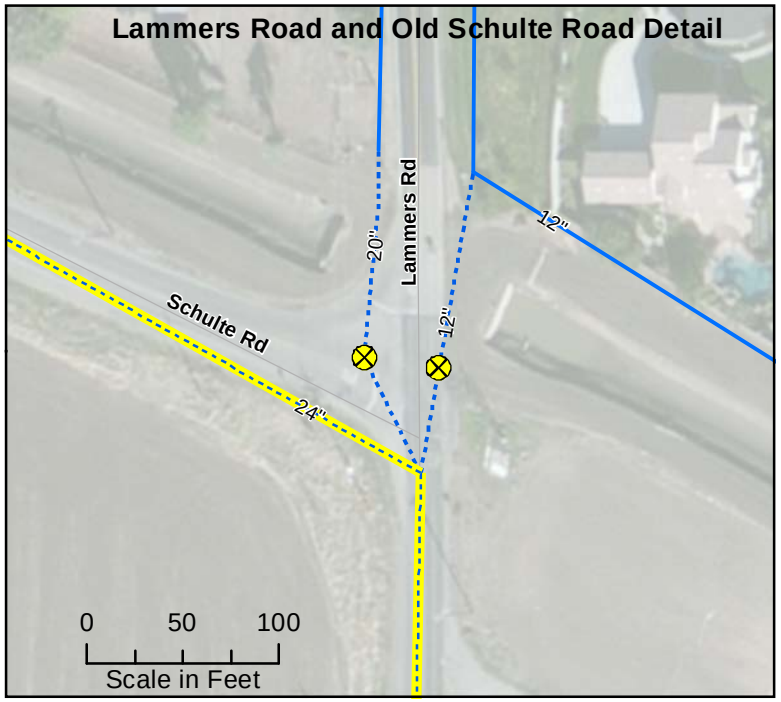

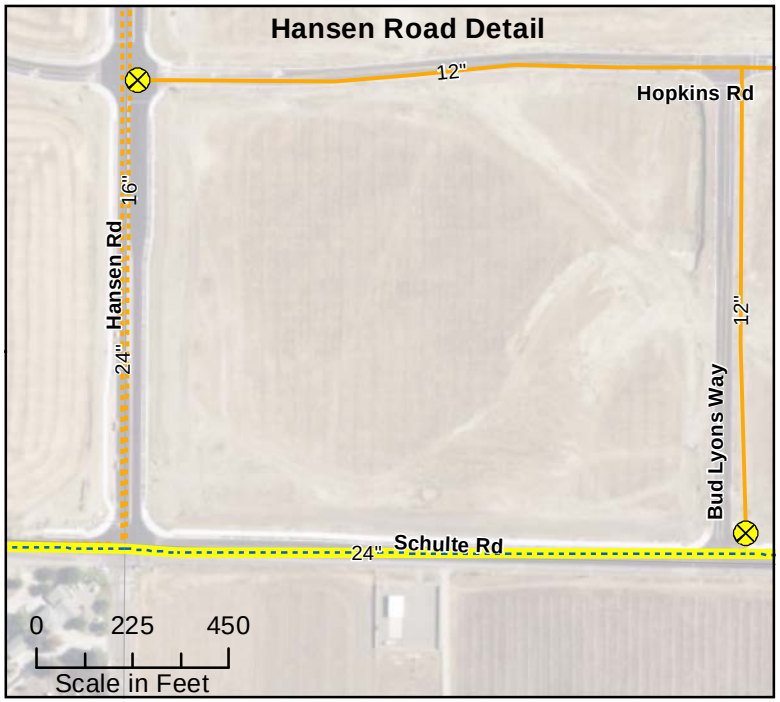

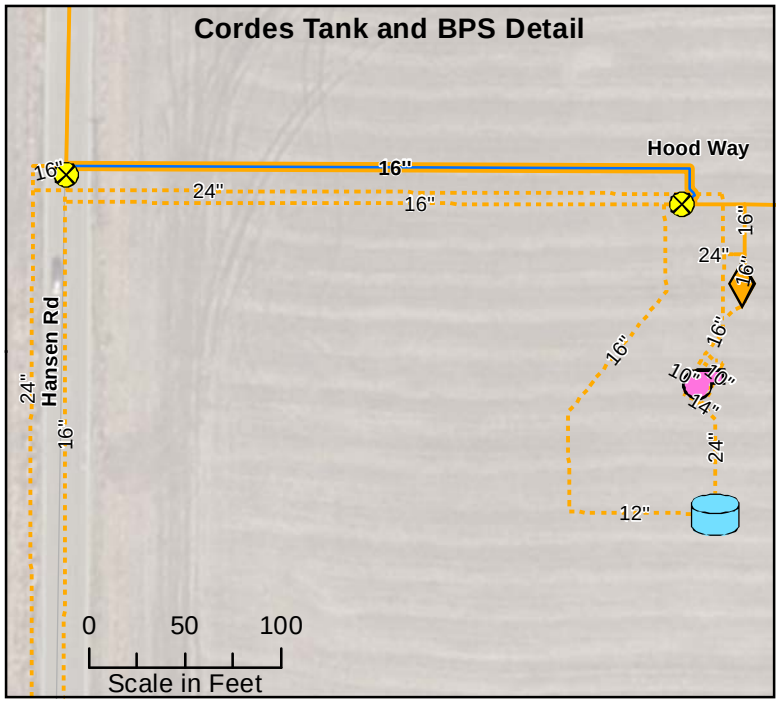

Symbology

- 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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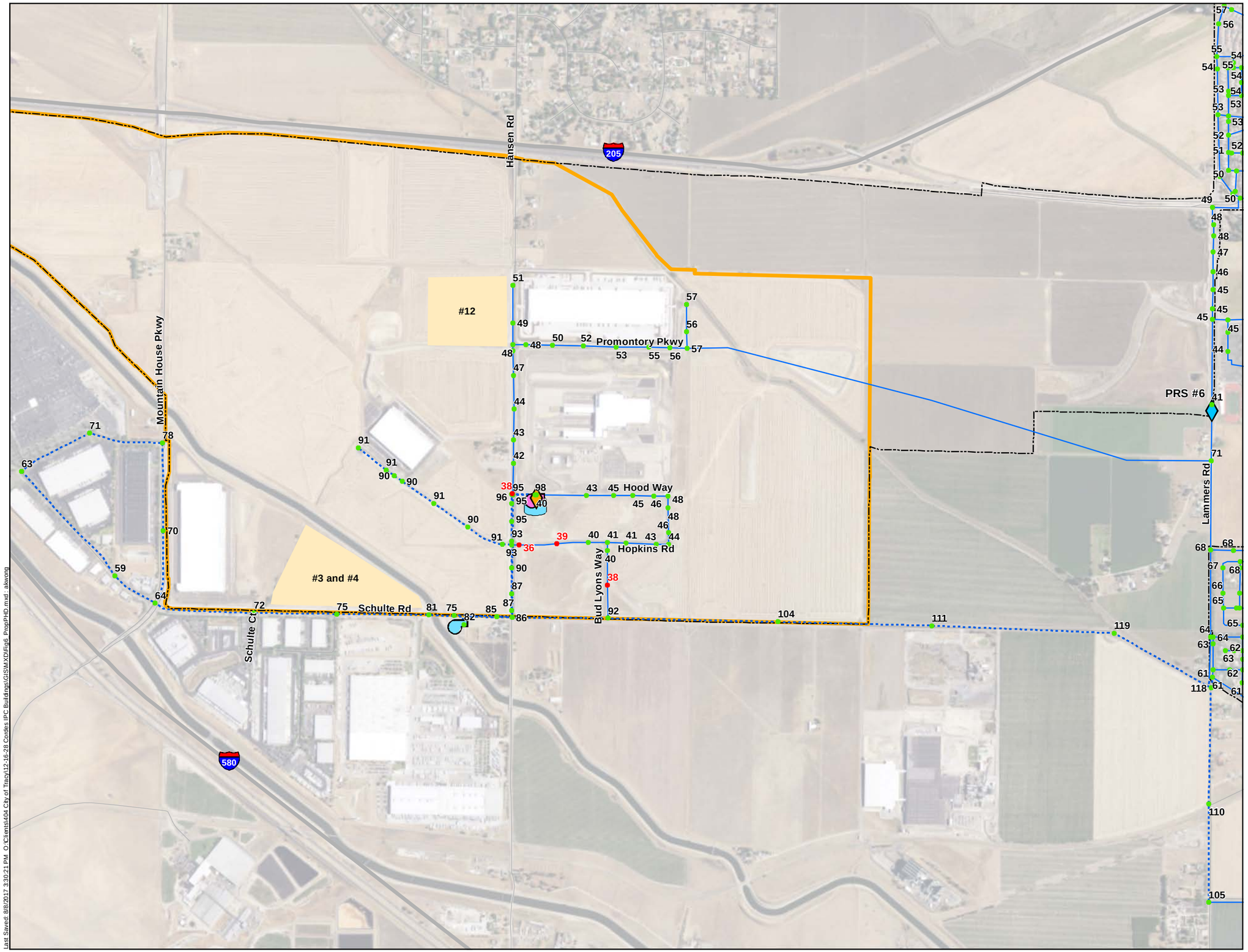
Figure 5B

Proposed Alternative Operations: Details for Closed Valves

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12



Symbology

Junction Pressure

- Less than 40 psi
- Greater than or equal to 40 psi

Zones 1 and 2 Pipeline Velocity

- Less than or equal to 8 fps
- Greater than 8 fps

Zone 3 Pipeline Velocity

- Less than or equal to 8 fps
- Greater than 8 fps
- Pressure Regulating Station #9
- Existing Pressure Regulating Station
- Cordes Booster Pump Station
- Existing Patterson Pass Booster Pump Station
- Cordes Tank
- Proposed Project
- IPC Development
- City Limit

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Figure 6

Peak Hour Results: Proposed Alternative Operations

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12

Note: The available fire flow shown is the maximum flow available while maintaining 30 psi residual system pressure. Available fire flows in new development areas had a maximum pipeline velocity criterion of 12 fps. Flows are labeled in gpm.

N

0 700 1,400

Scale in Feet

Symbology

Available Fire Flow (see Note)

- Does Not Meet Fire Flow Requirement
- Meets Fire Flow Requirement
- Zones 1 and 2 Pipeline
- Zone 3 Pipeline
- Pressure Regulating Station #9
- Existing Pressure Regulating Station
- Cordes Booster Pump Station
- Existing Patterson Pass Booster Pump Station
- Cordes Tank
- Proposed Project
- IPC Development
- City Limit

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Figure 7

Available Fire Flow Results: Proposed Alternative Operations

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12

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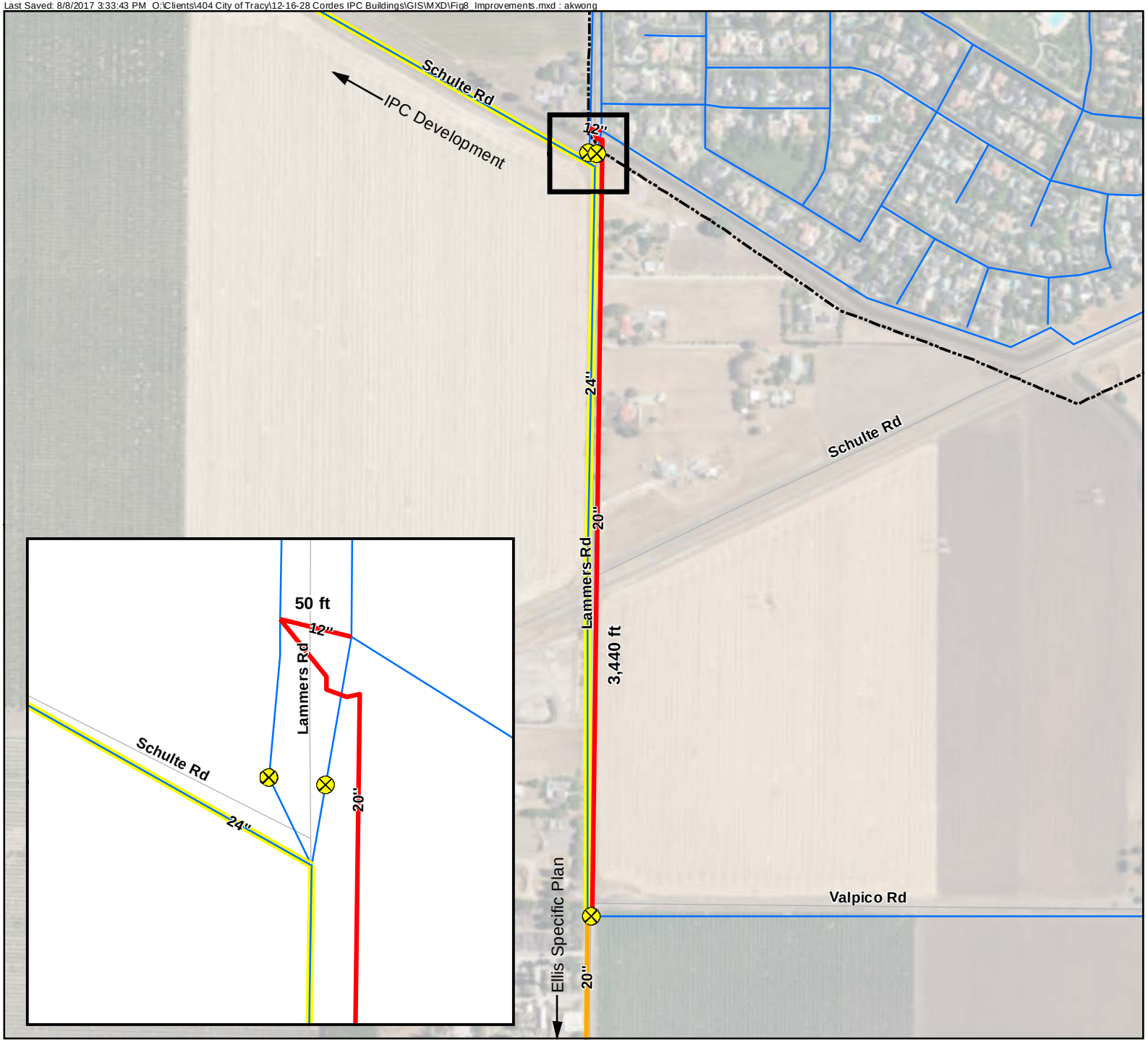

0 300 600

Scale in Feet

Symbology

- Closed Valve Due to Re-zoning
- Recommended Pipeline
- Existing Pipeline to be Re-zoned
- Proposed Pipeline Required for Alternative Operatons (IPC)
- Existing Pipeline
- City Limit

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Figure 8

Recommended Improvements for Proposed Alternative Operations

City of Tracy
Hydraulic Evaluation of
IPC Buildings 3, 4, and 12