

TECHNICAL MEMORANDUM

DATE: March 16, 2017 Project No.: 693-20-16-01-10.0
SENT VIA: EMAIL
TO: SRWA Technical Advisory Committee
FROM: Polly Boissevain, RCE #C36134
REVIEWED BY: Gerry Nakano, RCE #C29524
SUBJECT: Sensitivity Analysis for Recommended Improvements for the Cities of Ceres and Turlock Local Distribution Systems to Integrate the Stanislaus Regional Water Authority Surface Water Supply Project

OVERVIEW

This Technical Memorandum (TM) documents sensitivity evaluations completed at the request of the Cities of Ceres and Turlock to evaluate whether some local system improvements could be phased later in time, or eliminated altogether. The *Recommended Improvements for the Cities of Ceres and Turlock Local Distribution Systems Technical Memorandum, submitted November 22, 2016* (November 2016 TM), documented preliminary infrastructure sizing and alignment location recommendations for the Stanislaus Regional Water Authority (SRWA) Surface Water Supply Project (Project) transmission and distribution facilities within the cities of Ceres and Turlock systems. Specific requests for hydraulic re-analysis were based on information presented in that TM.

Improvement recommendations documented in the November 2016 TM were developed using the hydraulic performance criteria developed for the Project. The sensitivity analysis considered slightly relaxing criteria to reduce the number of improvements required, including allowing system pressures to slightly exceed 60 pounds per square inch (psi) (original pressure criteria range was 40 to 60 psi), and disregarding pipeline head loss criteria if pressure criteria could generally be met.

Findings for each system are presented below.

CERES LOCAL IMPROVEMENTS

Phase 1 – 10 million gallons per day (mgd) to Ceres

The November 2016 TM identified local infrastructure improvements for the Phase 1 delivery of 10 mgd to Ceres (Figure 1). A new 24-inch and 16-inch diameter pipeline along East Hatch Road was included to complete the transmission line between the proposed Terminal Tank and the existing 16-inch diameter pipeline on Richland Avenue. A 24-inch and 16-inch diameter pipeline along Faith Home Road and other streets was recommended to connect to the existing 24-inch diameter pipeline on East Service Road, principally to provide a redundant transmission feed to supply areas west of Highway 99.

Ceres requested a hydraulic system sensitivity analysis to determine whether 10 mgd could be delivered by only installing pipelines in the current pipeline gaps along East Hatch Road. A sensitivity analysis was conducted for the 2025 maximum day demand scenario with a 24-inch pipeline from the Terminal Tank to the existing 12-inch diameter and 8-inch diameter pipeline on East Hatch Road, east of Mitchell Road, and completing gaps west of Mitchell Road connecting 16-inch diameter pipelines to existing 10-inch diameter pipelines.

The sensitivity analysis found just installing pipelines to fill the pipeline gaps did not provide sufficient water system capacity. A new, continuous, 24-inch diameter pipeline from the Terminal Tank to Mitchell Road must be installed to provide adequate system pressure. With this configuration, pressures can be maintained between 40 psi and 60 psi in most of the system, with a few areas along East Hatch Road east of Mitchell Road above 60 psi, up to 67 psi.

Figure 2 shows revised infrastructure requirements identified in the sensitivity analysis.

Phase 2 – 15 mgd to Ceres

Figure 3 shows the Phase 2 facilities required to deliver 15 mgd to Ceres identified in the November 2016 TM. Phase 2 included a new 16-inch diameter pipeline from Faith Home Road, running along East Whitmore Avenue, Third Street, Railroad Avenue, and Kinser Road to connect to the existing 16-inch pipeline on Blaker Road. A variant of this alignment was originally identified in the 2011 Water Master Plan, and provides another connection between areas east and west of Highway 99.

A sensitivity analysis for 2035 maximum day demands identified the following infrastructure revisions (see Figure 4):

- Eliminate the 16-inch diameter pipeline on Whitmore Avenue. There are still two large-diameter crossings of Highway 99, one 16-inch on Richland and one 24-inch diameter on Service Road; and
- Downsize the short length of 24-inch diameter pipeline on Faith Home Road near East Hatch Road to 16-inch diameter.

These improvements result in system pressures generally between 40 and 60 psi, with slightly higher pressures near the Terminal Tank connection to the system. The highest system pressure is 68 psi.

Recommended Local Improvements

The sensitivity analysis was reviewed in a workshop with Ceres on February 2, 2017. Ceres requested using revised infrastructure recommendations from the sensitivity analysis for cost estimates being developed for the Project. Table 1 summarizes project improvements.

Table 1. Local System Improvements for the Ceres Distribution System^(a)	
Phase 1	
<ul style="list-style-type: none"> • 2 MG Terminal Tank • Booster pump station at Terminal Tank with 14 mgd firm capacity, 160 feet (ft) total dynamic head • 5,300 ft of 24-inch diameter pipeline, along East Hatch Road, from Faith Home Road to Mitchell Road • 700 ft of 16-inch diameter pipeline, along East Hatch Road, from Mitchell Road to existing 10-inch diameter pipeline west of Mitchell Road • 2,000 ft of 16-inch diameter pipeline, along East Hatch Road, from 300 ft west of Well 23 to N. Central Avenue 	
Phase 2	
<ul style="list-style-type: none"> • Expand booster pump station at Terminal Tank to 19 mgd firm capacity • 2,700 ft of 16-inch diameter pipeline along East Hatch Road, from 700 ft west of Mitchell Road to 300 ft west of Well 23 • 2,800 ft of 16-inch diameter pipeline along East Hatch Road, from Central Avenue to Richland Road • 5,200 ft of 16-inch diameter pipeline along Faith Home Road, from East Hatch Road to East Whitmore Avenue • 1,800 ft of 16-inch diameter pipeline, along East Whitmore Avenue from Faith Home Road to Eastgate Road • 2,700 ft of 16-inch diameter pipeline, along Eastgate Road from East Whitmore Avenue to Roeding Road • 800 ft of 16-inch diameter pipeline, along Roeding Road from Eastgate Road to Esmar Road • 2,600 ft of 16-inch diameter pipeline, along Esmar Road from Roeding Road to East Service Road • 2,800 ft of 16-inch diameter pipeline, along East Service Road from Esmar Road to existing 24-inch diameter pipeline 	
(a) Based on sensitivity analysis presented in this TM.	

TURLOCK LOCAL IMPROVEMENTS

Phase 1 – 20 mgd to Turlock

The November 2016 TM identified Phase 1 local infrastructure improvements for delivery of 20 mgd to Turlock (Figure 5). Phase 1 improvements include 42-inch, 30-inch and 24-inch diameter pipelines along North Quincy Road, 24-inch diameter pipeline along East Taylor Road and on Colorado Avenue, and 30-inch diameter pipeline along Canal Street. Five turnouts were also included to supply water to the existing system. The turnouts were provided so that the

pipeline could be operated at higher pressure and provide flows to the system at the desired system pressure.

Turlock requested a sensitivity analysis to determine whether 20 mgd could be delivered by completing only the 42-inch diameter portion of the pipeline along North Quincy Road, from Tuolumne Road north, and the pipeline along East Taylor Road from North Quincy Road to Colorado Avenue. They also suggested adding new turnouts at Christofferson and Monte Vista.

The sensitivity analysis found that the pipeline on Quincy Road south of Tuolumne Road is also needed, but that the Canal Drive pipeline could be eliminated (Figure 6). With this configuration, system pressures generally range from 40 to 60 psi, with a few locations with pressures up to 65 psi.

Phase 2 – 30 mgd to Turlock

Figure 7 shows Phase 2 facilities to deliver 30 mgd to Turlock that were identified in the November 2016 TM. Phase 2 included a 16-inch diameter pipeline on East Taylor Road, a 24-inch diameter pipeline along West Canal Drive, a 24-inch diameter pipeline on North Quincy Road, south of East Canal Drive, and a 16-inch diameter pipeline along East Avenue.

A sensitivity analysis for 2040 maximum day demands identified the following possible infrastructure revisions (see Figure 8):

- Elimination of the 16-inch diameter pipeline on East Taylor Road, and
- Elimination of the 24-inch pipeline along West Canal Drive.

These improvements result in system pressures generally between 40 and 65 psi, with a few locations in the southwest part of the system marginally below 40 psi (39 psi lowest pressure).

Recommended Local Improvements

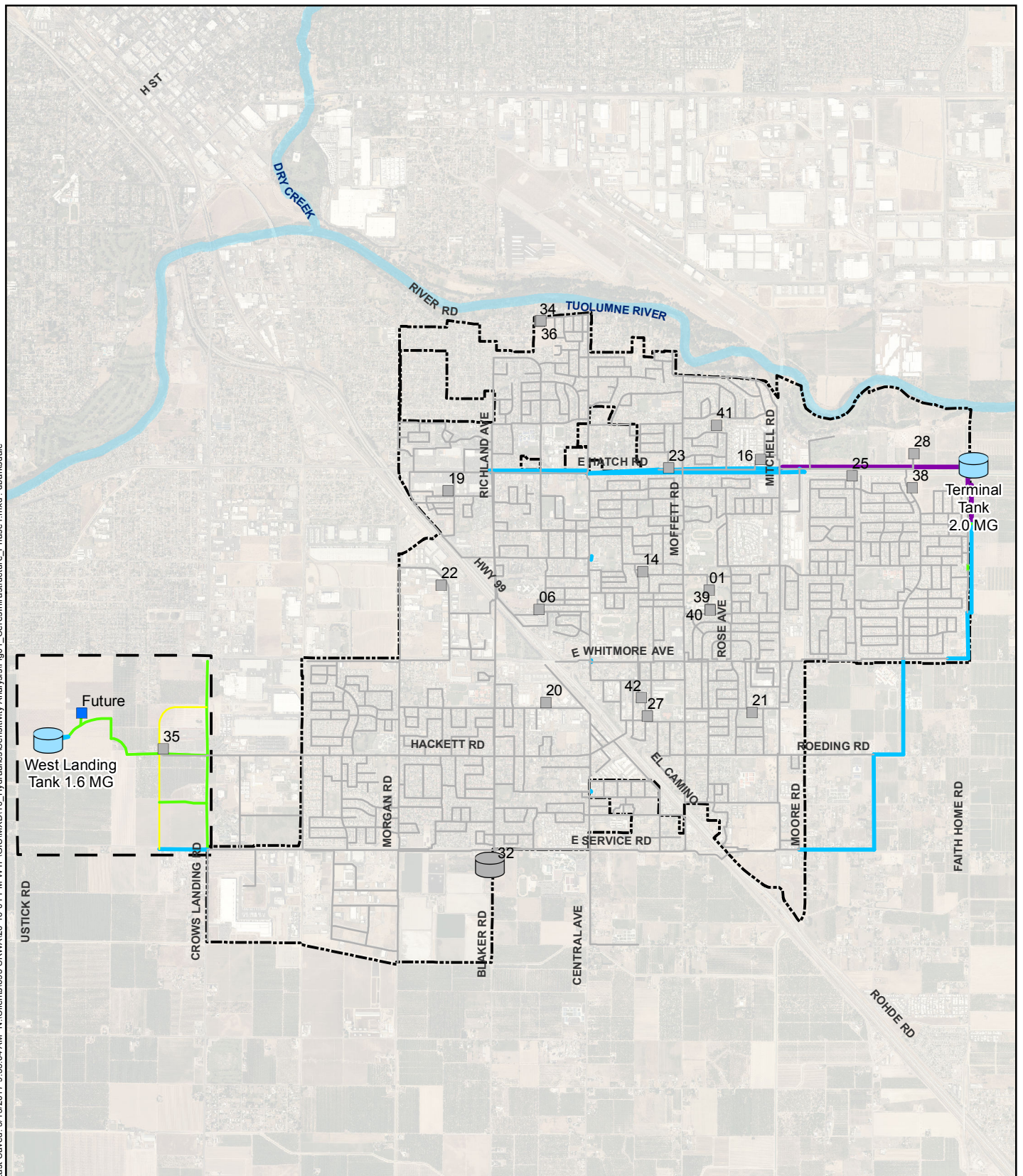
The sensitivity analysis was reviewed in a workshop with Turlock on January 26, 2017. Turlock opted to continue using infrastructure recommendations from November 2016 TM for cost estimates being developed for the Project.

Table 2 summarizes project improvements to be used for the cost analysis. These improvements are based on the analysis documented in the November 2016 TM.

Table 2. Recommended Local Improvements for Turlock System^(a)

Phase 1
<ul style="list-style-type: none"> • 2.5 MG tank at Terminal Tank site • Terminal Tank booster pump station with 20 mgd firm capacity, 185 ft total dynamic head • 4,000 ft of 24-inch diameter pipeline along East Taylor Road, between Colorado Avenue and North Quincy Avenue • 700 ft of 24-inch diameter along Colorado Avenue, from East Taylor Road to Dancer Way • 4,100 ft of 24-inch diameter pipeline, along North Quincy Road from Terminal Tank tie-in to East Taylor Road • 3,900 ft of 42-inch diameter pipeline along North Quincy Road from Terminal Tank tie-in to East Tuolumne Road • 5,100 ft of 36-inch diameter pipeline, along North Quincy Road from East Tuolumne Road to East Canal Drive • 8,000 ft of 30-inch pipeline along East Canal Drive, from North Quincy Road to North Geer Road
Phase 2
<ul style="list-style-type: none"> • Second 2.5 MG tank at the Terminal Tank site • Expand terminal Tank booster pump station to 37 mgd firm capacity, 185 ft total dynamic head • 3,800 ft of 16-inch diameter pipeline, along East Taylor Road from Colorado Avenue to North Geer Road • 700 ft of 24-inch diameter pipeline, along North Geer Road from East Taylor Road to Memory Lane • 1,200 ft of 42-inch diameter pipeline from Terminal Tank site to North Quincy Road • 2,900 ft of 24-inch diameter pipeline, along North Quincy Road from East Canal Drive to East Avenue • 6,800 ft of 24-inch diameter pipeline, along West Canal Drive, from North Geer Road to North Tully Road, and along North Tully Road to Chakkar Estates Drive • 4,300 ft of 16-inch diameter pipeline, along East Avenue, from North Quincy Road to 200 ft east of Oak Street
<p>^(a) Based on hydraulic analysis presented in November 2016 TM.</p>

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Symbology

Existing Tank

Future Tank

Existing Well

Future Well

Infrastructure assumed to be in place. Not part of Surface Water Project.

— Existing Pipeline

Phase 1 Pipeline Diameter

≤8"

10"

12"

14" - 18"

≥24"

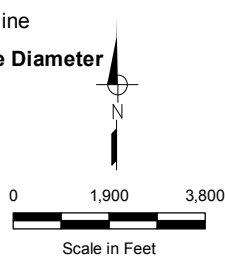
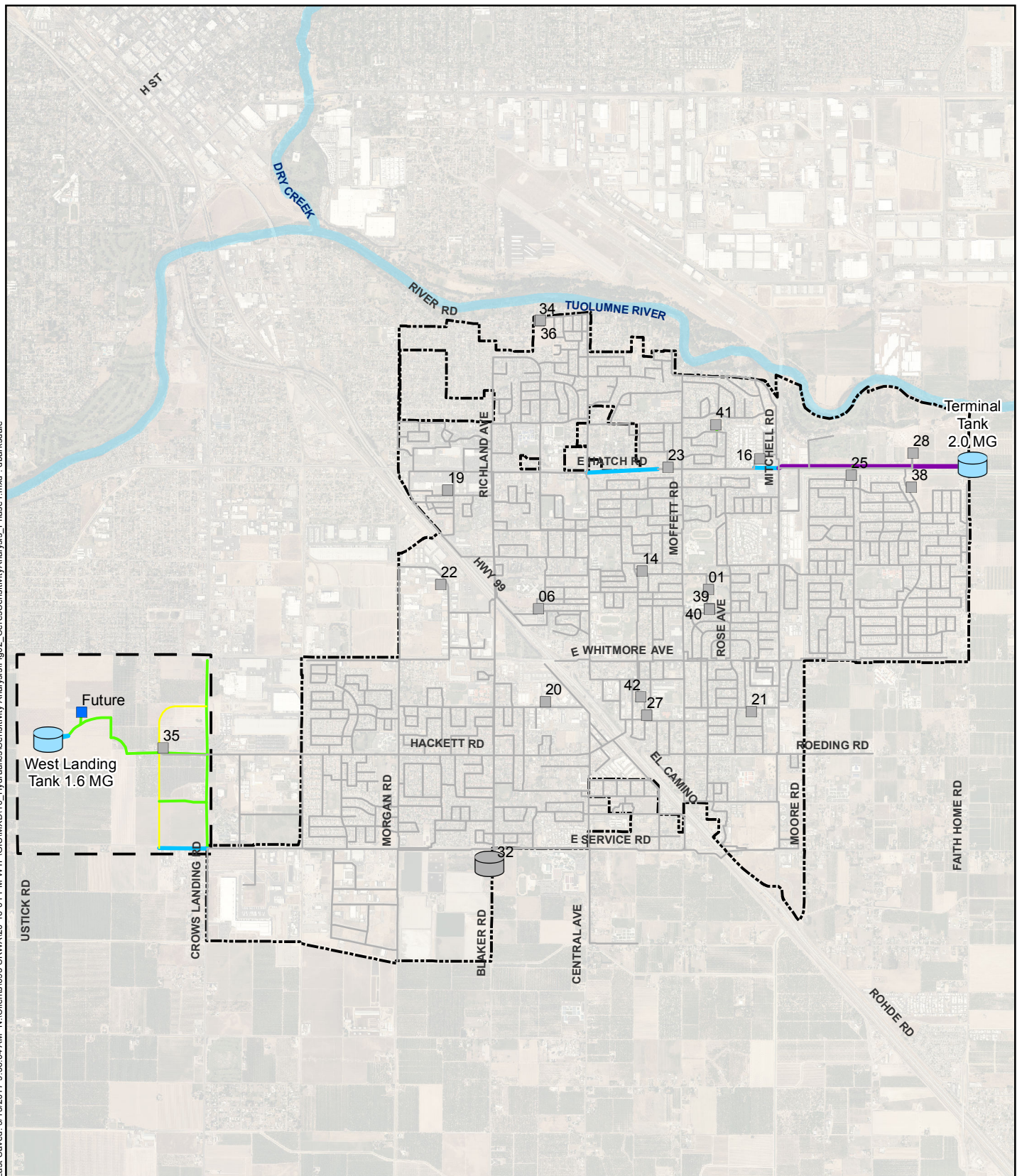


Figure 1

Ceres Infrastructure Required for Phase 1 (10 mgd) Project

Stanislaus Regional Water Authority
Surface Water Supply Project

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Symbology

Existing Tank

Future Tank

Existing Well

Future Well

Infrastructure assumed to be in place. Not part of Surface Water Project.

— Existing Pipeline

Phase 1 Pipeline Diameter

≤8"

10"

12"

14" - 18"

≥24"

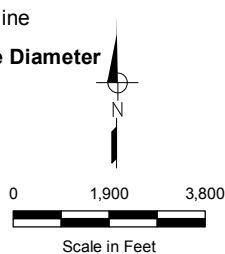
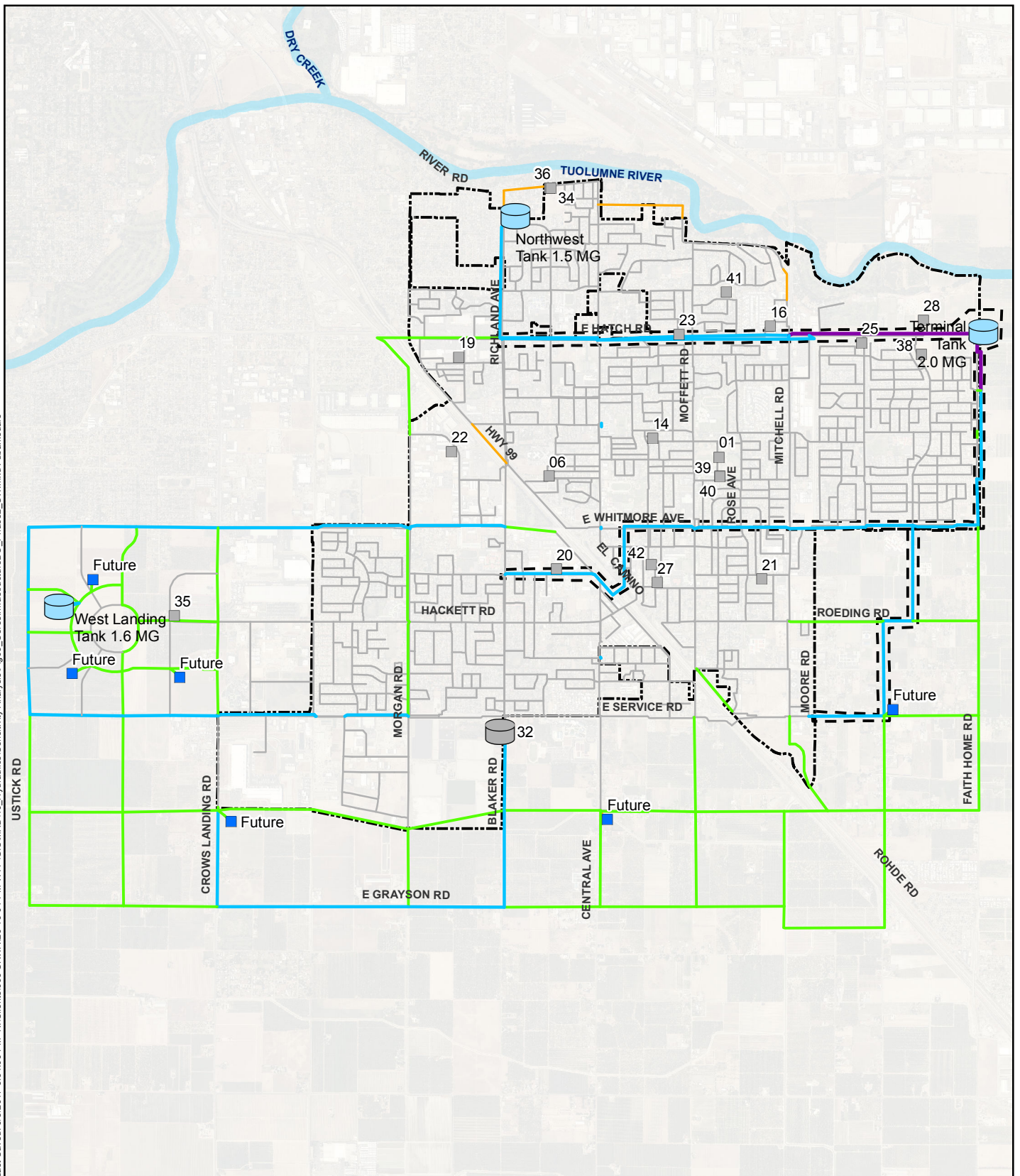


Figure 2

Ceres Sensitivity Analysis Revised Infrastructure for Phase 1

Stanislaus Regional Water Authority
Surface Water Supply Project

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Symbology

- Existing Tank
- Future Tank
- Existing Well
- Future Well
- Included in Surface Water Project Cost Estimate

- Existing Pipeline
- Future Pipeline Diameter**
 - ≤8"
 - 10"
 - 12"
 - 14" - 18"
 - ≥24"

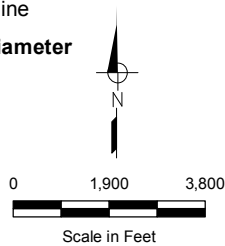
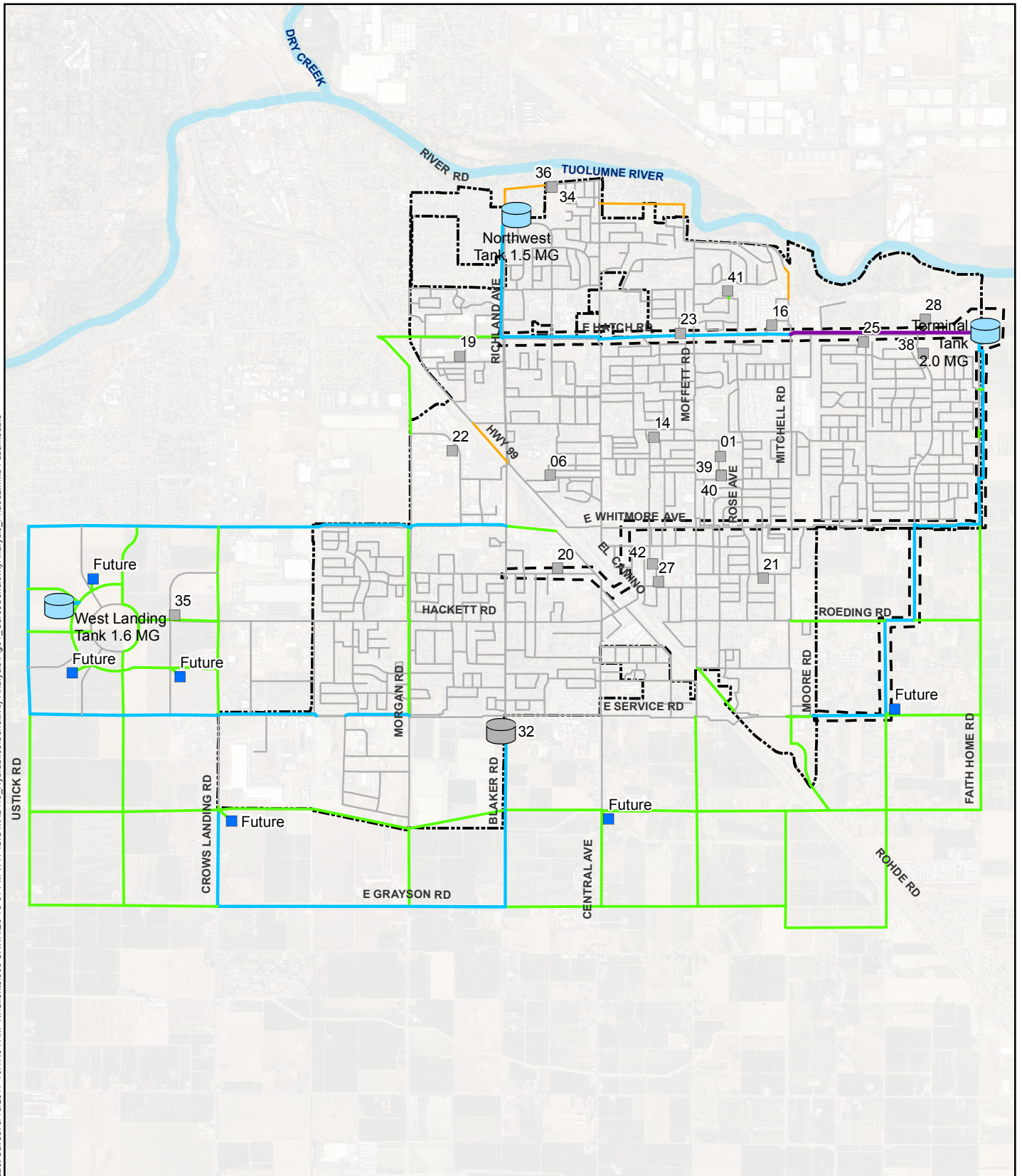


Figure 3
Ceres Infrastructure at
Buildout with Phase 2
(15 mgd) Surface Water
Project
 Stanislaus Regional Water Authority
 Surface Water Supply Project

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Symbology

Existing Tank

Future Tank

Existing Well

Future Well

Included in Surface Water Project Cost Estimate

— Existing Pipeline

Future Pipeline Diameter

— ≤8"

— 10"

— 12"

— 14" - 18"

— ≥24"

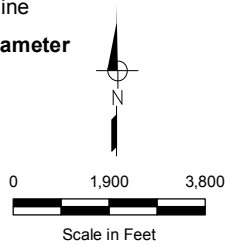
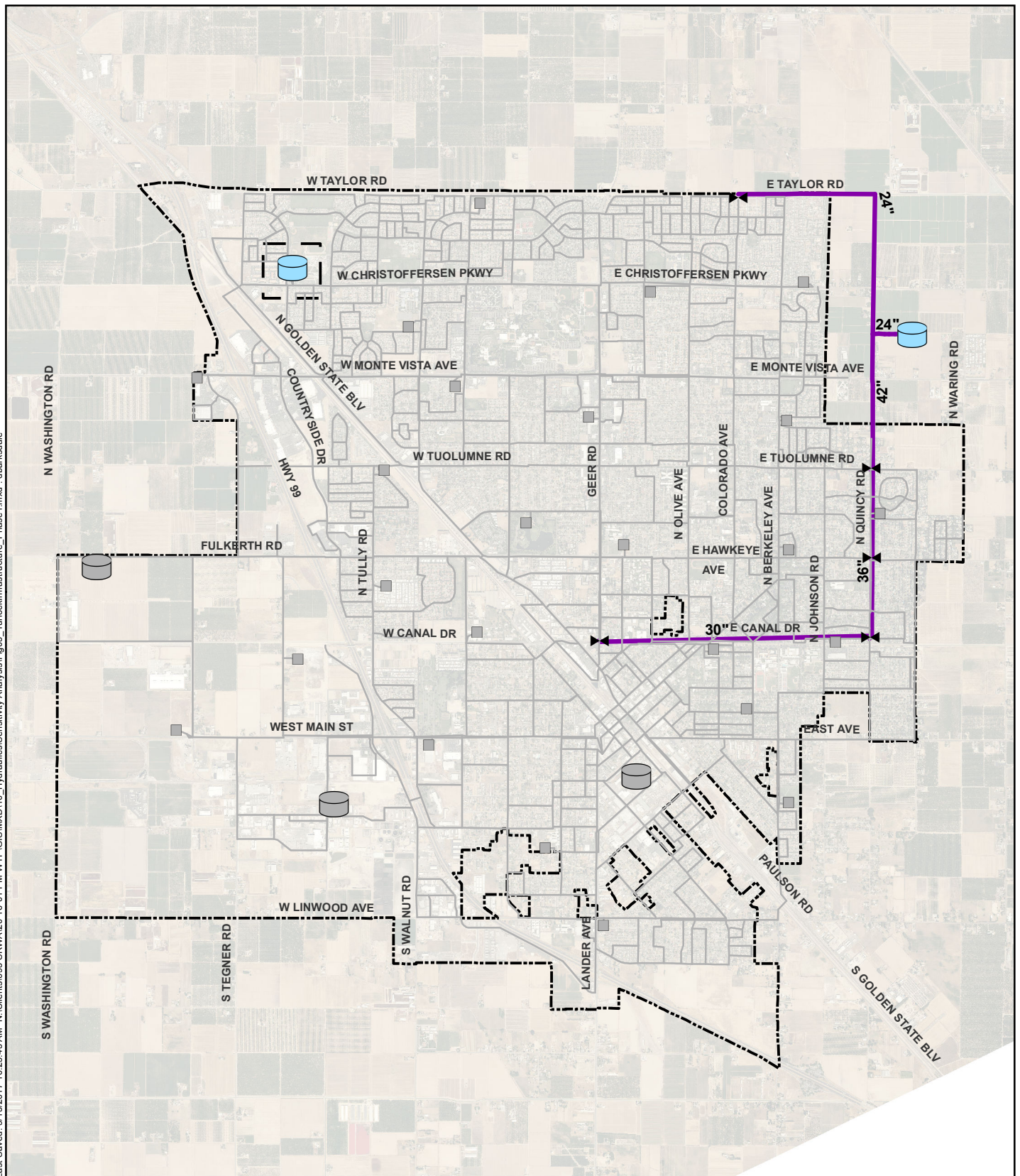


Figure 4

Ceres Sensitivity Analysis Revised Infrastructure for Phase 2

Stanislaus Regional Water Authority
Surface Water Supply Project

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Symbology

- Existing Tank
- Future Tank
- Future Control Valve
- Existing Well
- Infrastructure assumed to be in place. Not part of Surface Water Project.

Existing Pipeline

Phase I Pipeline Diameter

- ≤8"
- 10"
- 12"
- 14" - 18"
- ≥24"

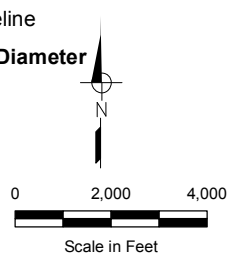
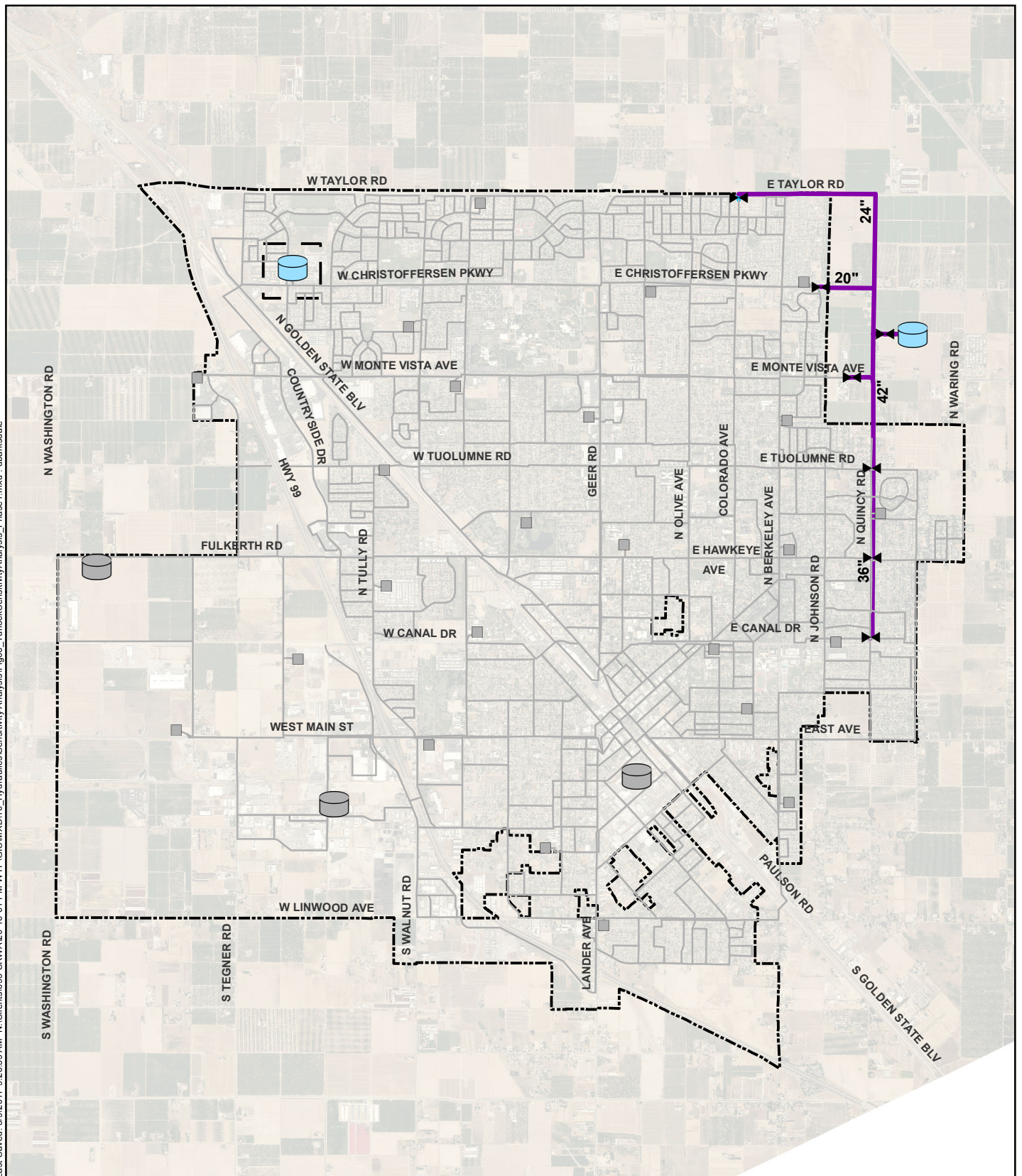


Figure 5

Turlock Infrastructure Required for Phase 1 (20 mgd) Project

Stanislaus Regional Water Authority
Surface Water Supply Project

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Symbology

- Existing Tank
- Future Tank
- Future Control Valve
- Existing Well
- Infrastructure assumed to be in place. Not part of Surface Water Project.

- Existing Pipeline
- Phase I Pipeline Diameter**
- ≤8"
 - 10"
 - 12"
 - 14" - 18"
 - ≥24"

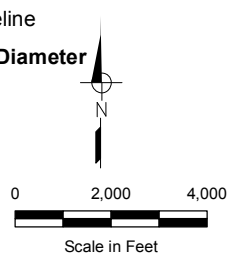
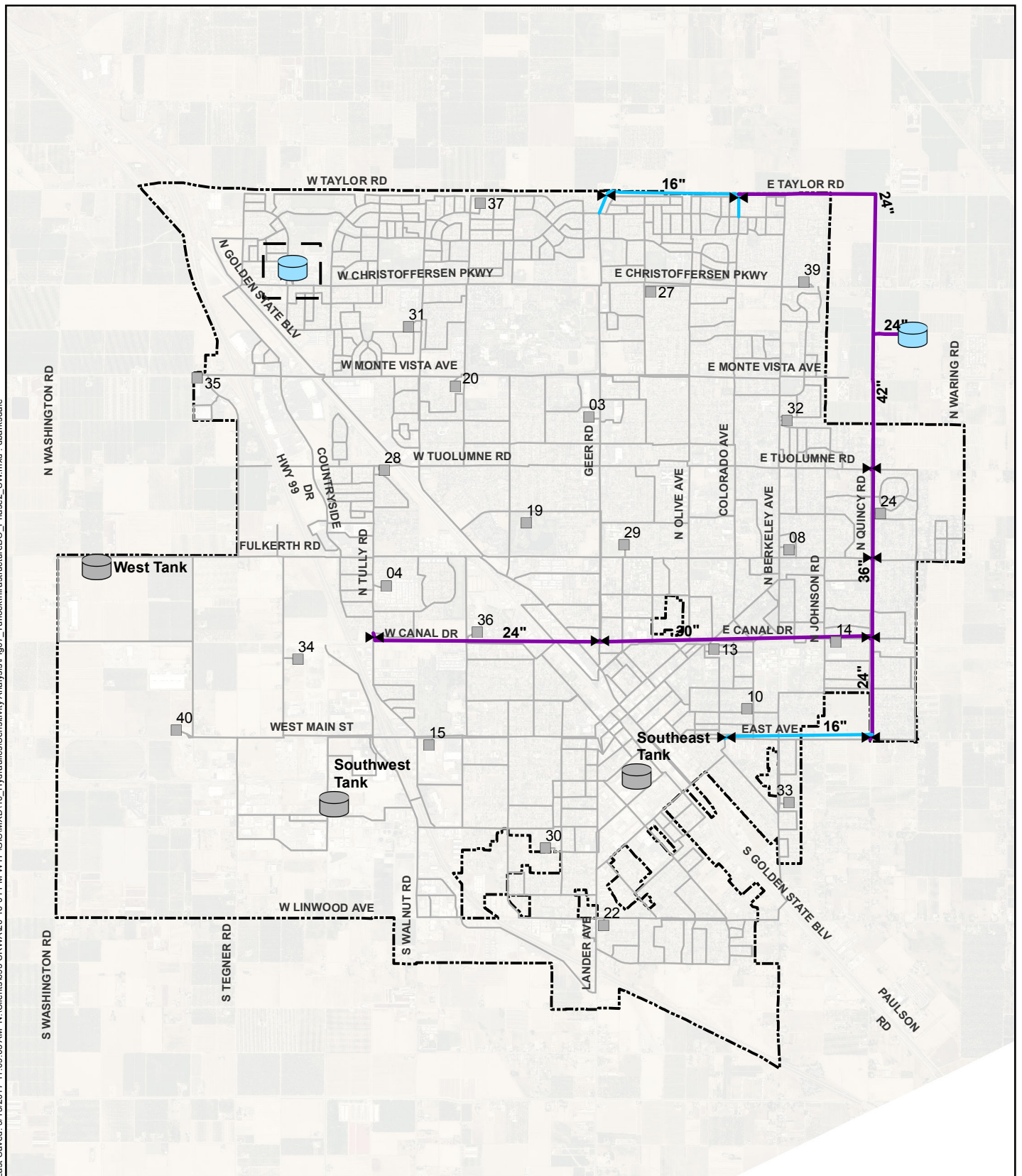







Figure 6
Turlock Sensitivity Analysis
Revised Infrastructure
for Phase 1
Stanislaus Regional Water Authority
Surface Water Supply Project

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Symbology

-  Existing Tank
-  Future Tank
-  Existing Well
-  Future Control Valve
-  Infrastructure assumed to be in place. Not part of Surface Water Project.

Existing Pipeline

Future Pipeline Diameter

-  ≤8"
-  10"
-  12"
-  14" - 18"
-  ≥24"

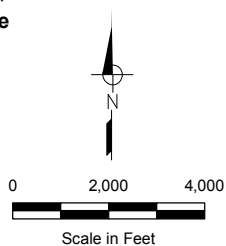
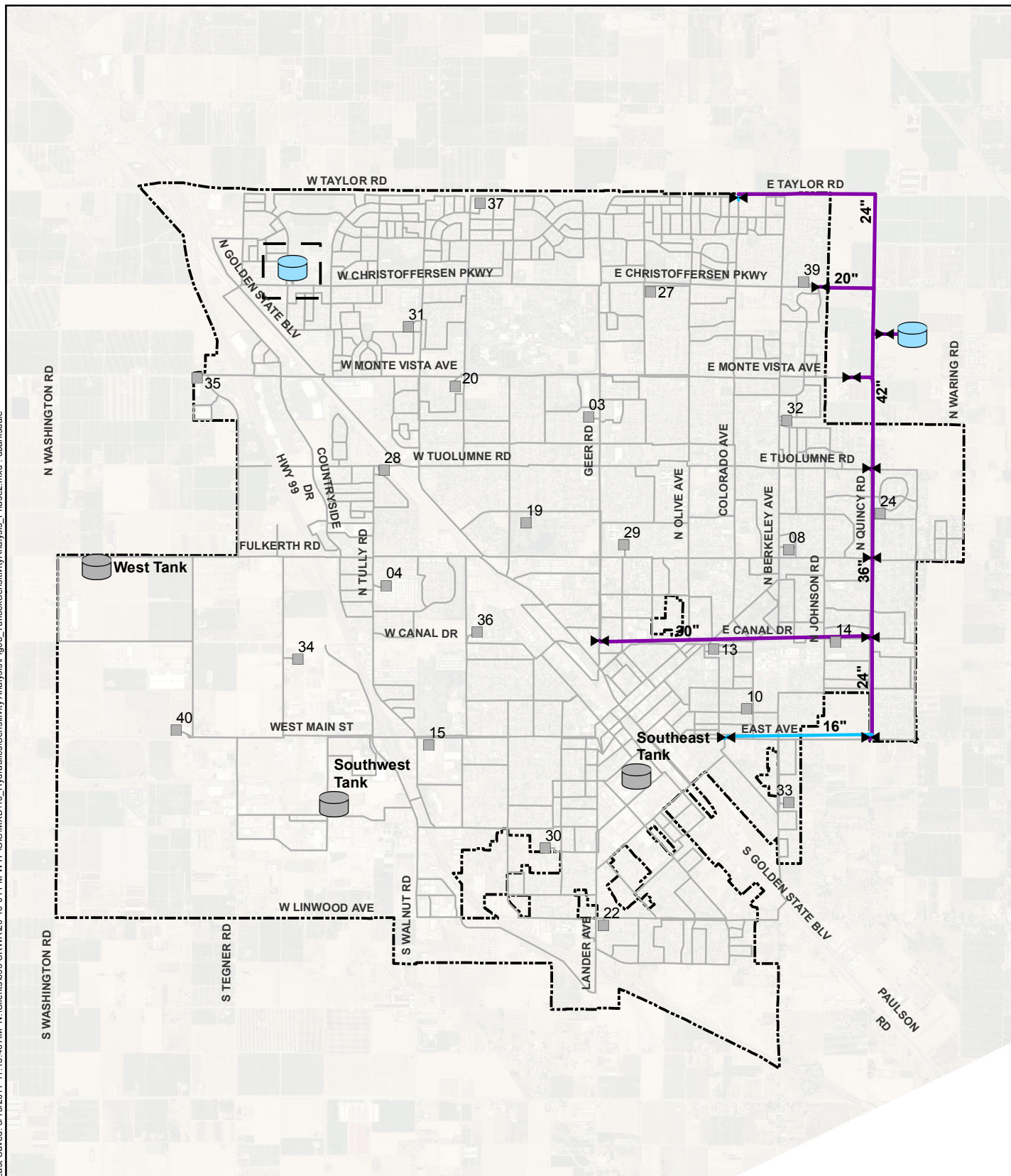


Figure 7

Turlock Infrastructure at Buildout with Phase 2 (30 mgd) Surface Water Project

Stanislaus Regional Water Authority
Surface Water Supply Project

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Symbology

- Existing Tank
- Future Tank
- Existing Well
- Future Control Valve
- Infrastructure assumed to be in place. Not part of Surface Water Project.

Existing Pipeline
Future Pipeline Diameter

- ≤8"
- 10"
- 12"
- 14" - 18"
- ≥24"

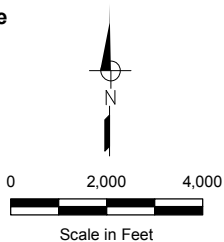


Figure 8
Turlock Sensitivity Analysis
Revised Infrastructure
for Phase 2
Stanislaus Regional Water Authority
Surface Water Supply Project