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CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON AND CANNERY SEGREGATION LINE IMPROVEMENT PROJECT

VOLUME I
PRELIMINARY DESIGN REPORT

FINAL
September 2015

VOLUME II
35% PRELIMINARY DESIGN DRAWINGS

FINAL
September 2015

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CITY OF MODESTO

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VOLUME I
PRELIMINARY DESIGN REPORT

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ABBREVIATIONS AND ACRONYMS

ADWF	Average Dry Weather Flow
BD	Beckwith/Dakota
BMP	Best Management Practice
CCRFPMP	Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe
CCTV	Closed Circuit Television
CEQA	California Environmental Quality Act
CIP	Capital Improvement Plan
COM	City of Modesto
CPD	Comprehensive Planning District
d/D	Ratio of flow depth to pipe diameter
DS	Downstream
EIR	Environmental Impact Report
ENR	Engineering News Record
ft	feet
ft/sec	feet per second
GPDA	Gallons per day per acre
gpm	Gallons per minute
ID	Identifier / Inside Diameter
in	inch
KCN	Kiernan/Carver North
LRP	L.R. Paulsell Consulting
LS	Lift Station
MEIR	Master Environmental Impact Report
MG	million gallons
mgd	million gallons per day
MH	manhole
MID	Modesto Irrigation District
MLK	Martin Luther King (Drive)
MTBM	Micro-Tunneling Boring Machine
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPV	Net Present Value
O&M	Operations and Maintenance
PACP	Pipeline Assessment and Certification Program
PCP	Polymer Concrete Pipe
PDR	Preliminary Design Report
PTMT	Pilot Tube Micro Tunneling
PVC	Polyvinyl Chloride Pipe
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
SAPTP	Sutter Avenue Primary Treatment Plant
SOI	Sphere of Influence
SR	State Route
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
US	Upstream
VCP	Vitrified Clay Pipe
WWMP	Wastewater Master Plan

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION LINE IMPROVEMENT PROJECT

1.0 INTRODUCTION

The Preliminary Design Report (PDR) provides the basis of design for the following wastewater collection system improvement projects:

- River Trunk realignment, including a new pump station for the River Trunk and River Trunk force main (pressure pipeline).
- Beard Brook Siphon improvements.
- A new Shackelford Pump Station and force main.
- Rehabilitation of the Sutter and existing River Trunk pipelines. (Rehabilitation of the Cannery Segregation Line (CSL) will be addressed as a separate project.)

The project was initiated to address deficiencies identified in the City's 2007 Collection System Master Plan, but has been modified to address additional system limitations identified by related work efforts. In general, the project will improve the accessibility, capacity, and reliability of key domestic trunk sewers and the reliability and capacity of the CSL, as well as extend the useful life of the existing infrastructure.

2.0 BACKGROUND

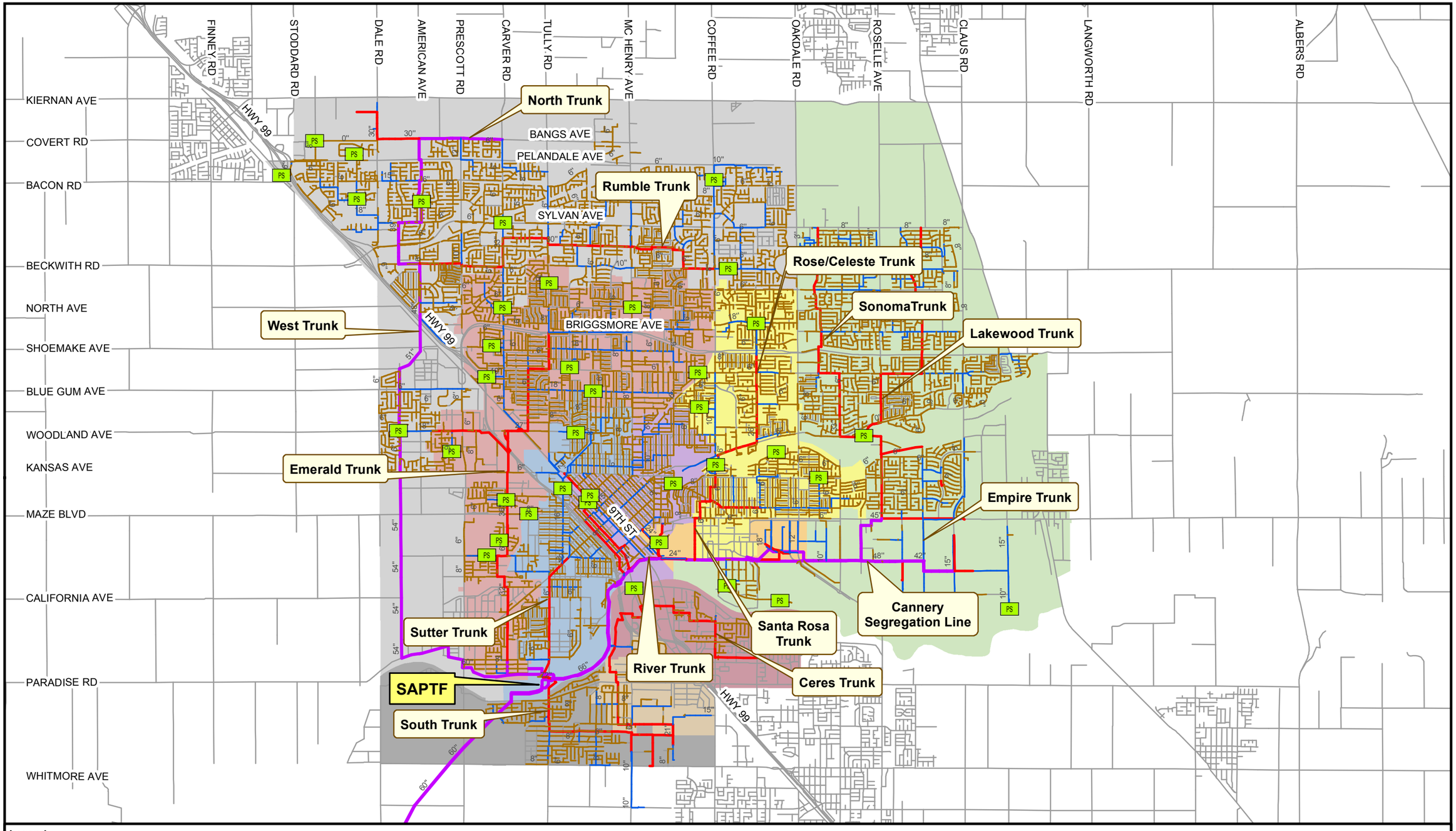
2.1 Existing Wastewater System Configuration

The City operates its own wastewater collection system, providing service to properties located within the City limits as well as some properties located in unincorporated Stanislaus County. The City's wastewater collection system is presented on Figure 1. The wastewater collection system consists of 39 sewage lift stations and an estimated 641 miles of sewer pipe.

As shown in Figure 1, the wastewater collection and treatment system is divided into two separate systems: the domestic system and the segregated cannery process water system (referred to as "can seg" for this report).

The domestic collection system transports wastewater to the City's Sutter Primary Treatment Facility (Sutter Plant) at Sutter Avenue via five major trunk lines:

- West Trunk.
- Emerald Trunk.
- Sutter Trunk.
- River Trunk.
- South Trunk.



EXISTING WASTEWATER COLLECTION SYSTEM

FIGURE 1

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

MODESTO CALIFORNIA

D:\Modesto_DEM\Figure 02 - Existing Wastewater Collection System.mxd

Primary effluent from the Sutter Avenue Primary Treatment Facility (Sutter Plant) flows approximately 6.5 miles southwest to the Jennings Road Secondary Treatment Facility (Jennings Plant) via a 66-inch primary outfall.

Cannery process water from the Beard Industrial Park area is conveyed by the CSL, which consists of upper and lower segments. The upper segment of the CSL transports the cannery flows to the Sutter Plant. During canning season (mid-June to mid-October), the flow from the upper CSL bypasses the Sutter Plant and flows through the lower CSL for direct irrigation on the City's ranch land at the Jennings Plant. The 66-inch lower CSL runs parallel to the primary outfall pipeline. Originally, both outfall pipelines were used to convey blended flows from the domestic/commercial flow and cannery flows. Their use was segregated as part of the can seg program to allow separate treatment of the cannery flows.

Some food processing industries in the Beard Industrial Park discharge year round. During the non-canning season, flows from the industries are conveyed by the upper CSL to the Sutter Plant and combined with domestic flow for treatment.

2.2 Project History

The City's 2007 Collection System Master Plan recommended capital projects for the River Trunk, Sutter Trunk, and CSL to increase hydraulic capacity for wet weather flow conditions. In addition, a condition assessment performed for the Master Plan found evidence of corrosion on the interior concrete surfaces of the Sutter Trunk and the River Trunk pipelines.

After the 2007 Master Plan was published, the City found an exposed section of the CSL adjacent to the Tuolumne River. The pipeline was exposed by riverbank erosion during high river flows in 2006/07. In 2014, the City found another section of exposed pipe along the river. The City has constructed temporary bank reinforcement for both locations. However, a permanent solution will be required to prevent a washout of the pipeline along the river bank during high river flows.

The Master Plan identified two other projects for the River Trunk: the Beard Brook Siphon and the CSL Diversion Structures. Beard Brook Siphon improvements were recommended to address three deficiencies: insufficient hydraulic capacity during wet weather flow conditions, odors, and frequent maintenance to prevent clogging. In January 2012, West Yost Associates (West Yost) prepared the Cannery Segregation Line and River Trunk Diversion Plan Study, which identified a conceptual contingency plan to divert flows from the River Trunk to the CSL or from the CSL to the River Trunk, in the event of a failure of either trunk line. Subsequently, West Yost expanded on this analysis as part of the Draft 2014 Vulnerability Assessment Report and found that while the CSL can convey the current flows, the CSL would not be able to convey the peak hour flows if each contributor

discharged their maximum flow allocation. The diversion structures are included in this project because they are impacted by the new alignment of the River Trunk.

The importance of correcting the hydraulic deficiencies and increasing the reliability is critical because:

- The River Trunk conveys nearly 50 percent of the City's domestic wastewater to the City's wastewater plant at Sutter Avenue
- An interruption of service on the CSL would prevent production at the canneries and cause severe economic losses to the industries and the region.

3.0 PROJECT OBJECTIVES

The main objectives for this project are to address capacity and structural deficiencies in the Sutter and River Trunk systems, and address capacity and operation and maintenance issues associated with the Beard Brook Siphon.

During the conceptual development of the project, two additional objectives were identified:

- Address CSL peak flow limitations.
- Improve River Trunk O&M access and mitigate vulnerability of river washout.

A list of the proposed River Trunk Project elements and the purpose of each is provided in Table 1.

4.0 REVIEW OF EXISTING CONDITIONS

4.1 Description of Existing Facilities

This section describes the existing collection system facilities affected by this project.

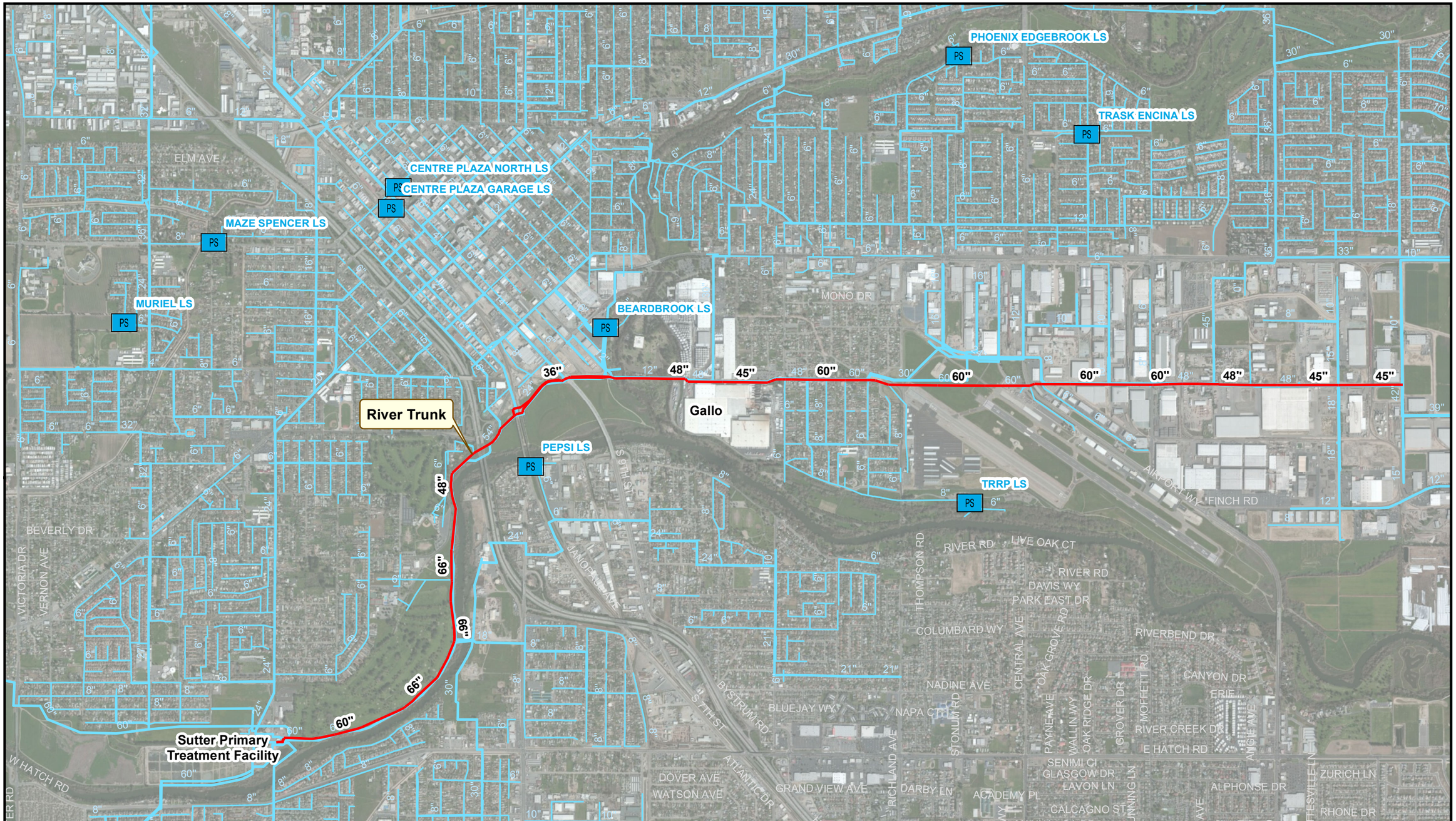
4.1.1 River Trunk

Originally constructed in the 1940s, the River Trunk is approximately five miles long, and it conveys flows from six major tributaries of the City's collection system. All segments of the River Trunk were constructed of unlined reinforced concrete pipe (RCP). As shown in Figure 2, The River Trunk begins near the intersection of Beard Avenue and Nathan Avenue and terminates at the Sutter Plant. Pipeline sizes range from 45 to 60 inches in diameter. The hydraulic model indicates that the maximum full flow capacity of the River Trunk is approximately 25.3 million gallons per day (mgd).

Table 1 River Trunk Project Elements and Purpose River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto		
Project Element	**Components**	**Purpose/Benefits**
River Trunk Improvements	River Trunk Pump Station (RTPS)	Eliminates River Trunk inverted siphon and associated maintenance and odors
	River Trunk Forcemain	Convey pumped wastewater from RTPS to a new realignment of the River Trunk at Colorado St and Tuolumne. Allows current River Trunk along the Tuolumne River to be used either as a redundant pipeline for the CSL or provide a backup system for the RTPS
	New River Trunk alignment on Colorado Ave and juncture with Sutter Trunk	Combines flows from the River Trunk and a portion of the Sutter Trunk flow to gain more capacity for the Sutter Trunk
	Shackleford Pump Station and forcemain	Eliminates inverted siphon below the Tuolumne River, and provides way to connect flow from Shackleford area to the new River Trunk alignment
Can Seg Line (CSL) Improvements	Structural rehabilitation and river bank armament	Reduce risk of structural failures from corrosion and river bank washout during high river flows
	Beard Brook Siphon Improvements	Improve capacity and reliability of the inverted siphon for the CSL
	CSL/River Trunk Diversion Structures	Allows switch from CSL to River Trunk in case of CSL failure and vice versa
Sutter Trunk Improvements	Rehabilitation by lining	Improves reliability of the trunk
	Sutter PWWF diversion to River Trunk	Provides capacity relief for the Sutter Trunk during the PWWF

4.1.2 Sutter Trunk

The 13,000 foot long Sutter Trunk was constructed in 1965. All segments of the pipeline were originally constructed of unlined RCP; however, portions of the alignment have since been lined with a plastic liner. The Sutter Trunk begins near the intersection of Jefferson and 8th Street and terminates at the Sutter Plant (Figure 3). Pipeline sizes range from 16 to 24 inches in diameter. The hydraulic model indicates the maximum full flow capacity of the Sutter Trunk is approximately 3.6 mgd.



Legend

PS Lift Station

River Trunk

Other Pipelines

8" and Smaller

Greater than 8"

carollo

Feet

0 1,500 3,000

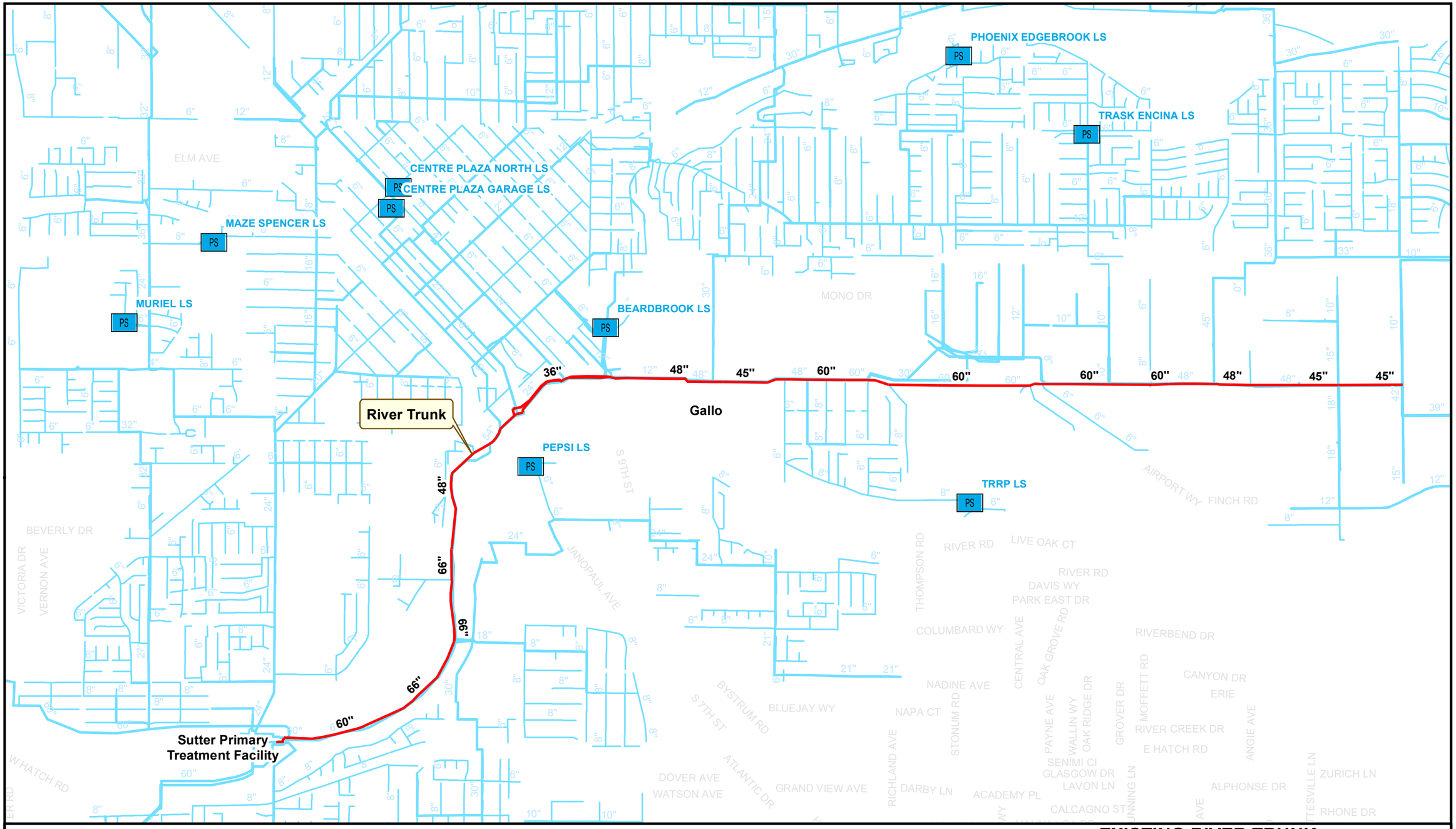
EXISTING RIVER TRUNK ALIGNMENT

FIGURE 2

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\OLD Figures\Figure 03 - Existing River Trunk Alignment.mxd



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PS Lift Station

River Trunk

Other Pipelines

8" and Smaller

Greater than 8"

N

0 1,500 3,000 Feet

EXISTING RIVER TRUNK ALIGNMENT

FIGURE 2

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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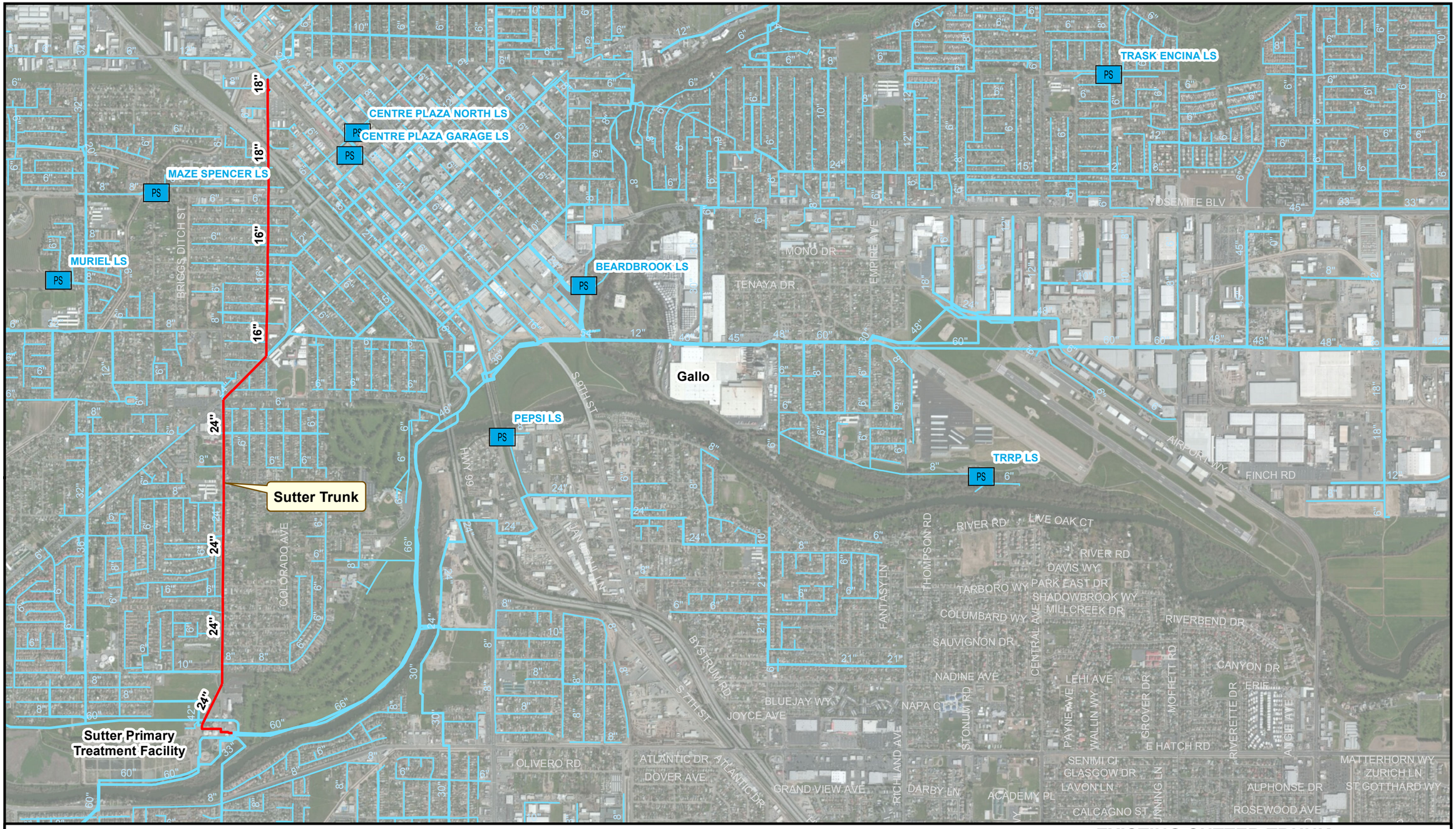

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PS Lift Station

Sutter Trunk

Other Pipelines

8" and Smaller

Greater than 8"

N

0 1,500 3,000 Feet

carollo

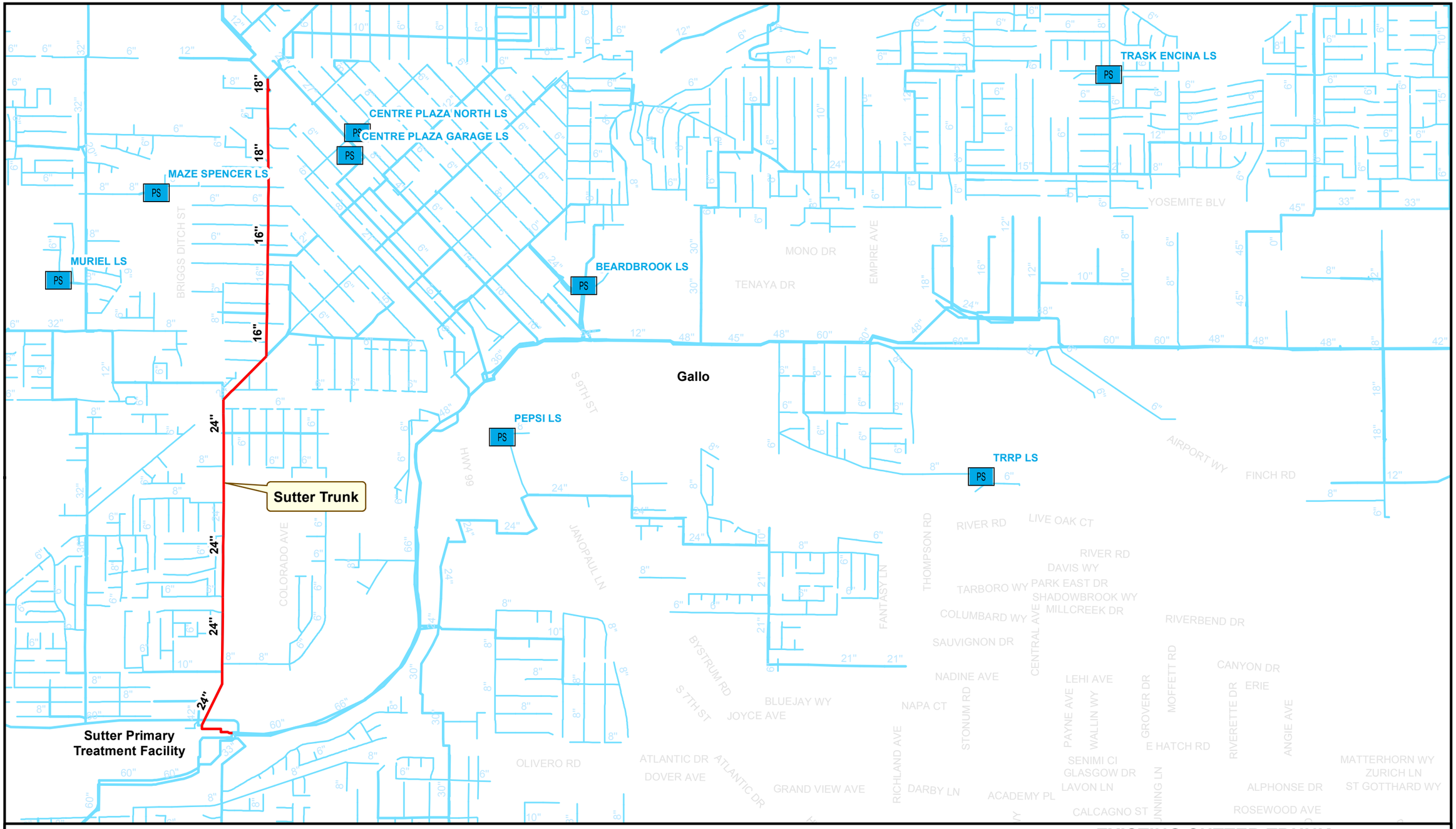
EXISTING SUTTER TRUNK ALIGNMENT

FIGURE 3

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_Edits_4_17_15\Figure 03 - Existing Sutter Trunk Alignment.mxd



Legend

PS Lift Station

Sutter Trunk

Other Pipelines

8" and Smaller

Greater than 8"

N

0 1,500 3,000 Feet

EXISTING SUTTER TRUNK ALIGNMENT

FIGURE 3

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_Edits_4_17_15\Figure 03 - Existing Sutter Trunk Alignment.mxd

4.1.3 Beard Brook Siphon – River Trunk

The Beard Brook Siphon for the River Trunk is a single barreled 48-inch diameter pipeline that runs under Dry Creek for a distance of 1,720 feet. The siphon conveys domestic wastewater for three of the City's main tributaries (Areas 5, 6, and 7 as defined by the Master Plan). The inverted siphon runs parallel to the triple barrel siphon for the CSL. The siphon is a critical section of the River Trunk because serves most of the downtown areas on the east side.

In addition, the siphon is in an environmentally sensitive area and access for maintenance is restricted to prevent interference with the Gallo Winery operations. Because the siphon passes below Dry Creek, the upstream end traps floating debris and grease. The siphon only has a single barrel. Without multiple barrels to adjust for varying flows and velocities, the siphon is vulnerable to clogging at low flows increasing the potential for sewer overflows. In addition, odors and grease are a consistent problem and City crews must clean the siphon on a monthly basis.

4.1.4 Shackelford Siphon

New dual 18-inch inverted siphons made of fusible PVC pipe were recently installed to replace the existing single-barrel Shackelford Siphon. The new siphons convey flow from the Crows Landing area east of the Tuolumne River to the existing River Trunk on the west side of the Tuolumne River.

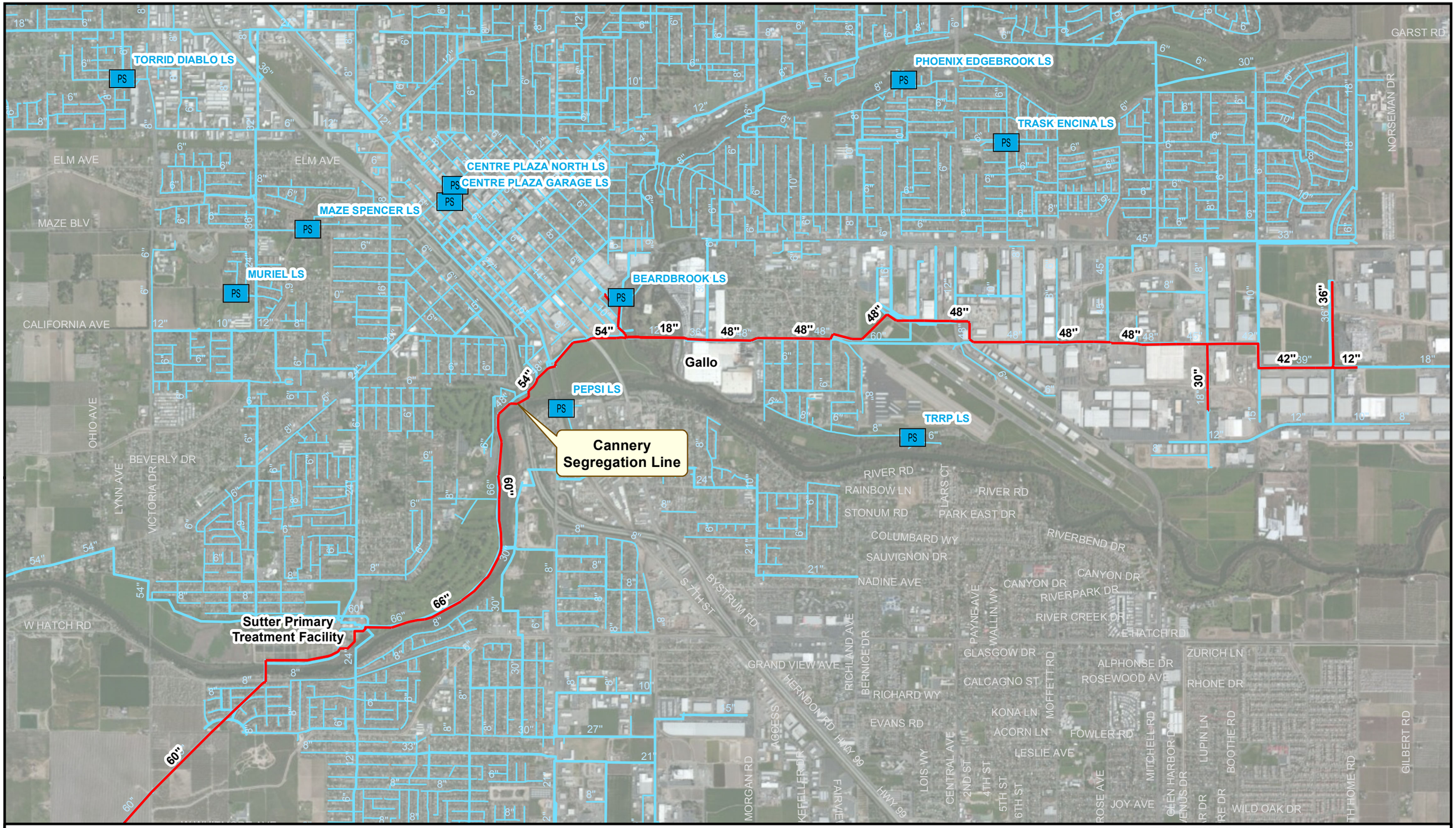
4.1.5 Cannery Segregation Line (CSL)

The CSL was originally one of the two twin River Trunk sewers. In 1998, it was dedicated to conveying only cannery process water, separate from domestic wastewater. The CSL alignment is shown on Figure 4. The CSL begins at the Beard Industrial Park as a 66-inch diameter pipe that runs parallel to the River Trunk and the Tuolumne River. At the crossing under Dry Creek, the CSL transitions to a 12-inch, 18-inch, and 24-inch diameter – barreled inverted siphon. The total length of this pipeline is approximately 12 miles. All segments of the CSL are constructed of unlined RCP. Existing and future CSL flows are provided in Chapter 5 of the Wastewater Treatment Vulnerability Assessment Report prepared by West Yost Associates in 2014.

The inverted siphon for the CSL does not experience the same maintenance issues as the siphon for the River Trunk because the multiple barrels allow for adequate flushing velocities, and there is little grease in the wastewater from the canneries.

4.1.6 Dryden Box

The Dryden Box is located at the Sutter Plant and serves as a diversion box for the existing River Trunk and CSL pipelines. Diversion gates are provided to blend or separate cannery flows from the domestic wastewater, depending on the season. A condition assessment



Legend

PS Lift Station

Cannery Segregation Line

Other Pipelines

8" and Smaller

Greater than 8"

N

0 1,900 3,800 Feet

carollo

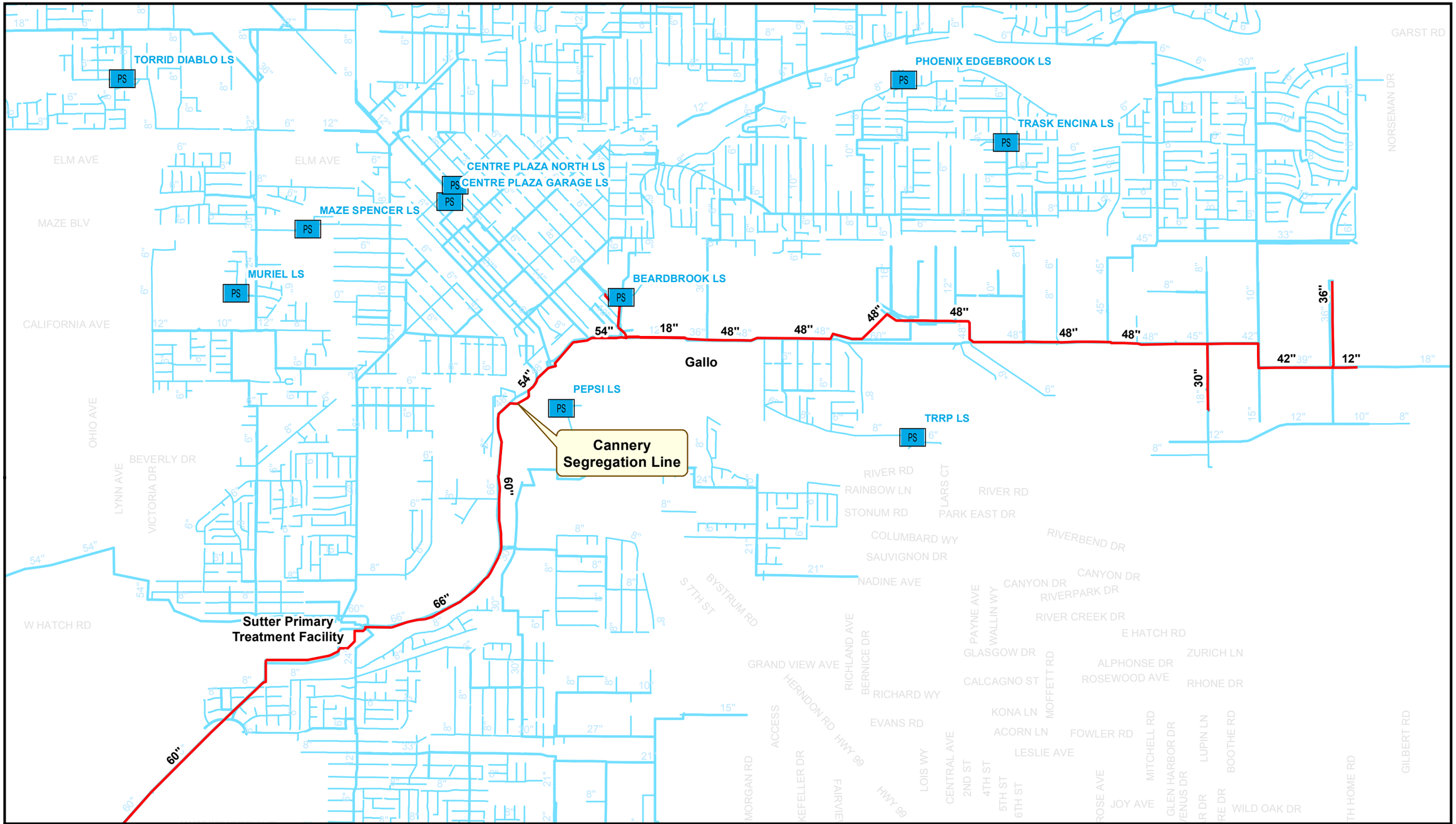
EXISTING CSL ALIGNMENT

FIGURE 4

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_Edits_4_17_15\Figure 05 - Existing Canary Segregation Line.mxd



EXISTING CSL ALIGNMENT

FIGURE 4

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_Edits_4_17_15\Figure 05 - Existing Canary Segregation Line.mxd

was conducted for the Dryden Box in February 2015 for the Headworks, Dryden Box and Influent Flume Improvements Project. In general, the box interior is heavily corroded with exposed aggregate but not exposed steel reinforcement bars. The recommendations for rehabilitation will be detailed in the PDR for the Headworks, Dryden Box and Influent Flume Improvements Project, and repairs to the box will be included in the design documents for that project..

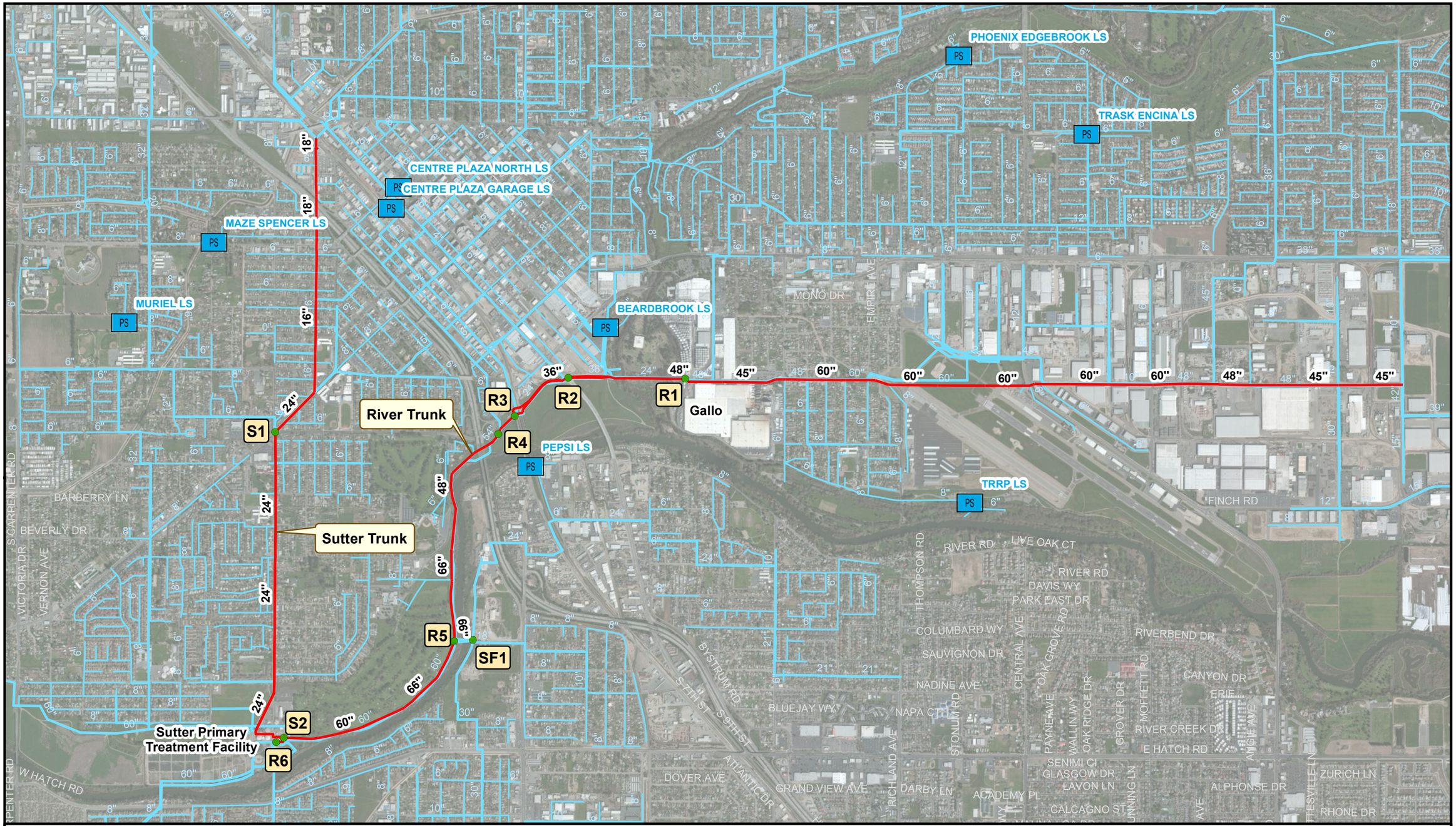
4.2 Existing Flows

A summary of existing flows in the Sutter Trunk, River Trunk, and Shackelford Siphon are provided in Table 2 below. The locations of the flows identified in Table 2 are shown in Figure 5.

Table 2 Existing Sutter Trunk, River Trunk, and Shackelford Siphon Flows River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto

Location	Existing conditions		Future Conditions	
	Flow (mgd)		Flow (mgd)	
	ADWF[(1)]	PWWF[(2)]	ADWF	PWWF
Sutter Trunk				
S1	0.72	5.36	0.82	2.89
S2	1.07	6.98	1.28	3.82
River Trunk				
R1	8.58	38.2	13.67	31.71
R2	8.86	39.92	13.96	30.89
R3	10.37	47.95	15.53	36.31
R4	10.56	46.38	15.73	37.63
R5	12.22	49.37	17.97	41.19
R6	12.22	49.37	17.97	41.42
Shackelford Siphon				
SF1	1.71	3.2	2.22	4.20

Notes:
(1) ADWF = Average Dry Weather Flow. ADWF is flow generated by routine water usage and the contribution of dry weather infiltration into the collection system.
(2) PWWF = Peak Wet Weather Flow. PWWF includes storm water inflow, trench infiltration, and ground water infiltration. Peak WWF is based on a 10-year, 24-hr design storm.



Legend

- PS — Lift Station
- SF1 — Key Flow Locations
- Existing Trunk Sewers

Other Pipelines

- 8" and Smaller
- Greater than 8"

carollo

0 1,500 3,000 Feet

EXISTING SYSTEM FLOWS

FIGURE 5

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

D:\Modesto_DEM\Figure X - Existing System Flows.mxd

4.3 Geotechnical Findings

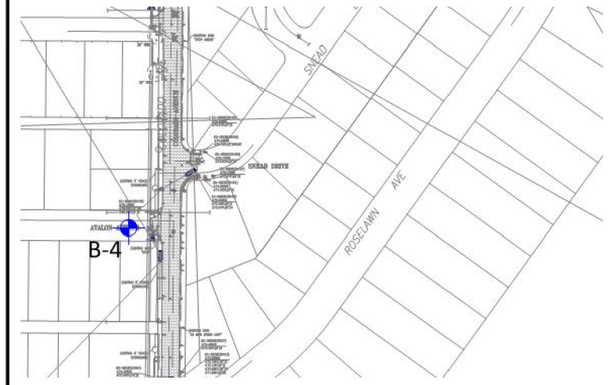
Crawford and Associates, Inc. (Crawford) was retained to provide geotechnical engineering services for this project. Crawford's services for preliminary design included project review, three geotechnical borings located near Dry Creek, preliminary seismic evaluation, and a technical memorandum summarizing the results of the investigation. Crawford provided a Draft Geotechnical Study (35 percent), dated November 25, 2014, which can be found in Appendix A of this report. Additional subsurface exploration will be required during final design to finalize the report and provide specific design recommendations for excavation and shoring, structures, trenchless construction, and trench backfill. Important geotechnical considerations are included below:

- Groundwater was not measured during this phase of the geotechnical investigation but based on historical data, it is anticipated that the groundwater elevation will be at approximately 40 feet.
- Boring B-2, the closest boring to the creek, encountered notably different ground conditions. The soils were much more clayey than those encountered in Borings B-1 and B-3. The boring locations are shown in Figure 6. In addition, the consistencies of several layers in and around the proposed tunnel profile were much softer than what was encountered in the rest of the borings drilled by Crawford and Associates. From the ground surface at approximate elevation 76 feet, to approximate elevation 53 feet, Boring B-2 encountered stiff to hard clay with sand. Below this, from approximate elevation 53 feet to approximate elevation 40 feet, the soils encountered were hard sandy silt. From approximate elevation 40 feet to approximate elevation 33 feet Boring B-2 encountered soft sandy clay. From approximate elevation 33 feet to approximate elevation 28 feet the soils encountered were medium dense silty sand. Below this, from approximate elevation 28 feet to approximate elevation 21 feet, the boring encountered soft lean clay. Finally, from approximate elevation 21 feet to the termination of Boring B-2 at approximate elevation 19 feet, the soils encountered were loose sand with gravel.

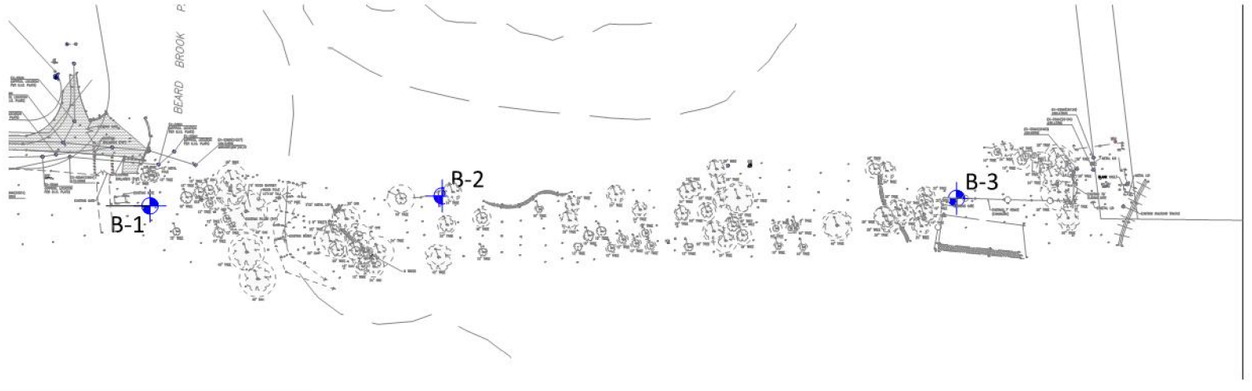
There were nine geotechnical borings drilled on the river side of the E&J Gallo property for the flood mitigation study performed by URS. These borings encountered soils very similar to those encountered in the three borings drilled for this project. They primarily indicate that the soils are a mixture of medium dense to dense sand, silty sand, and clayey sand; and stiff to hard sandy silt, clayey silt, and silty clay. However, like Boring B-2, Boring B-5 also encountered a soft layer of silty clay at approximate elevation 57 feet.

4.4 Existing Utilities

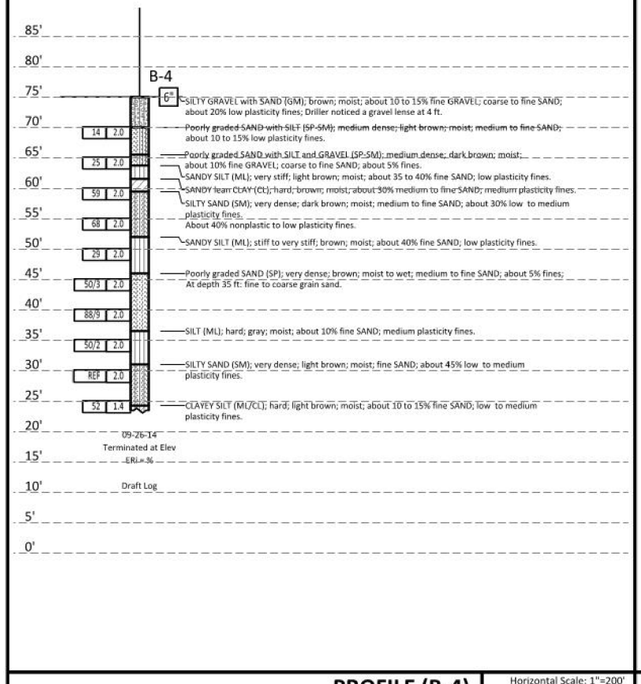
Existing utilities were contacted to provide mapping of their facilities within the project area. Each agency was sent a map of the project area and asked either to confirm they have no facilities within the project area or to provide mapping of their facilities within the project



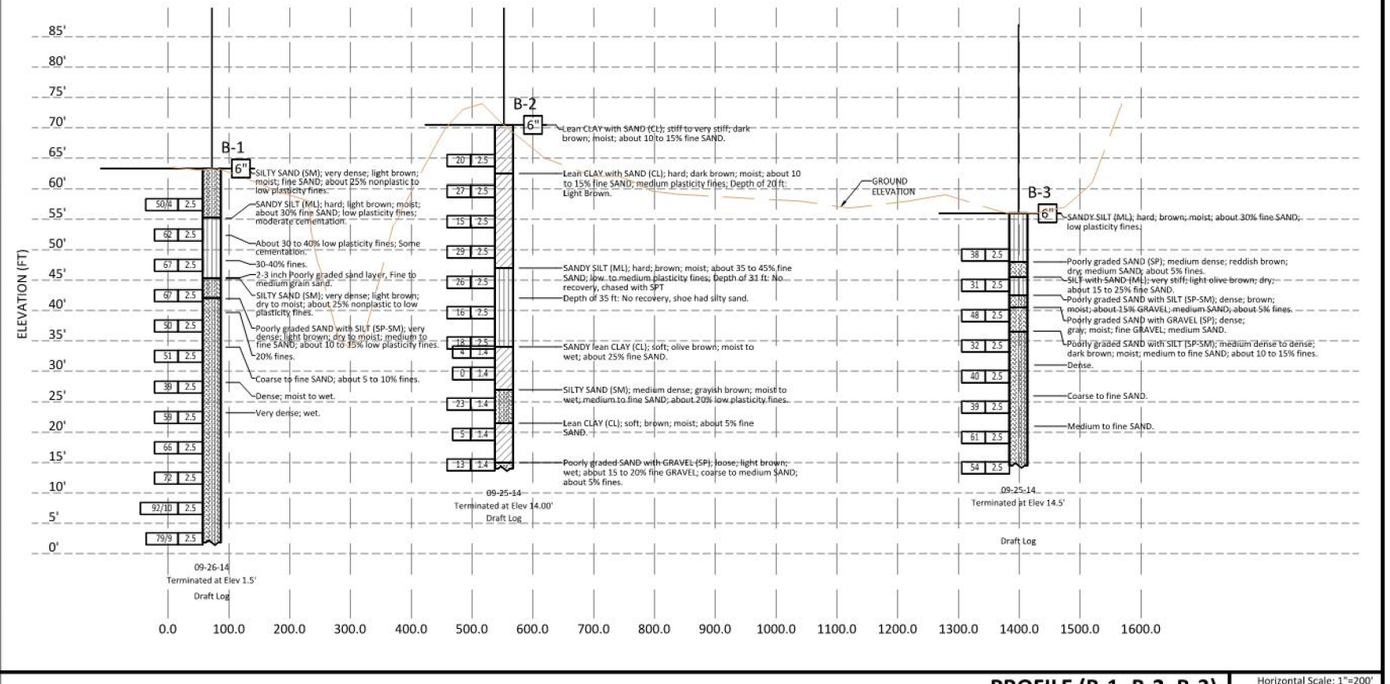
PLAN (B-4) 1"=200'



PLAN (B-1, B-2, B-3) 1"=200'



PROFILE (B-4) Horizontal Scale: 1"=200' Vertical Scale: 1"=20'



PROFILE (B-1, B-2, B-3) Horizontal Scale: 1"=200' Vertical Scale: 1"=20'

NOTES:
1. Field classification of soils was in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010). See Log of Test Borings No. 2, "Soil Legend".
2. Standard Penetration tests were performed using in accordance with ASTM D 1586-99 using a hammer operated with an automated drop system. Drill rods were 1 5/8-inch diameter "A"-rods; sampler was driven with stainless steel liners.
3. "2.4 inch sampler": ID=2.4 inch, OD=2.9 inch. "2.0 inch sampler": ID=2.0 inch, OD=2.5 inch. Both driven in same manner as SPT ("1.4 inch") sampler.
4. If laboratory tests are not shown as being performed, the soil descriptions presented in the LOTB are based solely on the visual practices described in this Manual.
5. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with the Caltrans Soil & Logging, Classification, and Presentation Manual (June 2010). Where less than 0.5 inches of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated.
6. Consistency of soils shown in ( ) where estimated.
7. Ground water surface (GWS) elevations in the borings indicated on the Log of Test Boring Sheets reflect the fluid level in the borings on the specified date.
8. Ground water surface elevations are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services
1165 Scenic Drive, Suite B
Modesto, CA 95350

Project Mgr.	BDC	10/27/14
Project Eng.		
Designer		
Checked By		
Drawn By	SJC	10/27/14
	By	Date

City of Modesto
River Truck Realignment

Modesto, CA

DRAFT
Log of Test Borings

Project No.	14-159.1
Scale	As Noted
Date	10/27/14

GEOTECHNICAL BORING LOCATIONS

FIGURE 6

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

MODESTO CALIFORNIA

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GEOTECHNICAL BORING LOCATIONS

FIGURE 6

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK
SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 06 - Geotechnical Boring Locations.mxd

area. Mapping information provided by the utilities was incorporated into the topographic mapping and verified with visible surface features, where available. The horizontal alignments provided in the 35 percent plans were developed to maintain regulated separation and standard code clearance minimums. Supplemental utility surveys and potholing will be required during final design to confirm vertical clearances. Table 3 provides the agency name, contact, telephone number, and email address for each agency contacted during the utility investigation. A potholing plan identifying recommended utilities to be potholed during final design is provided as Appendix B.

Table 3 Agency Contacts
River Trunk Realignment, Beard Brook Siphon, and Cannery Segregation Line Improvement Project
City of Modesto

Agency Name	Phone/Email	Contact Name
Caltrans (District 10)	(209) 576-6299	Rohullah Afzal
Union Pacific Railroad	(916) 789-5152 pygbuhay@up.com	Peggy Ygbuhay
Stanislaus County Public Works	(209) 525-4302 leamond@stancounty.com	David Leamon
City of Modesto	(209) 571-5569 wcorreia@modestogov.com	Wendy Correia
Pacific Gas and Energy (PG&E)	(209) 384-4930 RLDf@pge.com	Roger Dial
Kinder Morgan	(714) 560-4604 PayneK@kindermorgan.com PipelineInquiries@KinderMorgan.com	Karly Payne
MID	(209) 526-7433 Celia.Aceves@mid.org	Celia Aceves
MID (Electrical Service)	(209) 526-7425 allen.ayoubkhan@mid.org	Allen Ayoubkhan
TID (Electrical Maps)	adonahue@tid.org	Aaron Donahue
TID (Irrigation Maps)	(209) 883-8367 trtroglin@tid.org	Todd Troglin
TID (Electrical Service)	(209) 883-8390 jstschantz@tid.org	Justin Tschantz
Verizon (MCI)	(972) 729-6322	Dean Boyers
Charter Communications	(209) 633-3311 Abel.Davila@charter.com	Abel Davila
Comcast	(209) 955-6020 kris_cook@cable.comcast.net	Kris Cook
Sprint	kjweger@comcast.net	Ken Weger
AT&T	(559) 454-4697 gr7434@att.com	Geneva McJunkin
Underground Survey Alert (USA)	1-800-227-2600	N/A

5.0 CONDITION ASSESSMENT

A condition assessment was performed on selected segments of the River Trunk, Sutter Trunk and CSL facilities. The field investigation was performed in the Fall of 2014. Findings and recommendations from the Fall 2014 field investigation are presented in Technical Memorandum No. 2 (TM-02) (Appendix C). A summary is provided below.

5.1 River Trunk Facilities

Corrosion is present on the pipeline interior throughout the length of the pipeline. There are isolated sections that have recently failed or are on the verge of failure. A segment of the River Trunk in the Gallo property recently failed and created a sinkhole. Another section is severely corroded, with exposed concrete reinforcement bars in the crown of the pipe that indicate another possible failure. The City has made emergency repairs to the structural failure at the Gallo property. Permanent repairs for that location and the pipeline upstream of the failure are currently in design and expected to be completed in 2015. The River Trunk from the Sutter Plant to the west side of Dry Creek, will need to be rehabilitated (lined) within the next 5 years.

5.2 Sutter Trunk Facilities

The upper reaches of the Sutter Trunk are in good condition. Approximately 85 percent of the entire length of the trunk line has been lined with a plastic liner. Repairs or rehabilitation of the pipeline are not required. However, the lower unlined reach (from Garden to the Sutter Plant) shows signs of heavy corrosion with limited service life remaining. Rehabilitation (lining) will be required for this section. In addition, the brick manholes for the entire length of the Sutter Trunk have not been rehabilitated and will need an epoxy coating.

5.3 CSL Facilities

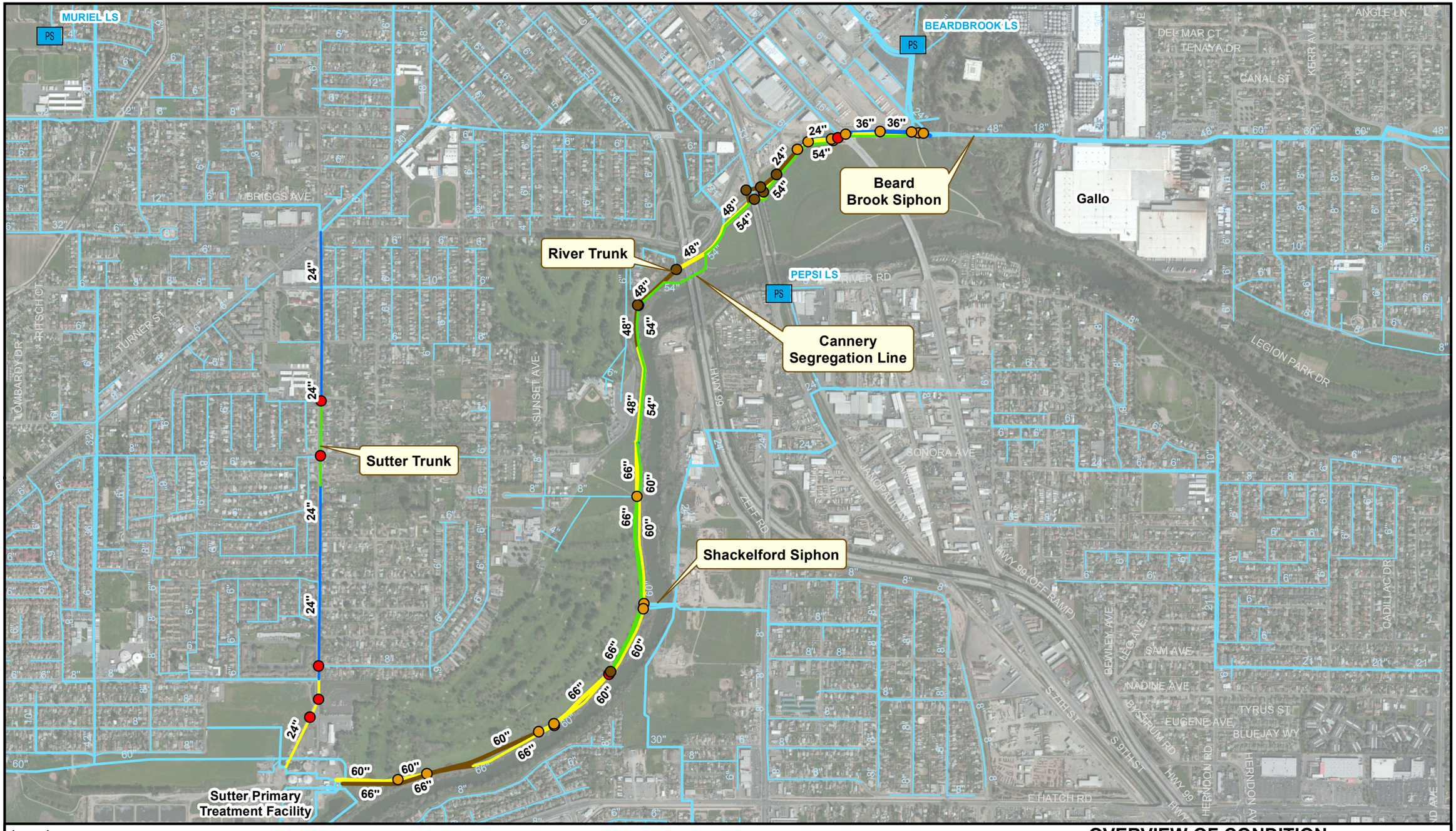
There are signs of slight corrosion throughout the CSL alignment; however, the corrosion is not severe enough to require immediate rehabilitation of the pipeline. The pipeline has heavy sediment in its entire length, and it should be flushed to restore hydraulic capacity. There are segments of pipeline that have lost all soil cover and pipe support due to erosion. Additional inspection is recommended to inspect the pipe support throughout the alignment to assess the cause of these failures and help determine a permanent solution for protecting the pipeline along the river bank. The segments that are already exposed should be repaired using gabion baskets or other erosion control devices. Segments that parallel the river have an extremely high consequence of failure and therefore it is recommended to re-inspect these pipelines every 5 years in order to track the rate of deterioration and detect potential failures before they become catastrophic.

5.4 Recommendations for Improvements

Table 4 presents a summary of the trunk sewer condition assessment findings and recommended improvements. Figure 7 presents an overview of the condition assessment findings.

Table 4 Trunk Sewer Rehabilitation Recommendations
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project
City of Modesto

Pipe Segment/ Manhole	Structural/Maintenance Defects	Recommendation
River Trunk		
Entire length (13,700 feet)	Heavy corrosion	Rehabilitate interior with CIPP lining or coating
Spot location	Broken pipeline	Replace broken section
Manholes	Missing covers and cover bolts, surcharging occurring, subject to flooding	Replace cover bolts, seal covers, various spot repairs
Exposed section along river bank	Vulnerable to being washed out during high river flows	Install river bank armament
Sutter Trunk		
Unlined portion of the trunk sewer (the lower reaches just upstream of the discharge point at the Sutter Plant (1,279 feet)	Significant corrosion, with exposed aggregate and steel reinforcement	Rehabilitate with CIPP liner or coating. This can be achieved after the new River Trunk alignment is completed, which will permit temporary bypassing of the affected section of the Sutter Trunk
Brick manholes	Poor structural condition, subject to ground water intrusion	Line manholes with epoxy coating
Other concrete manholes	Deteriorating concrete and broken frames	Rehabilitate manhole interior, make spot repairs
Can Seg Line		
Entire length (12 miles)	Mild corrosion	Develop cleaning and condition monitoring program
Manholes	Corroded frame missing bolts	Make spot repairs
Exposed section along river bank	Vulnerable to being washed out during high river flows	Install river bank armament
Beard Brook Siphon – River Trunk		
Beard Brook Siphon	Routine grease blockages that increase exposure to overflows, odors	Replace with gravity sewer and new River Trunk Pump Station



Legend

NASSCO PACP PIPE RATING
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5

MANHOLE DEFICIENCIES
- Maintenance
- Inaccessible
- Structural

PS Lift Station

Other Pipelines
- 8" and Smaller
- Greater than 8"
- Not Able to Inspect

0 1,000 2,000 Feet

carollo

OVERVIEW OF CONDITION ASSESSMENT FINDINGS

FIGURE 7

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 07 - Overview of Condition Assessment Findings.mxd

MURIEL LS

BEARDBROOK LS

PEPSI LS

Beard Brook Siphon

Cannery Segregation Line

River Trunk

Sutter Trunk

Shackelford Siphon

Sutter Primary Treatment Facility

Gallo

BRIGGS AVE

TURNER ST

RITSCH CT

LOMBARDY DR

SUNSET AVE

HWY 99

RIVER RD

SONORA AVE

JANOPAUL AVE

JANOPAUL LN

ZEFF RD

DEL MAR CT

TENAYA DR

CANAL ST

SANTA RITA AVE

KERR AVE

ANGLE LN

LEGION PARK DR

HWY 99 (OFF RAMP)

BEWLEY AVE

LEO AVE

SAM AVE

NADINE AVE

EUGENE AVE

TYRUS ST

BLUEJAY WY

BYSTRUM RD

S 7TH ST

S 9TH ST

HERNDON RD

HERNDON AVE

CADILLAC DR

E HATCH RD

Legend

NASSCO PACP PIPE RATING

- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5

MANHOLE DEFICIENCIES

- Maintenance
- Inaccessible
- Structural

PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"
- Not Able to Inspect

0 1,000 2,000 Feet

OVERVIEW OF CONDITION ASSESSMENT FINDINGS

FIGURE 7

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 07 - Overview of Condition Assessment Findings.mxd

It should be noted that there were sections of the River Trunk facilities that were not assessed due to inability to locate the existing manholes or accessibility. An effort should be made to evaluate the condition of manholes and pipelines that were not able to be inspected during the condition assessment effort. Many of these areas were not accessible due to bolted manhole lids or inability to locate the manhole. Coordination with O&M staff will be required to access these areas.

6.0 ALTERNATIVES EVALUATION

The recommended project was selected through a series of workshops conducted with the City. The alternatives evaluation, and the basis for selecting the recommended project, is presented in the Alternatives Evaluation Memorandum (Appendix D).

7.0 RECOMMENDED PROJECT

Alternative 9A, ranking the highest in non-financial components and the lowest cost approach, was selected as the recommended alternative and the basis for final design. Key elements of the recommended project include:

- Rehabilitation of the lower portion of the Sutter Trunk.
- A Sutter Trunk wet weather diversion structure and pipeline.
- Replacement of the Beard Brook Siphon with a new gravity sewer.
- Realignment of the River Trunk Pipeline.
- New River Trunk Pump Station and dual force mains.
- New Shackelford Pump Station and force main.
- New structure and piping to combine the River Trunk and Sutter Trunk at the Sutter Plant.
- New structure to combine the River, Sutter, and West Trunk flows at the Sutter Plant.
- Modifications to Junction Box No. 1 to receive combine trunk flows.
- CSL Diversion Structures to allow operational flexibility.

The recommended project is shown on Figure 8.

7.1 Design Criteria

7.1.1 Projected Flows

Projected flows for the recommended project were developed using the hydraulic model and available information from the current collection system master plan update. Projected flows are provided for existing conditions and future conditions. Projected future flows assume separation of storm and sewer flows has occurred. While future average dry weather flows (ADWF) are shown as increasing, future peak wet weather flows (PWWF)

MURIEL LS

CALIFORNIA LS

BEARDBROOK LS

RIVER TRUNK LS

PEPSI LS

BENSON LS

SHACKELFORD LS

Replace Beard Brook Siphon with Gravity

Reverse Flow to RTPS

Sutter Trunk Wet Weather Diverson

Duel River Trunk Force Main

Collection Line

River Trunk Converts to CSL for Additional Capacity

Collection Line - Reverse Flow for Local Lines

River Trunk/Sutter Trunk Gravity

Rehab Sutter Trunk

Combined Sutter Trunk/River Trunk

Shackleford Force Main

Sutter Primary Treatment Facility

Combined Sutter Trunk/River Trunk/ West Trunk

Gallo

TENAYA DR

CANAL ST

KERR AVE

ANGLE LN

RIVER RD

ZEFF RD

FLORES AVE

MONTAGUE CT

LEGION PARK DR

PICARDY DR

LOMBARDY DR

BEVERLY DR

VERNON AVE

LEON AVE

ROUSE AVE

SUNSET AVE

MANOR DR

W HATCH RD

OLIVERO RD

E HATCH RD

ATLANTIC DR

DOVER AVE

WATSON AVE

PARKLAWN AVE

MIDWAY AVE

MORGAN RD

HWY 99 (ON RAMP)

BYSTRUM RD

LEO AVE

SAM AVE

NADINE AVE

EUGENE AVE

TYRUS ST

JOYCE AVE

S 7TH ST

S 9TH ST

HERNDON AVE

GIDDINGS ST

GRAND VIEW AVE

RICHLAND AVE

PISMO PL

SAUSALITO WY

YELLOW BRICK RD

DARBY LN

PHIL WY

CADILLAC DR

THOMPSON RD

STONUM RD

Legend

Proposed Gravity Main

Proposed Force Main

Other Pipelines

8" and Smaller

Greater than 8"

Proposed Lift Station

Other Lift Stations

N

0 1,000 2,000 Feet

RECOMMENDED PROJECT

FIGURE 8

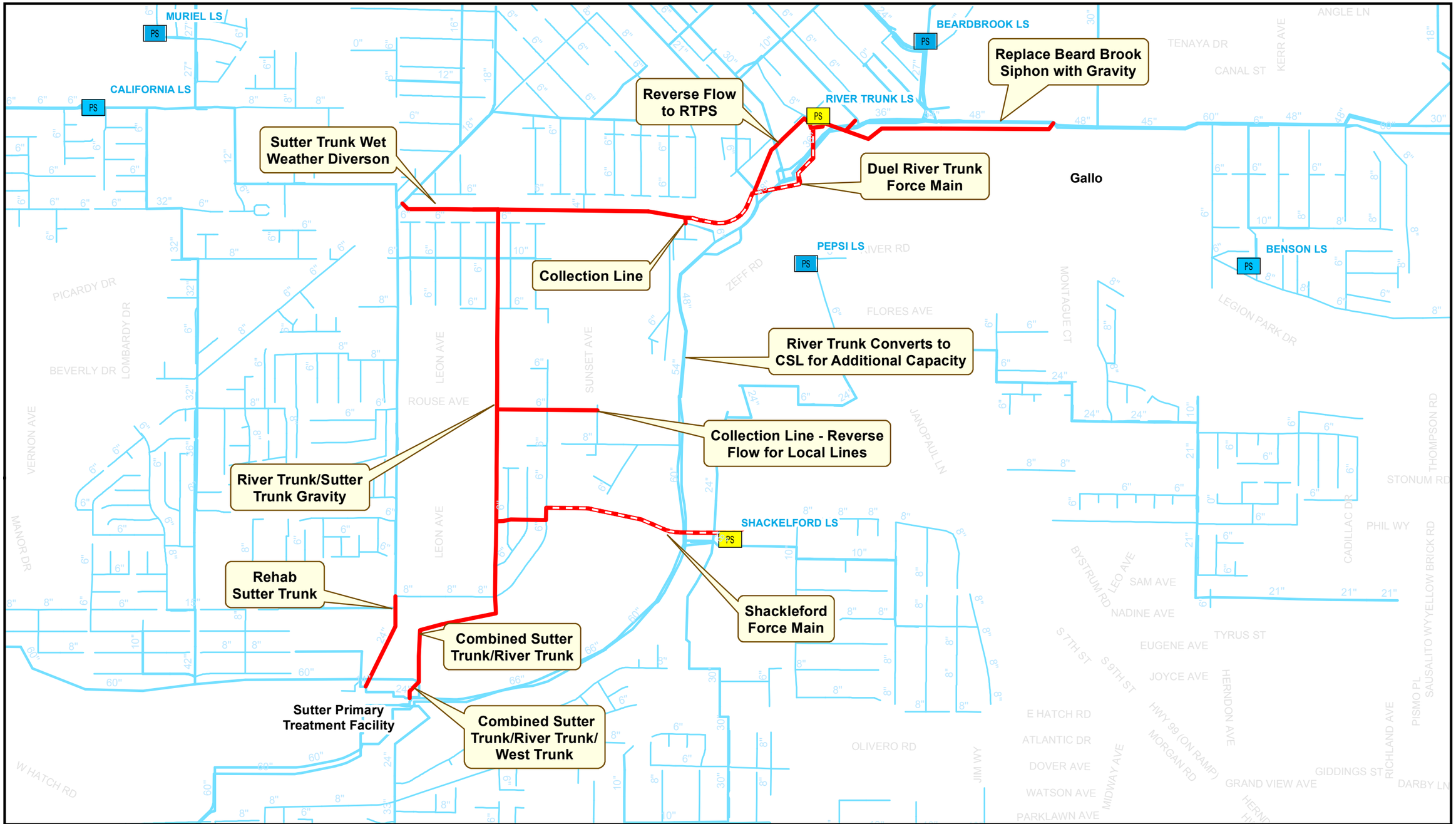
CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

MODESTO CALIFORNIA

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_Edits_4_17_15\Figure 7 - Project Element Map.mxd



Legend

- Proposed Gravity Main
- Proposed Force Main
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- PS Proposed Lift Station
- PS Other Lift Stations

N

0 1,000 2,000 Feet

RECOMMENDED PROJECT

FIGURE 8

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_Edits_4_17_15\Figure 7 - Project Element Map.mxd

are projected to be less than existing PWWF. Because of the uncertainty in the timing of the storm/sewer separation work, this project has been designed to convey the existing PWWF. Design flows for the proposed pipelines are provided are provided in Table 5. Design flows developed for the River Trunk and Shackelford pump stations are provided in Tables 6 and 7.

Table 5 Projected Project Flows
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project
City of Modesto

Location	Existing Conditions Flow (mgd) ADWF[1]	Existing Conditions Flow (mgd) PWWF[2]	Future Conditions Flow (mgd) ADWF	Future Conditions Flow (mgd) PWWF
Diversion Structure – Dry Creek				
48” River Trunk In	8.5	38.4	13.7	31.7
48” River Trunk Out	8.5	38.4	13.7	31.7
Junction Structure – Tuolumne Blvd & Neece Dr				
36” Flow in from Force Main	10.5	32.0	15.7	16.7
42” Flow in from Force Main	0	22.5	0	21.4
6” Flow in from Local Collector	0.02	0.03	0.02	0.03
48” Flow out to Tuolumne	10.5	54.5	15.7	38.1
Junction Structure – Tuolumne Blvd & Colorado Ave				
21” Flow in from Tuolumne (W)	0	2.6	0.0	0.6
48” Flow in from Tuolumne (E)	10.5	55.0	15.7	38.0
54” Flow out to Colorado	10.5	55.9	15.7	38.6
Junction Structure – Paradise Rd & Tuolumne Blvd				
24” Flow in from Paradise	0.69	6.1	0.75	2.7
24” Flow out to Sutter	0.69	3.3	0.75	2.1
21” Flow out to Tuolumne	0	2.8	0.0	0.6
Junction Structure – Colorado Ave & Pelton Ave				
54” Flow in from Colorado	10.5	56.6	15.7	38.6
18” Flow in from Pelton	1.7	3.2	2.2	4.2
60” Flow out to Colorado	12.2	59.9	17.9	42.5
Junction Structure – Colorado Ave & Pelton Ave				
72” Flow in from combined River/Sutter Trunk	13.7	64.3	19.2	45.6
60” Flow in from West Trunk	12.7	30.8	20.4	40.1
84” Flow out to Junction Box No. 1	26.4	93.1	39.6	84.4
Junction Box No. 1				
84” Flow in from combined West/Sutter/River Trunks	26.4	93.1	39.6	84.4
84” Flow out to Headworks	27.9	94.4	42.9	89.0

Notes:
(1) ADWF = Average Dry Weather Flow. ADWF is flow generated by routine water usage and the contribution of dry weather infiltration into the collection system.
(2) PWWF = Peak Wet Weather Flow. PWWF includes storm water inflow, trench infiltration, and ground water infiltration. Peak WWF is based on a 10-year, 24-hr design storm.

Table 6 River Trunk Pump Station Design Flows River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto		
	Existing conditions	Future Conditions
Flow Type	Flow (mgd)	Flow (mgd)
Minimum ADWF(1)	5.53	6.61
Average ADWF	10.5	12.53
Maximum ADWF	14.68	17.58
Minimum PWWF(2)	9.74	9.36
Average PWWF	25.37	21.77
Maximum PWWF	54.47	38.06

Notes:
(1) ADWF = Average Dry Weather Flow. ADWF is flow generated by routine water usage and the contribution of dry weather infiltration into the collection system.
(2) PWWF = Peak Wet Weather Flow. PWWF includes storm water inflow, trench infiltration, and ground water infiltration. Peak WWF is based on a 10-year, 24-hr design storm.

Table 7 Shackelford Pump Station Design Flows River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto		
	Existing conditions	Future Conditions
Flow Type	Flow (mgd)	Flow (mgd)
Minimum ADWF(1)	0.8	1.03
Average ADWF	1.71	2.22
Maximum ADWF	2.66	3.66
Minimum PWWF(2)	0.84	1.07
Average PWWF	1.90	2.42
Maximum PWWF	3.20	4.20

Notes:
(1) ADWF = Average Dry Weather Flow. ADWF is flow generated by routine water usage and the contribution of dry weather infiltration into the collection system.
(2) PWWF = Peak Wet Weather Flow. PWWF includes storm water inflow, trench infiltration, and ground water infiltration. Peak WWF is based on a 10-year, 24-hr design storm.

7.1.2 Gravity Sewer Pipelines

Hydraulic Design Criteria

When designing sewer pipelines it is common practice to adopt different depth criteria for different pipe sizes. This criterion is expressed as a maximum depth of flow to pipe

diameter ratio (d/D). The design d/D ratio typically ranges from 0.5 to 0.92, with the lower values usually used for smaller pipes which may experience flow peaks greater than design flow or may experience blockages from debris, paper or rags. Table 8 outlines the d/D ratios for used for the proposed and existing sewer pipes.

Table 8 d/D Ratios for Design Flow Conditions
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project
City of Modesto

Criteria	Value
Existing Sewers	0.85
Future/Proposed Sewers	0.7

In order to minimize the settlement of sewage solids, the City's design standard requires that sewer velocity be equal to or greater than 2 feet per second (fps) for all sewers when flowing full. At this velocity, the sewer flow will keep solids suspended and "scour" any solids deposition that may occur during low flow periods.

Table 9 lists the recommended minimum slopes for new sewers when the pipe is flowing full and for different d/D ratios.

Pipeline Materials

The existing River Trunk is constructed of unlined reinforced concrete pipe (RCP). City standards identify vitrified clay pipe (VCP) and ductile iron pipe (DIP) as approved materials for gravity sewer applications. VCP is available in diameters ranging from 4 to 42 inches. DIP is available in diameters ranging from 3 to 64 inches. Due to the corrosion potential of ductile iron and the higher cost in comparison to VCP, ductile iron pipe was eliminated from further consideration.

The gravity sewers in this project range from 18 to 84 inches in diameter and will be installed either by open cut, jack and bore, or microtunneling. Recommended materials for each construction method are provided below.

Open Cut. The recommended pipeline material for new gravity pipelines up to 36 inches in diameter installed by open cut, is VCP, in accordance with City standards. For smaller diameter pipe, the City may also want to consider the use of PVC. For new gravity sewers 36-inch larger, lined reinforced concrete pipe (RCP) is common. However, polymer concrete pipe (PCP) and centrifugally cast fiberglass reinforced polymer mortar pipe (CCFRPMP) are both becoming more frequently used for gravity sewer applications. The benefit to these products over lined RCP is that they are inert to most corrosive soils and acids without the need for additional linings or coatings and they are lighter weight than RCP making installation easier. Historically RCP has been more cost effective, but the more frequent use of polymer pipes recently has made the pricing more competitive. For open cut construction of pipelines 36-inch and larger, lined RCP or a polymer pipe (PCP or

CCFRPMP) are recommended. Multiple pipe materials could be included in the specifications to increase competition.

Table 9 Minimum Slopes and Flow Capacities for New Gravity Sewers River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto

Pipe Dia. (inch)	Recommended Minimum Slope[1] (ft/ft)	Existing Sewers Flow Capacity at d/D=0.85[2]		New Sewers Flow Capacity at d/D=0.70[3]	
		(cfs)	(mgd)	(cfs)	(mgd)
8	0.0035[4]	0.74	0.48	0.60	0.39
10	0.0025[4]	1.13	.073	0.92	0.59
12	0.002[4]	1.64	1.06	1.33	0.86
15	0.0012	2.31	1.49	1.87	1.21
18	0.0010	3.42	2.21	2.78	1.80
21	0.0008	4.62	2.98	3.75	2.42
24	0.0007	6.17	3.99	5.01	3.24
27	0.0006	7.82	5.05	6.35	4.10
30	0.0005	9.45	6.11	7.68	4.96
33	0.0005	12.19	7.88	9.90	6.40
36	0.0004	13.75	8.88	11.17	7.22
42	0.0003	17.96	11.61	14.59	9.43
48	0.0003	25.64	16.57	20.83	13.46
54	0.0003	35.10	22.68	28.52	18.43
60	0.0003	46.48	30.04	37.77	24.41
72	0.0003	75.59	48.85	61.41	39.69
84	0.0003	114.02	73.69	92.64	59.87

Notes:
(1) Recommended minimum slope to maintain velocity greater than or equal to 2 ft/sec when pipe is full.
(2) Design flow for existing pipes at a d/D of 0.85 and velocity greater than or equal to 2 ft/sec.
(3) Design flow for new pipes at a d/D of 0.7 and velocity greater than or equal to 2 ft/sec.
(4) City design standards for minimum slopes of sewer lines. Slopes provided only for 8-, 10- and 12-inch pipes.

Jack and Bore. For pipelines to be installed using jack and bore, a steel casing pipe meeting the loading requirement and the requirements of the agency having jurisdiction will be installed and the carrier pipe will be inserted into the casing pipe using casing spacers or skids as necessary to maintain grade. The pipe materials recommended above for open cut construction are also recommended for the carrier pipe in jack and bore installations. The need for cathodic protection of the steel casing will be evaluated after review of the final geotechnical report during final design.

Microtunneling. For pipelines to be installed using microtunneling, a pipe material that can be jacked directly in place must be used. Pipe materials that are compatible with microtunneling include steel pipe, VCP, lined RCP, PCP, and CCFRPMP. However, for microtunneling drives in excess of 1,000 feet, suitable pipeline materials are limited to steel pipe, RCP, and PCP. Steel is not suitable as a carrier pipe for sanitary sewer flows because of corrosion concerns. Therefore, lined RCP or PCP is recommended for microtunneling drives longer than 1,000 feet. For microtunneling drives length is less than 1,000 feet, CCFRPMP could also be considered.

Structures

Manholes or junction structures will be provided at a maximum spacing of 500 feet along gravity pipeline alignments and at all changes in direction to facilitate access and cleaning. Due to constraints on the Gallo property, the Dry Creek crossing will span approximately 1,175 feet with no intermediate manholes.

Cast in place junction structures will generally be used in areas where there are two or more influent pipelines over 24 inches in diameter. Where a custom junction structure is required, a 24-inch diameter standard City manhole cover will be provided for access to the junction structure. The City's standard trunk manhole will be used where there is a single pipe in and out of a manhole, or where the proposed pipeline sizes will allow the use of a standard circular manhole.

When pipes with differing pipe diameters meet at a junction structure or manhole, pipe crowns will be matched to minimize surcharging of upstream pipelines. All structures on trunk lines will be lined with SewperCoat or polyurethane as required by the City Standards.

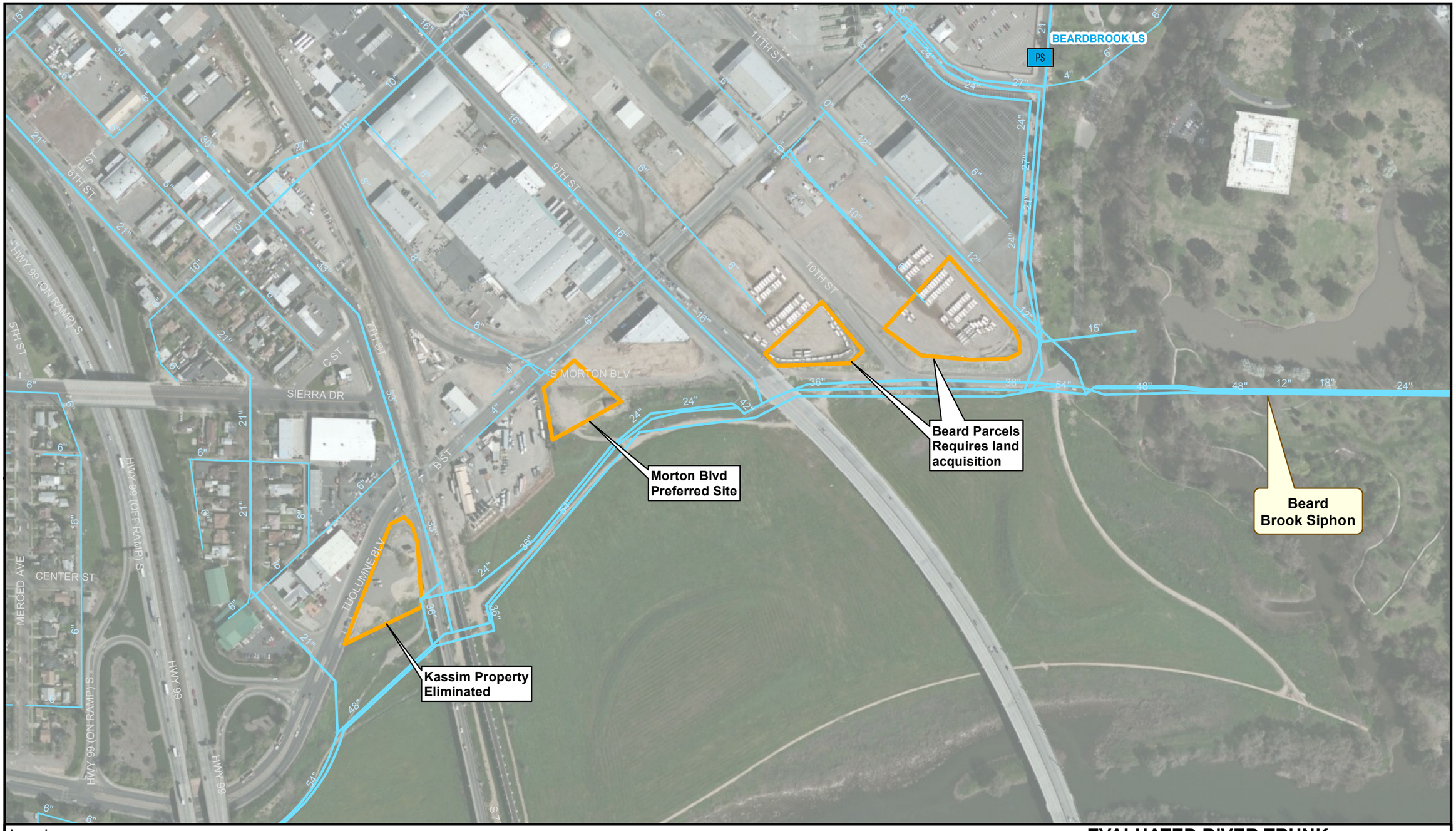
7.1.3 Pump Stations

Design criteria for the pump stations were based on the American National Standard for Rotodynamic Pumps for Pump Intake Design (also known as ANSI/HI 9.8-2012),and the Hydraulic Institute (HI) Standards.

7.1.3.1 River Trunk Pump Station

Description

Four pump station sites were considered for the RTPS. These locations are depicted in Figure 9. The Kassim property is no longer being considered a viable option since there are other planned uses for this property. The remaining three parcels, Beard East, Beard West, and Morton Boulevard are considered viable options. The Morton Boulevard parcel is the preferred site since it is City owned. The 35 percent design drawings were developed for the Morton Boulevard parcel. However, general site plans for the other parcels are also included in the drawings in case the Morton Boulevard site is not available.



Legend

- Evaluated Sites
- PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"

0 500 1,000 Feet

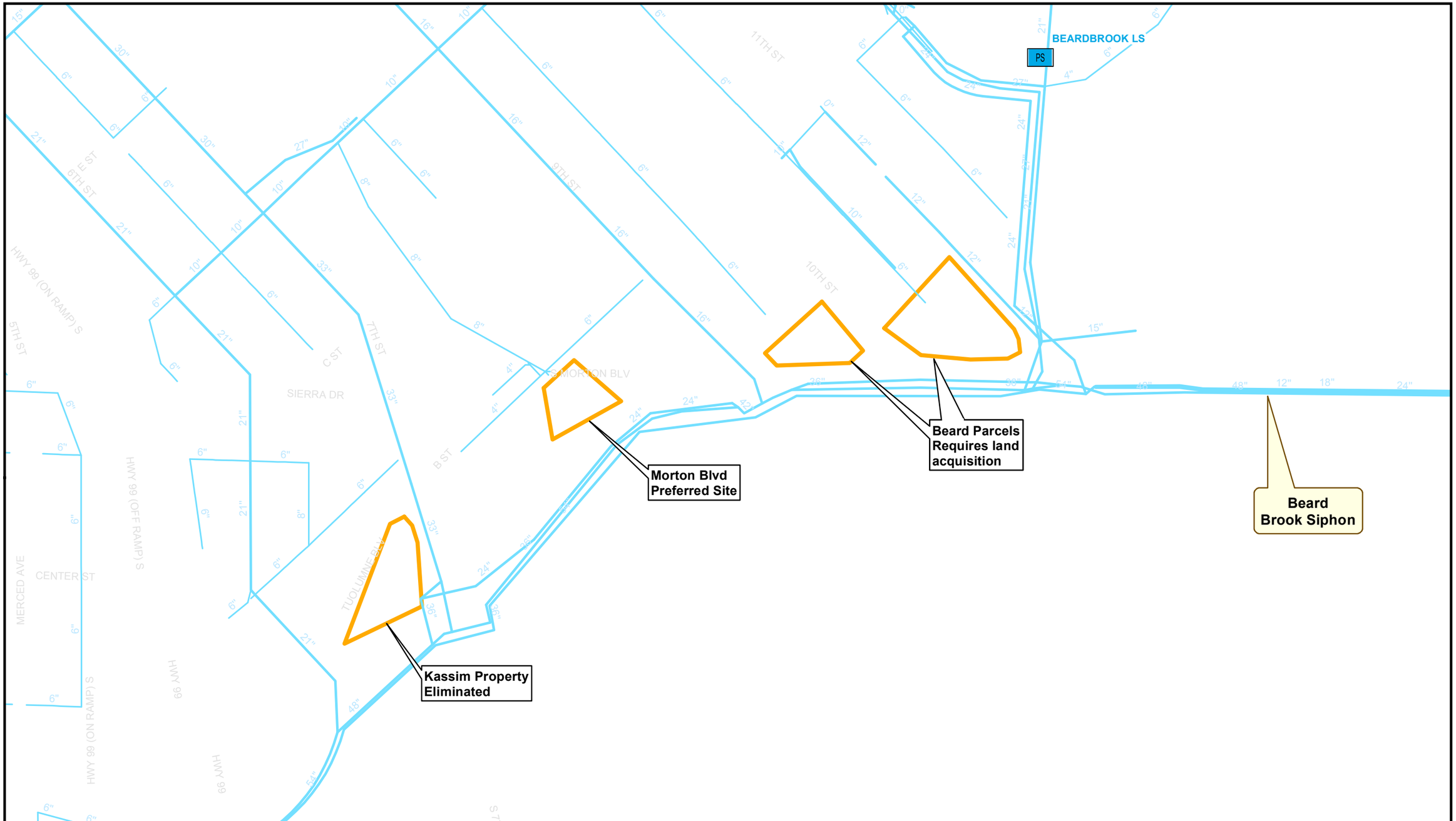
EVALUATED RIVER TRUNK PUMP STATION SITES

FIGURE 9

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 09 - Evaluated River Trunk Pump station Sites.mxd



Legend

- Evaluated Sites
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Other Pipelines

- 8" and Smaller
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0 500 1,000 Feet

EVALUATED RIVER TRUNK PUMP STATION SITES

FIGURE 9

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 09 - Evaluated River Trunk Pump station Sites.mxd

The RTPS was originally designed as a rectangular pump station with a deep self-cleaning trench style wet well as described in the following sections. An alternative design was developed for a circular pump station with a self-cleaning trench style wet well, which includes intermediate floors to improve operations and maintenance access and significantly shortens the required lift to remove the pumps, making the RTPS more in-line with the depths of other City pump stations. With the reduced depth, the use of the City's preferred WEMCO pumps will be re-evaluated during final design. The circular design concept for the RTPS is shown in Figures 10 and 11 on the following pages. The design concept will be developed further during final design.

Wet Well Configuration

Rectangular Pump Station Configuration: The depth of the wet well at the Morton Boulevard site is approximately 74 feet deep measured from finished grade to the bottom of the wet well trench. The depth will vary depending on which site is being considered. These wet well depths lead to many challenges for the construction, operation, and maintenance of the pump station.

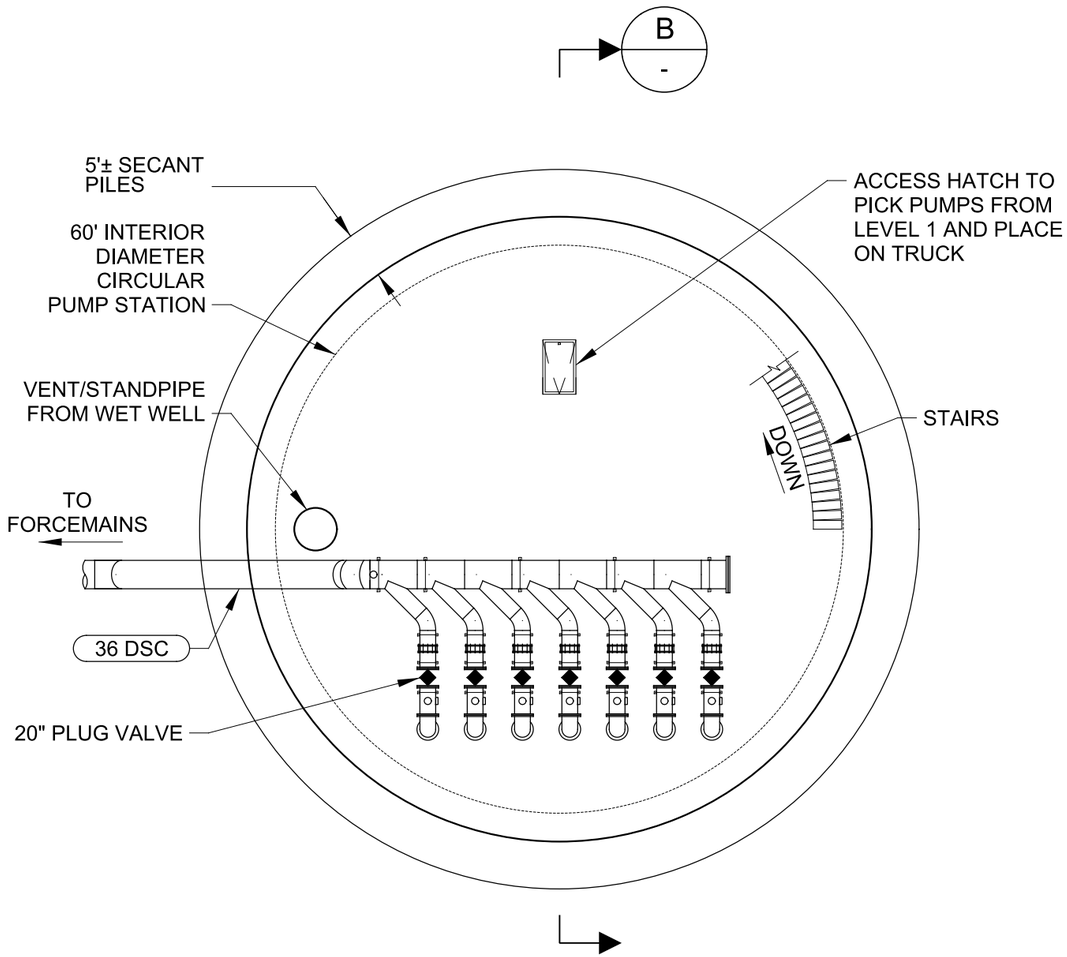
Circular Pump Station Configuration: While the depth of the pump station is still 74 feet deep, the intermediate floors reduce the lift required for the pumps to approximately 29 feet, making the wet well depth more in line with the wet wells in existing City pump stations.

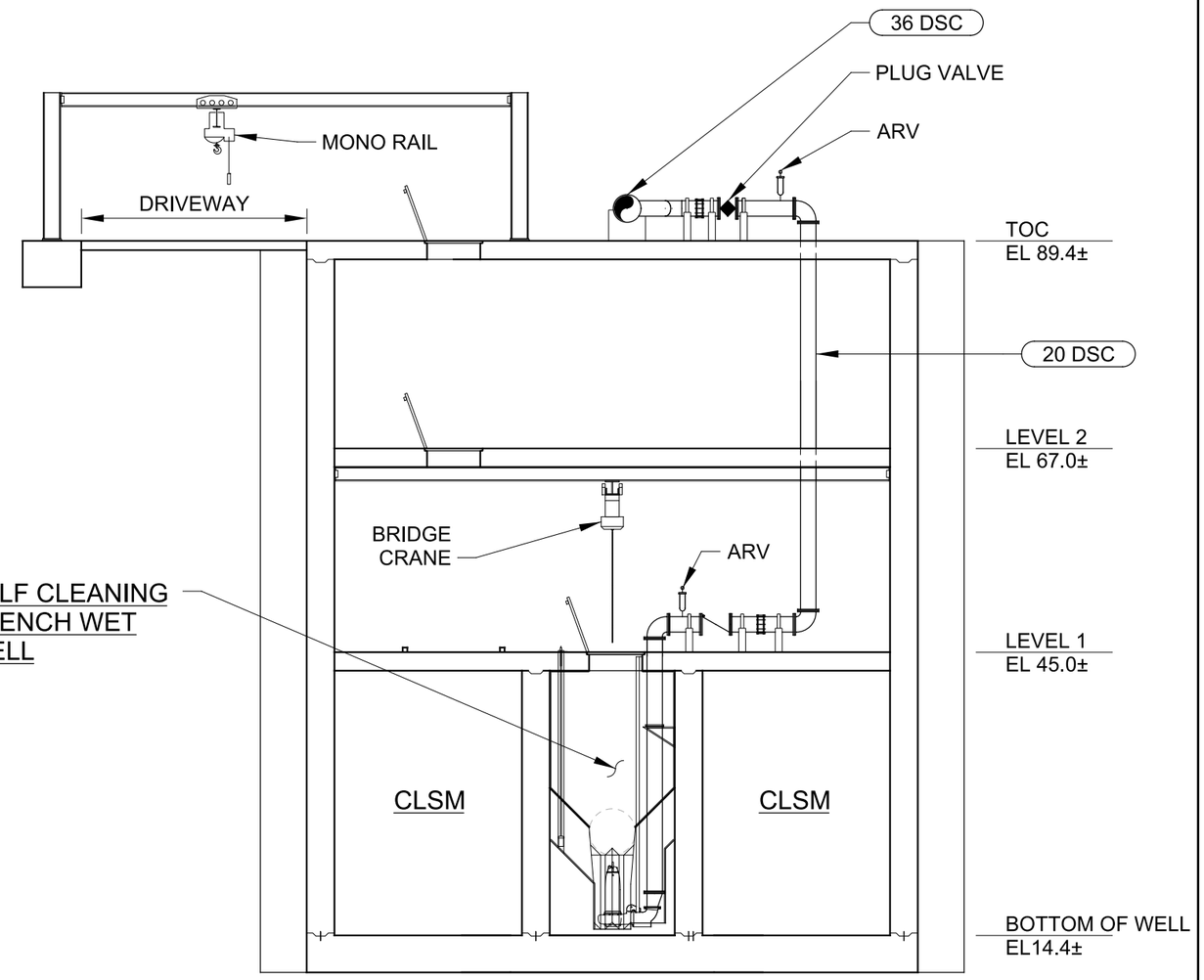
The wet well walls will be lined with "T-lock" PVC lining or an elastomeric polyurethane coating to prevent concrete corrosion. Sloped fillets will be constructed at the top of the wet well trench to prevent collection of solids between the trench and wet well walls.

Two wet well configurations were examined for the RTPS including circular wet wells and self-cleaning trench wet wells. A comparison of the two configurations is presented in Table 10:

Table 10 River Trunk Pump Station Wet Well Configuration Comparison
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project
City of Modesto

Circular Wet Well		Trench Type Self-Cleaning Wet Well	
Advantage	**Disadvantage**	**Advantage**	**Disadvantage**
• Lower cost • Easier construction	• HI requires a physical model study for four or more pumps • Difficult to clean	• Self-cleaning • Endorsed by HI for multiple pumps • Linear construction allows overhead crane to assist in pump retrieval	• Higher construction cost





A TOP PLAN

SCALE: 1/16" = 1'-0"
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B - SECTION

SCALE: 1/16" = 1'-0"
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Figure No. 10

RTPS SECANT PILE DESIGN CONCEPT TOP PLAN & SECTION

CITY OF MODESTO

carollo

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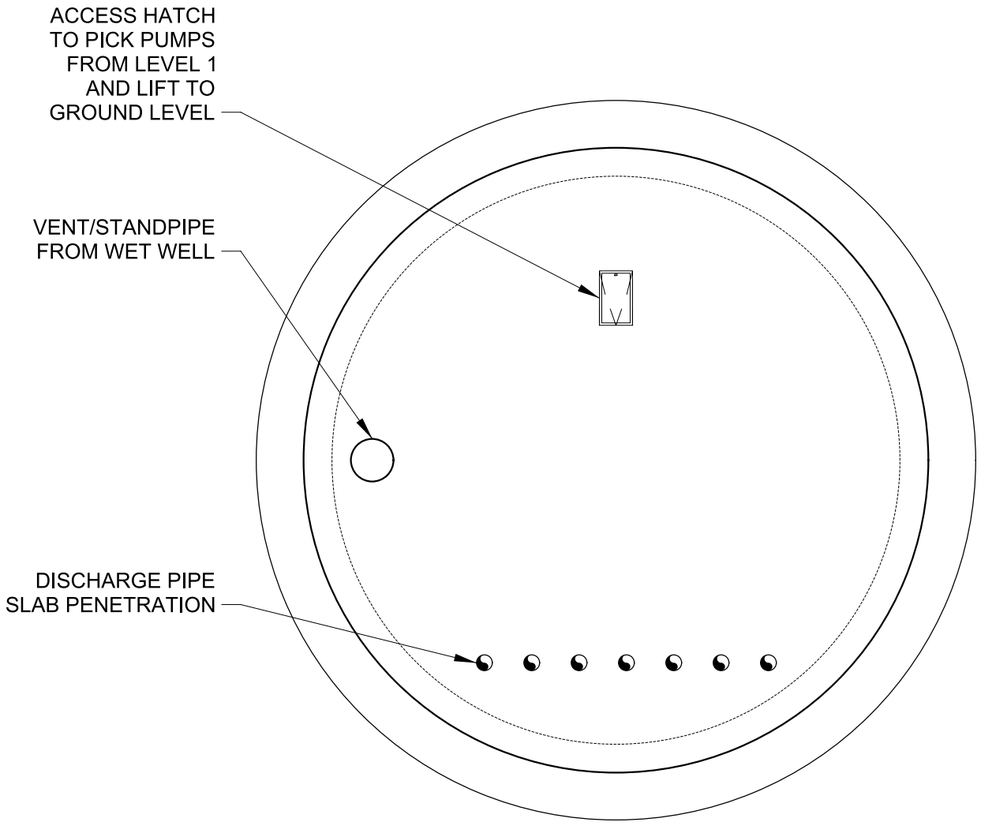

C - **PLAN - LEVEL 2**

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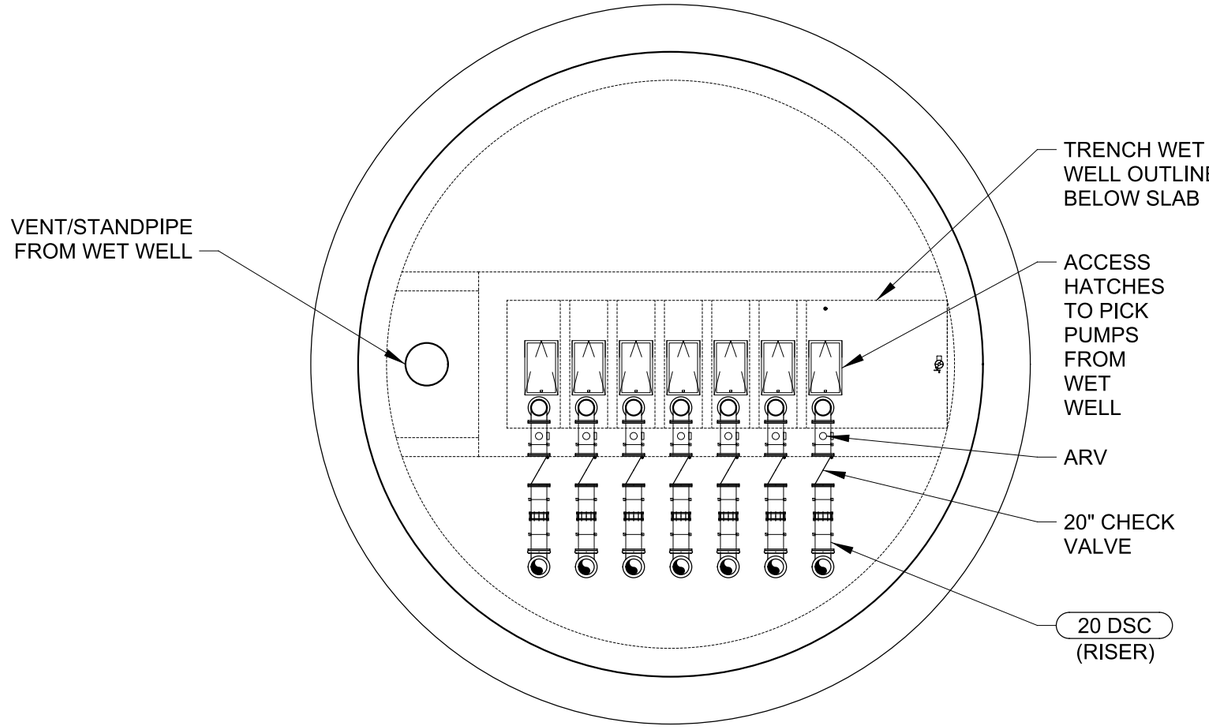

D - **PLAN - LEVEL 1**

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Figure No. 11

RTPS CIRCULAR DESIGN CONCEPT LEVEL 1 AND LEVEL 2 PLANS

CITY OF MODESTO

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According to the Hydraulic Institute, circular wet wells may offer a more compact design and lower construction costs since the use of the caisson construction technique may be employed. However, the Hydraulic Institute also requires a physical model study for circular wet wells with four or more pumps because complex flow patterns may occur. The depth of a wet well also limits the ability for cleaning using a vactor truck, which typically cannot be used at depths greater than 30 feet.

As indicated in Table 10, trench type self-cleaning wet wells do not require a physical model study for pump stations with more than four pumps; however, performing a physical model study is recommended for a pump station of this importance and size. Self-cleaning trench style pump stations also provide the ability to scour settled solids and scum that floats on the water surface in the wet well. Cleaning cycles should be performed when the inflow is about half the capacity of the last pump. As the water level is drawn down by the pumps, the liquid flowing down the ramp reaches supercritical velocity and forms a hydraulic jump. The supercritical flow and hydraulic jump will move from the bottom of the ramp to the last pump taking all solids with it as it progresses. Ideally, the hydraulic jump should move from the toe of the ramp to the last pump in no more than 30 seconds, because operation at low intake submergence is severe for the pump. If the inflow is insufficient for cleaning, enough liquid to complete the cleaning cycle can be stored in the upstream conduits by stopping the pumps for a short time or by using an influent gate to throttle flows. If the inflow is too high, two pumps can be operated to produce enough turbulence to clean the trench. As the hydraulic jump passes under each pump intake, the pump loses prime and should be stopped.

Another advantage of the linear construction of a trench type wet well is that it allows a monorail type crane to assist in the retrieval of the pumps. The pump station configuration allows access for a boom truck to be adjacent to either side of the pump station for pump and valve maintenance.

Pump Sizing/Selection

Wet well design criteria are presented in Table 11. These criteria assume the pumps will operate with variable frequency drives to maintain the water surface elevation inside the wet well at the crown of the influent pipe.

The following pump manufacturers will be evaluated for the RTPS: Xylem/Flygt (Flygt), KSB, Wemco, and ABS. The City's preference is to use Wemco.

Preliminary pump curves and system head curves are presented in Figure 12.

Pump Accessories

Rectangular Pump Station Configuration: Because there are no intermediate floors with the rectangular pump station options, a deep lift system is required. Both Flygt and KSB have

Table 11 River Trunk Pump Station Wet Well Design Criteria River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto		
Items	**Rectangular Pump Station Configuration**	**Circular Pump Station Configuration**
Pump Station Depth	73.4 feet(1)	73.4 feet (1)
Wet Well Inside Dimension	46'-6" x 13'-6"	46'-6" x 13'-6"
Wet Well Total Depth	73.4 feet(1)	~29 feet(1,2)
Pump Operating Depth	13 feet	13 feet
Storage Depth	None	None
Overflow Elevation	57.7	57.7
Wet Well Storage Volume	None	None

Notes:
(1) Total depth is dependent on the selected pump station site. This depth is representative of the Morton Boulevard site.
(2) Wet well depth will be refined during final design.

special lifting accessories that can be used to retrieve pumps from deep wet wells. Carollo contacted a local sanitary sewer agency, the Sacramento Area Sewer District (SASD), to discuss using the Flygt Deep Lift mechanism to retrieve pumps from deep wet wells. SASD indicated that the device worked well even when the pump replacement or retrieval was performed when the pumps were submerged. It was recommended that an overhead crane be used to assist in the pump retrieval. The preliminary plans for the RTPS include a monorail with a crane that will assist in lifting the pumps. (See Table 12).

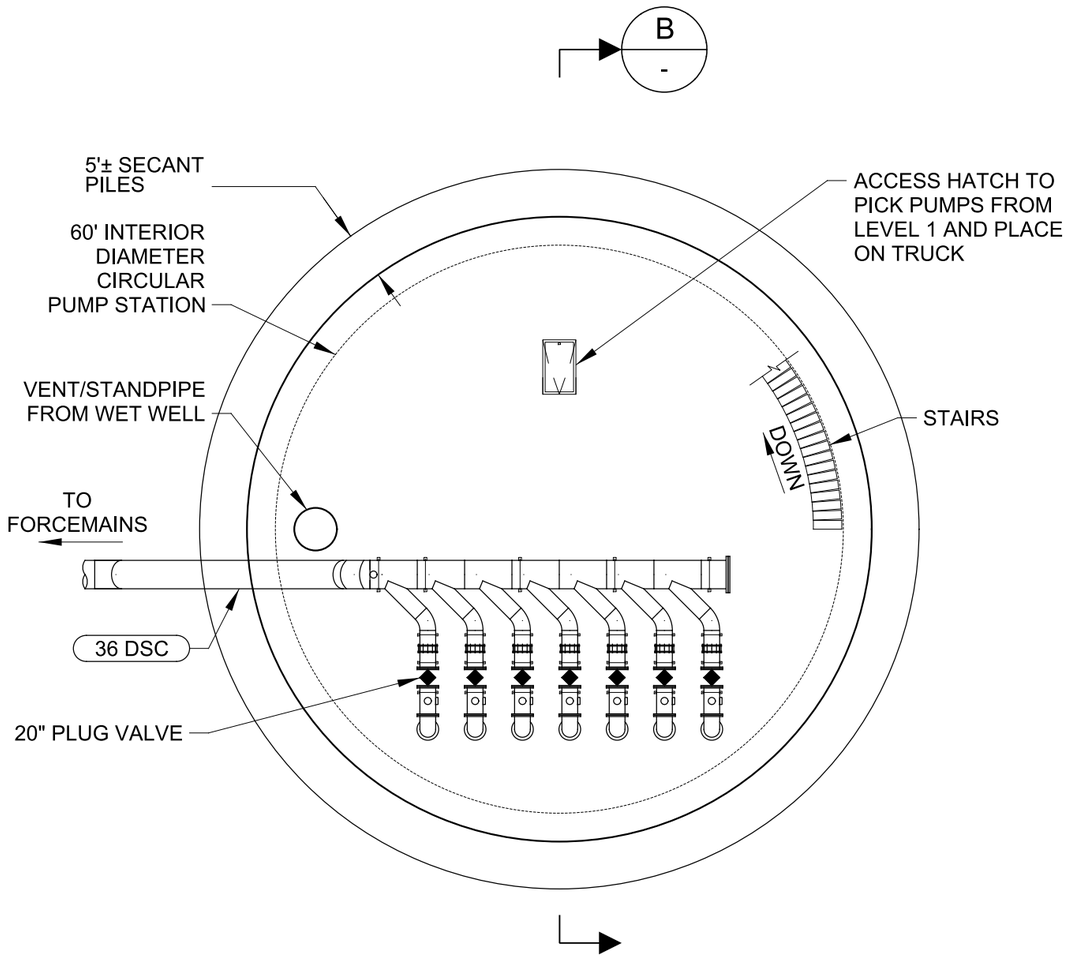
Circular Pump Station Configuration: Because of the intermediate floor, the required pump lift will only be approximately 29 feet and will not require a deep lift system. Standard lift systems similar to those the City is already familiar with can be used to retrieve the pumps from the wet well.

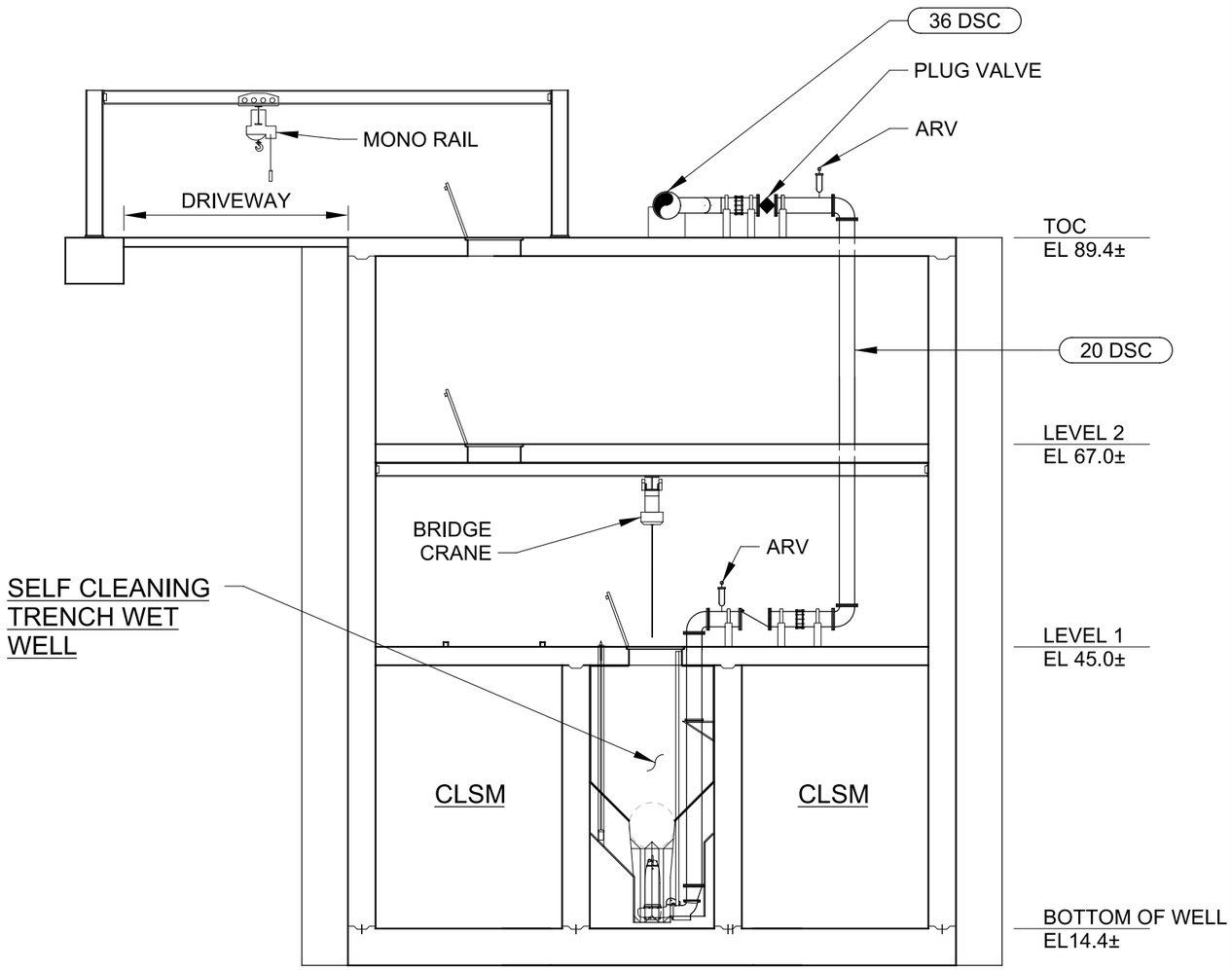
Electrical Requirements

The electrical systems for this project will be designed for general compliance with National Electrical Manufacturers Association (NEMA), American National Standards Institution (ANSI), Institute of Electrical and Electronics Engineers (IEEE), and Underwriters Laboratory, Inc. (UL) standards.

The following codes and standards are provided as design references:

- NFPA 70 - National Electric Code
- NFPA 101 - Life Safety Code
- NFPA 110 - Emergency and Standby Power Systems
- NFPA 820 - Fire Protection in Wastewater Treatment and Collection Facilities





A TOP PLAN

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B / - SECTION

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Figure No. 10

RTPS CIRCULAR DESIGN CONCEPT TOP PLAN & SECTION

CITY OF MODESTO

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Table 12 River Trunk Pump Station - Pump Design Criteria River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto		
Items	**Rectangular Pump Station**	**Circular Pump Station**
Configuration	6 duty + 1 standby	6 duty + 1 standby
Mode of Operation	Variable Frequency Drive	Variable Frequency Drive
Pump Type	Submersible (non-clog)	Hydrostal Immersible
Pump Manufacturer/Model	Flygt NP 3312/736 or KSB KRT K 350-630/1858XNG-S	WEMCO I10K-S
Pump Capacity (each)	9.08 mgd (6306 gpm)	9.08 mgd (6306 gpm)
Pump Efficiency At RDP(1)	Flygt = 80%, KSB = 74%	81%
Motor Horse Power(2)	Flygt = 215 hp, KSB = 250 hp	250 hp
Motor RPM	Flygt = 1190 rpm, KSB = 875 rpm	1100 rpm
Bell Diameter	20 inches	20 inches

Notes:
(1) RDP = Rated Design Point
(2) Motor horsepower non-overloading at any point on pump curve

Utility Power

Site shall receive power from Modesto Irrigation District. Utilization voltage of the site will be 480-volt, 3-phase, 3-wire. New switchboard will be installed to supply power to all site loads. The total anticipated load for the site is approximately 2410 kVA or 2899 A at 480-volt, 3 phase.

Standby Power

A new pad-mounted diesel generator unit will be installed outside the Electrical Room to provide standby power for the site. The generator will be sized to handle the major loads required for the site's operation. Preliminary sizing indicates that a 2200-kW generator will be required. An automatic transfer switchboard will be provided to automatically start and run the generator upon loss of utility power.

Power/Control Enclosure

A new electrical room will house the new electrical equipment including switchboard, Variable Frequency Drives (VFDs), lighting panel, and motor starters. The building will be conditioned with air conditioners to for temperature dependent electronic equipment. All floor-mounted equipment mounted inside the electrical room will be installed on 3-inch high housekeeping pads.

Electrical Criteria for Submersible Pumps

Table 13 provides a summary of the electrical criteria relating to the submersible pumps.

Table 13 River Trunk Pump Station - Electrical Criteria for Submersible Pumps
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project
City of Modesto

Description	Criteria
Service Standby Power	Duty(6)+Standby(1) Generator
Drive Type	Variable Frequency Drive
Starter Location	Electrical Building
Motor Horsepower (Hp)	300
Motor Voltage/Phase	480/3
Motor RPM	1800
Motor Service Factor	1.0
Motor Environment	TENV

Lighting Panel

A new lighting panel shall be provided in electrical area. Lighting panel shall be powered from the switchboard through a 30-kVA lighting transformer with secondary voltage of 120/208-volt, 3 phase, 4-wire.

Process Control and Instrumentation Design

Pump Station Control

The pumps will run on VFD that will adjust the speeds of the pumps to maintain a set water level inside the pump station. The water level set point will be set such that the influent velocity does not exceed 4 fps and the velocity above the wet well trench does not exceed 1 fps. The City's preferred VFD manufacturer is ABB.

Wet Well Level Monitoring

Two submersible level transducers will be used to measure the water level in the wet well. The primary level transducer will be placed near the influent pipe and will extend to the invert of the influent pipe. The redundant and secondary level transducer will be placed at the end of the trench. It will extend the full depth of the trench so that level can be measured during cleaning cycles. The City's preferred level system manufacturer is Miltronics.

A high level float will serve as a redundant level monitoring system and will be used for a high water alarm.

Flow Metering

Mag meters will be used to measure flow. Table 14 identifies the diameter, minimum and maximum flows and velocities through the magnetic flow meters for the large and small River Trunk force mains. Krohne and ABB are the City's preferred meter manufacturers. The required flow meter size may not be available by all manufacturers. Final sizing and flow meter manufacturer selection should be confirmed during final design.

Table 14 Magnetic Flow Meter Sizing – River Trunk
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project
City of Modesto

Force Main	Flow Meter Size[1]	Minimum Flow[2]	Maximum Flow	Minimum Velocity	Maximum Velocity
Large River Trunk Force Main	30-inch diameter	6.5 mgd	38.2 mgd	2.05 fps	12.04 fps
Small River Trunk Force Main	20-inch diameter	2.8 mgd	17.6 mgd	1.99 fps	12.5 fps

UPS

Control panels will be equipped with a UPS to provide battery backup power in the event of a power outage.

PLC

Allen-Bradley ControLogix PLCs will be located in each control panel to match City standards. Each control panel will be equipped with an operator interface for local monitoring and control. Operations staff will have control capabilities from each equipment location and remotely via SCADA. Vendors shall supply the instrumentation, PLCs and programming to match City standards. The Integrator will use the P&ID drawings and Control Strategies as the basis for programming the PLC.

P&ID drawings will be developed to show process flow and instrumentation/equipment used at the River Trunk Pump Station. Each process area will show field equipment and instrumentation, power sources for each device and PLC and SCADA level attributes associated with status, alarms, trending and functional description. A control strategy will be provided for each process.

SCADA

Available remote communications systems are described below:

Licensed radio system: Licensed radio systems require an antenna at each pump station to communicate with the central command room. This is more powerful than an unlicensed system and has some capability to pass signals through buildings, but an evaluation would

need to be performed to see if this is viable for each site. Since the City has an existing licensed radio system, it may be possible to expand that system for the new pump stations.

Unlicensed radio system: This system requires line of sight between the transmitter and receiver and would require an evaluation similar to the licensed system. Buildings could interfere with the signals if they conflict with line of sight.

Fiber: This would require a dedicated line from the pump stations to the command room. For instance, if the pump stations were to be monitored at the Sutter Treatment Facility, then a fiber line could be installed in the sewer and force main trenches back to the pump station.

Cellular modem: This is a newer technology and is similar to linking a cell phone to a computer for the data connection.

The City has expressed a desire to expand their current licensed radio system to include the River Trunk Pump Station with a second preferred option being cellular modem. It is recommended that two communications systems are implemented into the final design of the pump station to provide redundancy.

Structural Design

The structures will be designed in accordance with the California Building Code (CBC) 2013.

The walls and base slab of the River Trunk Pump Station were designed using an equivalent at-rest lateral earth pressure of 56 pounds per square foot per foot (psf/ft). A surcharge load of 100 psf was added for the top 15 feet of the structure. The groundwater elevation was assumed to be at elevation 40 feet. A seismic soil pressure of 6H (6 time the height of the wall applied as a rectangular load) was also incorporated into the preliminary structural design. The top slab of the pump station was not designed for traffic loading. If traffic loading on top of the wet well is desired, this change would not affect the preliminary sizing of the wall thicknesses.

The design criteria for the River Trunk Pump Station were also used to preliminarily size the walls of the buried diversion structures and Shackelford Pump Station.

HVAC Design

Temperature control will be required for Electrical Building of the River Trunk Pump Station to prevent the VFDs from operating at elevated temperatures that are detrimental to the anticipated service life. The VFDs themselves will have a temperature range of 32-104 degree Fahrenheit, but to keep the room reasonably comfortable, electrical rooms are commonly be kept between 60 and 90 degrees Fahrenheit.

Since the Shackelford Pump Station will operate with constant speed pumps, HVAC for the Shackelford Pump Station Electrical Building is not anticipated.

Pump Station Civil and Site Design

Location

Four pump station sites have been considered for the RTPS. Three locations are still considered viable: Beard East, Beard West, and Morton Boulevard. The City currently owns the Morton Boulevard site; however, the Beard East or Beard West parcels would need to be procured if these sites are used. These locations are depicted in Figure 9.

Layout

Each pump station site has a similar layout concept with a circular access road around the perimeter of the pump station and electrical building structures. Ancillary aboveground facilities such as the surge tank, generator, fuel tank, and biofilters are located outside of the circular access road. Belowground ancillary facilities such as the force main isolation valve vault and flow meters vault may be located within or outside of the access road.

A minimum 15-foot separation between the electrical building and pump station structure is maintained at each site to avoid differential settlement complications that may occur from constructing the electrical building on the pump station structural backfill. A minimum straight pipe run of eight pipe diameters is required upstream of the wet well per HI requirements.

Access

Access to the Morton Boulevard site will be will be located near the intersection of B Street and Beard Street. Two entry gates are required to allow drive-in / drive-out access to the pump station site without requiring a driver to backup or make multiple turn maneuvers. The orientation of the gates will allow left or right turns into the pump station site off of B Street by a California Legal Design Vehicle, which is a semi-tractor with a single trailer and a total length of 65 feet. The entry gates will be set far enough away from B Street to allow a design vehicle to wait on the road shoulder for the gate to open without backing up traffic.

The circular orientation of the access road allows truck access to all facilities, including the fuel tank, without having to backup or turn around within the pump station site. Additionally, no facilities are located along the long side of the wet well, which allows maintenance vehicles to park adjacent to the wet well.

Access to the Beard East and Beard West parcels require access road easements to enter from or exit onto 10th Street. Entry gates will isolate the pump station sites from the current landowners. A circular access road, similar to the Morton Boulevard site, will provide access to all of the facilities at each site without requiring backing up or multiple-turn driving maneuvers.

Paving and Drainage

The access road to the pump station site will be paved; crushed rock is anticipated to cover all other graded areas. Stormwater runoff at the pump station site will be collected and routed to the wet well influent pipe manhole that is located eight pipe diameters upstream of the wet well.

Cleaning / Wash Down Facilities

Cleaning and wash down facilities will be provided at the pump station. A concrete pad sloping to a drain will allow any sewage washed off of removed equipment to be drained back to the manhole upstream of the pump station. A washdown hose bib and hose will be located next to the concrete pad.

Landscaping

Landscaping consisting of low-lying shrubs and small trees may be provided in the non-paved areas on the public side of the pump station site. No landscaping is anticipated within the security fence of the pump station site.

Security

The City of Modesto has indicated a preference for decorative rail fence for fencing around the site. Site lighting will be provided to illuminate the wet well and generator locations.

Odor Control

Due to the close proximity to the planned Parks and Recreation Gateway Park improvements, odor control facilities are anticipated for the River Trunk Pump Station. The odor control system will be designed for 6 wet well volume air changes per hour, which equates to 5500 standard cubic feet per minute. The anticipated odor control facilities will include duplex blowers and a single biofilter. A connection for a portable biofilter unit will be provided on the blower discharge header such that the odor control facilities remain operational when the biofilter media from the permanent biofilter is replaced.

Valve Pad

A valve pad is located adjacent to the pump station wet well. The discharge piping will be located with a centerline elevation 3.5 feet above the top of the slab for ease of maintenance. A check valve, plug valve, and dismantling joint for each discharge pipe will be located above the pad. Each discharge pipe will be fitted with an air release valve that will control the fill rate of the vertical discharge piping. A combination air release / vacuum valve for sewer service will be located on the common header.

Valve Vault

A valve vault will be located upstream of the flow meter and will house three motorized plug valves. Two of the motorized plug valves will be used to isolate either of the River Trunk force mains and may be operated remotely. The third motorized plug valve will be a normally closed intertie valve and will also serve as a redundant valve if one force main is online and the valve for the second force main fails to open when called. A drain line will be added to the force mains at this location to dewater the piping between the motorized plug valves and the static loop downstream of the flow meters. Dewatering this section of piping allows the flow meters to be removed for maintenance or replaced without spilling sewage.

Flow Meter Vault

Flow will be metered for each force main. Since the pumps will be operated on VFDs to maintain a constant level, the total flow out of the pump station also indicates what the flow into the pump station is. The total flow will be the summation of the flow meter readings for each force main.

The flow meter vaults will be precast or cast-in-place concrete vaults located at the pump station site. The flow meters will be located such that straight runs of pipe are provided a minimum of five times the force main diameter upstream of the vault and three times the force main diameter downstream of the vault. Drains for the flow meter vaults will drain back to the pump station wet well.

Force Main Cleaning

Pig launching stations were initially considered at the pump station sites but are not shown on the preliminary drawings due to site constraints for both the launching station and pig retrieval. The pump station sites were designed to be compact and allow for vehicular access to all parts of the pump station. Adding aboveground pig launchers would conflict with the vehicular access unless an expanded site plan is considered.

Velocities in the force mains are identified in Section 5.1.2. Velocities above 4 fps are maintained through both force mains at least once a day. Since the force main velocities will be scoured at least once a day Carollo recommends not expanding the pump station site to accommodate a pig launching station.

Emergency Bypass

A passive overflow will be incorporated into the River Trunk Pump Station design that will allow sewage to bypass the pump station and flow to the existing River Trunk gravity sewer in the event that the pump station is not operational. This overflow will be located upstream of the River Trunk Pump Station.

7.1.3.2 Shackelford Pump System Design

The Shackelford Pump Station (SPS) will pump wastewater flows under the Tuolumne River and discharge into the new River Trunk alignment along Colorado Avenue. The pump station will connect to the recently installed dual siphons crossing under the river to utilize an existing City asset and avoid another river crossing. New piping will be installed to convey flows from the existing siphon to the new River Trunk gravity sewer. The Shackelford conveyance system will consist of a force main, including the existing river crossing, which discharges into a gravity sewer near the intersection of Roselawn Avenue and Pelton Avenue.

Wet Well Configuration

The wet well will be rectangular and approximately 24 feet deep measured from the finished grade to the bottom on the wet well. Three wet well configurations including circular, trench and rectangular were considered for the SPS. A circular wet well was ruled out due to layout difficulties with three pumps and a trench wet well was ruled out due to size and difficulty of construction when compared to a rectangular wet well. The rectangular pre-rotation style wet well is shown in the preliminary design drawings. Discussions with the City of Modesto indicated that the City has a preference for constant speed screw centrifugal submersible pumps with pre-rotation basins.

The pump station will operate with two duty pumps and one standby pump. The peak flows for the SPS will contribute approximately 8 percent of total flow in the River Trunk. Thus, it is not vital for the pumps to provide a varying supply of flow by the use of a VFD. Constant speed pumps were deemed appropriate for the SPS and when paired with the pre-rotation pumping scheme the system becomes self-cleaning.

Careful consideration to the number of starts an hour must be made when using constant speed pumps. An unnecessarily high number of starts and stops an hour can lead to excessive wear and damage of the pump. Use of the pre-rotation system helps with this problem. As the pumps draw down the water level, the geometry of the fabricated pre-rotation basin causes the water to rotate. The rotation of the water entering the pump causes the flow rate to drop. This drop in flow rate of the pumps continues as the water gets lower in the wet well until the pumps shut off at a predetermined wet well height.

Sizing

Pump station sizing was done in accordance with ANSI/HI 9.8 – 2012, Appendix B – Sump Volume. The appendix contains a guideline to sizing wet wells when using constant speed pumps. As mentioned previously, when using constant speed pumps a major concern is restricting the pumps to a certain number of cycles per hour. Setting a maximum of six starts per hour and taking into account the capacity of each pump a wet well size was determined. (See Table 15.)

Table 15 Shackelford Pump Station Wet Well Design Criteria River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto	
Items	**Description**
Wet Well Inside Dimensions	10’-0” x 12’-0”
Wet Well Total Depth	22’-8”
Pump Operating Depth	3’-0”
Storage Depth	None
Wet Well Storage Volume	None

Pump Selection

Figure 13 presents the system head curve and selected pump curve.

Valve Vault

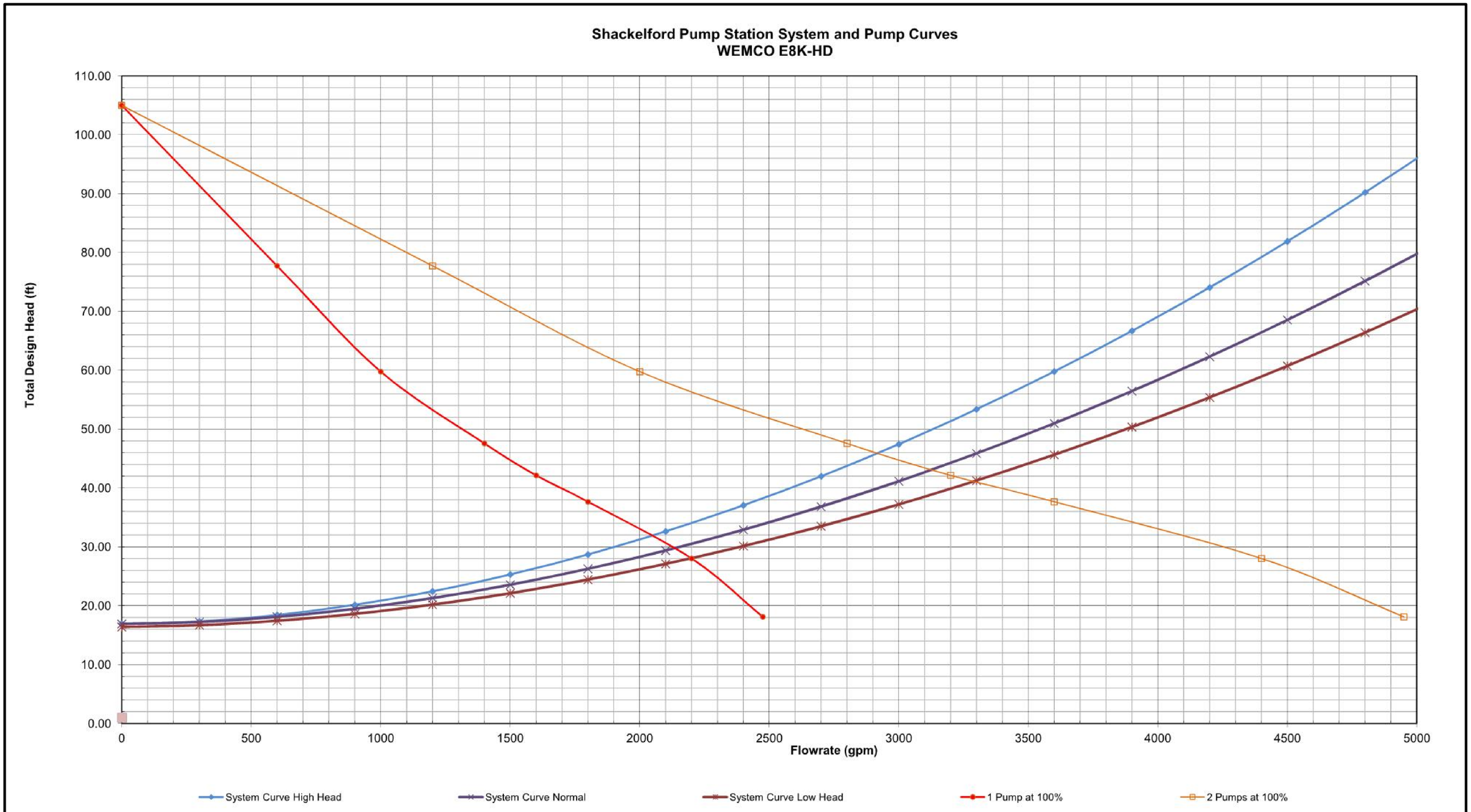
The SPS valve vault will be located northeast of the wet well at a depth of 7.5 feet. The valve vault will house a swing check valve, plug valve, pressure gauge, and a dismantling joint for each of the three discharge pipes. Access to the vault will be provided by two 6’-0” x 4’-6” spring assisted hatches. Ladders at each hatch will be installed to provide easy access during maintenance.

Flow Meter Vault

All flows for the SPS will be measured at the flow meter vault located downstream of the valve vault. The flow meter vault will be either precast of cast-in-place concrete. The flow meters will be positioned so there is a minimum of five pipe diameters of straight pipe upstream and a minimum of three pipe diameters of straight pipe downstream from the meter. City staff has indicated a preference for Kronhe or ABB magnetic flow meters.

Force Main Cleaning

A pig launcher is not necessary for the SPS. The SPS uses two duty constant speed pumps; therefore, the velocity in the force mains will be either one of two values when the pumps are running. The lowest velocity occurs when one pump is running and will be approximately 2.6 fps. Since there will be periods of no flow when the pumps turn off, solids and grit will need to be resuspended. With two pumps running, the velocity will be approximately 6 fps, which is sufficient to maintain the force main.



SHACKELFORD PUMP STATION PRELIMINARY PUMP AND SYSTEM HEAD CURVES

FIGURE 13

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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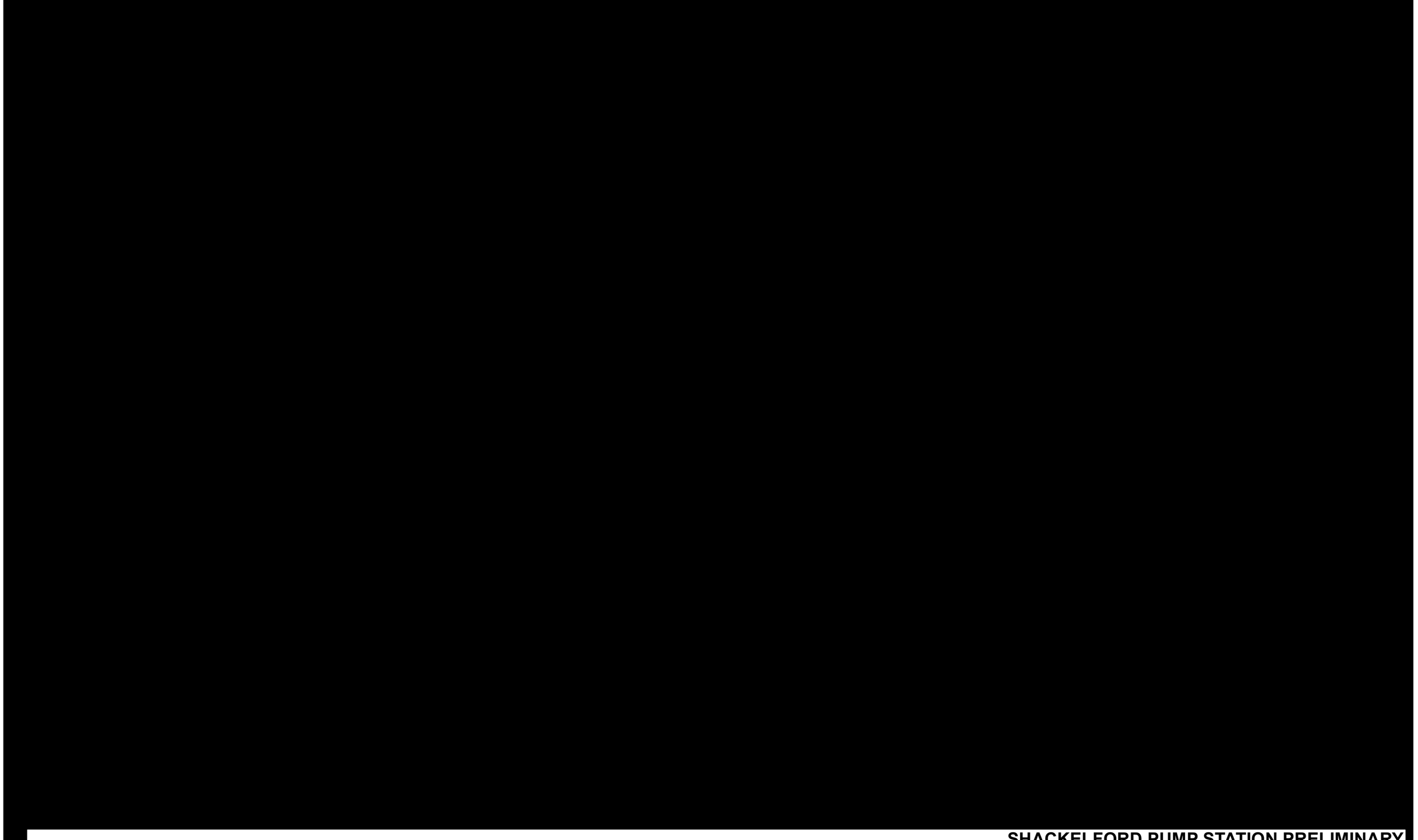
MODESTO CALIFORNIA

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 13 - Shackelford Pump Station Preliminary Pump and System Head Curves.mxd



SHACKELFORD PUMP STATION PRELIMINARY PUMP AND SYSTEM HEAD CURVES

FIGURE 13

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 13 - Shackelford Pump Station Preliminary Pump and System Head Curves.mxd

See Table 16 for Shackelford Pump Station design criteria.

Table 16 Shackelford Pump Station - Pump Design Criteria
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project
City of Modesto

Items	Description
Configuration	2 Duty, 1 Standby
Mode of Operation	Constant Speed
Pump Type	Screw Centrifugal Pump
Pump Manufacturer/Model	Wemco-Model E5K-H
Pump Capacity (each)	1460 gpm
Pump Efficiency at RDP	78%
Motor Horsepower	32 hp
Motor RPM	1800 rpm

Pump Station Civil and Site Design

Location

The pump station will be located in the Shackelford area where the City has a permanent sewer easement. The Shackelford area is most suitable as it is directly adjacent to the existing siphon that flows under the Tuolumne River. Tying into this existing siphon will be more economical than constructing a new line under the river.

Layout

The pump station wet well, valve vault, and meter vault will be located below ground and flush with the existing grade. See the preliminary design drawings for the site plant. All below ground structures will be traffic rated which will allow vehicles easy access around the site. The structures will be located such that the tops of the below grade structures will be above the 100-year flood plain. The finished floor elevation of the Electrical Building will also be located above the 100-year flood plain.

Access

Access to the Shackelford site will be from Crows Landing Road. An entry/exit gate will face east allowing maintenance vehicles to access the site without any difficult vehicular maneuvers. The access road is a low volume road and spans approximately 500 feet between the pump station gate and Zeff Road. Maintenance vehicles will not have to negotiate with heavy traffic as they leave the site.

Paving and Drainage

The access road to the pump station will be paved and crushed rock will be used to cover all other areas of the site. The site's storm water runoff will be routed back into the manhole upstream of the wet well to prevent any inadvertent runoff from the pump station site from reaching the river.

Cleaning / Wash Down Facilities

Facilities will be provided to ensure any sewerage washoff can be collected and disposed of back into the wet well. A concrete pad will collect washoff that will then be drained through a pipe back to the manhole upstream of the wet well.

Security

A perimeter fence will be used to secure the site with a gate that will allow vehicles to enter and exit easily. The City has indicated a preference for picket fending. Site lighting will be provided to illuminate the wet well and generator locations.

Odor Control

The SPS is a small pump station that is a considerable distance away from homes, businesses and other areas where odor would be a problem. It was therefore determined that odor control was not a high priority.

Electrical Design

Codes and Standards

The electrical systems for this project will be designed for general compliance with National Electrical Manufacturers Association (NEMA), American National Standards Institution (ANSI), Institute of Electrical and Electronics Engineers (IEEE), and Underwriters Laboratory, Inc. (UL) standards.

The following codes and standards are provided as design references:

- NFPA 70 - National Electric Code
- NFPA 101 - Life Safety Code
- NFPA 110 - Emergency and Standby Power Systems
- NFPA 820 - Fire Protection in Wastewater Treatment and Collection Facilities

Table 17 is a summary of the electrical criteria.

Table 17 Shakelford Pump Station - Electrical Criteria for Submersible Pumps River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto	
Description	**Criteria**
Service Standby Power	Duty(2)+Standby(1) Generator
Drive Type	Constant Speed
Starter Location	Electrical Building
Motor Horsepower	35
Motor Voltage/Phase	480/3
Motor RPM	1170
Motor Service Factor	1.0
Motor Environment	TENV
Motor Protection	Temperature and moisture detection

Process Control and Instrumentation Design

Process control design will be similar to the design described for the RTPS. Process and instrumentation diagrams for the pump station are shown in the preliminary design drawings.

7.1.4 Sanitary Sewer Force Mains

Hydraulic Design Criteria

Force mains are typically designed for a minimum velocity of 3 feet per second and a maximum velocity of 8 fps.

Since the pumps at the RTPS will operate with variable frequency drives that will match the outflow of the pumps to the inflow, the velocities in the River Trunk Force Mains will range from 1.15 fps to 8.01 fps depending on the time of day and how many force mains are in service. Two force mains will be in continuous service during PWWF and only one force main will be in service during ADWF. Table 18 summarizes the velocities at each flow condition and indicates the flow split through each force main required to achieve an equal amount of head loss. Since scouring velocities greater than 4 fps will be achieved at least once per day through each flow scenario, additional cleaning mechanisms, such as pig launching and receiving stations are not recommended.

Constant speed pumps will be utilized at the Shackelford Pump Station; therefore, velocities in the Shackelford force main will be discrete depending on how many pumps are running.

Table 18 River Trunk Force Main Flows and Velocities River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto				
Flow Condition	**Flow (mgd)**	**Force main internal diameters**	**Flow split per force main (mgd)**	**Velocity per force main (fps)**
Exist PWWF (max)	54.5	36.76 26.26	38.2 16.3	8.01 6.72
Future PWWF (max)	38.06	36.76 26.26	26.67 11.39	5.60 4.68
Future PWWF (avg)	21.77	36.76 26.26	15.25 6.52	3.20 2.68
Exist PWWF (min)	9.74	36.76 26.26	6.83 2.91	1.43 1.20
Future PWWF (min)	9.36	36.76 26.26	6.56 2.80	1.38 1.15
Future ADWF (max)	17.58	26.26	17.58	7.23
Exist ADWF (max)	14.68	26.26	14.68	6.04
Future ADWF (min)	6.61	26.26	6.61	2.72
Exist ADWF (min)	5.53	26.26	5.53	2.27
2 pumps at rated speed	18.2	26.26	18.2	7.49

The Shackelford force main will be constructed of 14-inch diameter HDPE pipe throughout most of the alignment except where it crosses the Tuolumne River. For the Tuolumne River crossing, the force main will connect to the existing 18-inch diameter siphon to avoid another river crossing. Table 19 summarizes the flows and velocities through the Shackelford force main.

Table 19 Shackelford Force Main Flows and Velocities River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto			
Number of Pumps Operating	**Flow (mgd)**	**Velocity, fps: 14" HDPE (ID = 13.392 inches)**	**Velocity, fps: Existing 18" FPVC DR 21 Siphon under Tuolumne River (ID = 17.53 inches)**
1	2.88	4.56	2.66
2	4.2	6.64	3.87

The pipelines should be designed to accommodate the maximum working pressures anticipated plus an appropriate safety factor. For the River Trunk force mains, the maximum

working pressure is 61 psi and occurs at the low spot within the alignment at the pump dead head condition. The pipeline will be designed to accommodate a test pressure that is 1.25 times the working pressure, or 76 psi. For the Shackelford force main, the maximum working pressure is 75 psi and occurs in the siphon portion of the alignment at the pump dead head condition. The pipeline will be designed to accommodate a test pressure that is 1.25 times the working pressure, or 94 psi.

Pipe Materials

The preferred pipe material for the force mains is high density polyethylene (HDPE). HDPE is a plastic pipe that will not corrode and is a fully restrained piping system eliminating the need for mechanical thrust restraints or thrust blocks. Another benefit of HDPE is that each joint is fusion welded which reduces the potential for leaks and root intrusion.

Fusible PVC (FPVC) offers similar benefits to HDPE with regard to corrosion resistance, thrust restraint, and fusion welded joints; however, FPVC is not available in as many pipeline sizes as HDPE, which limits the flexibility of using this pipe material if selecting the correct internal diameter is critical to meet the flow velocity design criteria.

The River Trunk force mains must be sized to maintain velocities over a wide range of flows. Additionally, the River Trunk force mains may operate both pipelines at the same time or as a single barrel force main. When operating both force mains at the same time, the pipeline diameters must be carefully selected such that the flow split between the two pipelines will result in similar velocities through each. HDPE is available in a wide range of sizes that allows the flexibility to select the appropriate internal diameters for the pipelines. The larger River Trunk force main is a 42-inch diameter, Standard Diameter Ratio (SDR 17), Iron Pipe Size (IPS), pipe with an internal diameter of 36.76 inches. The smaller River Trunk force main is a 30-inch diameter, SDR 17, IPS, pipe with and internal diameter of 26.26 inches. The pressure rating for SDR 17 pipes is 126 psi for pipe manufactured with PE 4710 resins, exceeding the minimum required pressure rating of 76 psi.

For the Shackelford force main, the flow through the pipe will depend on if one pump or two pumps are running at full speed; therefore, the range of flows that need to be accommodated is not as critical as the River Trunk force mains. The pipeline materials will be specified as either HDPE or FPVC to allow competitive bidding. The pressure rating of the selected pipe must be higher than 94 psi to meet the design requirements.

Appurtenances

The River Trunk force mains will follow an alignment that will allow them to be drained back to the RTPS influent manhole, where drain valves will be located for each force main. The drain valves and pipelines for each force main should be sized such that the draining velocity does not exceed 1 foot per second.

A surge analysis should be performed for each pump station and force main system during final design. A surge tank is shown on both the RTPS and Shackelford site plans as a placeholder to ensure the site is large enough to accommodate a surge tank, if needed.

Motorized plug valves will be installed near the beginning of the RTPS force mains. The valving will be arranged such that the valve on the 30-inch force main will normally be open and the intertie valve between the force mains will normally be closed. The intertie valve will serve as a redundant valve to allow flow to the 42-inch force main if the valve on the 42-inch force main fails to open when called.

7.1.5 Rehabilitation of Existing Pipelines

*Pipe Lining System. P*ipe lining systems for both the Sutter and River Trunk pipelines will be designed assuming the existing pipelines are fully deteriorated, providing a structurally sound new pipe. Important considerations in liner design include depth of groundwater over the existing pipe, ovality of the existing pipe, and depth of cover over the existing pipe. The 35 percent geotechnical investigation was limited to the Dry Creek area. During final design, additional geotechnical borings will be conducted and groundwater depth will be determined for use in the liner design.

7.2 Pipeline Reaches

The pipeline reaches, as defined below, are shown on Figure 14.

7.2.1 Alignment A – Colorado Ave: Tuolumne Blvd and Neece Dr to Sutter Plant

Description. Alignment A provides gravity conveyance of the River Trunk flows from the discharge of the River Trunk Force Mains to the Sutter Plant. This portion of the River Trunk is comprised of 54,60,72, and 84-inch diameter pipes and requires excavation in excess of 30 feet deep in some locations.

Public Impacts. In Tuolumne Blvd, the pipeline is located in the eastbound lanes to allow traffic to be routed in the westbound lanes during construction. Because of existing utilities in Colorado Avenue, the pipeline is located in the middle of the road. Due to the width and depth of the excavation, it will be difficult to maintain traffic during construction. The ability to close the road to through traffic during construction should be investigated during final design. We will also need to determine how to minimize or mitigate impacts to the Modesto Municipal Golf Course, John Thurman Field, and the Dryden Park Golf Course.

Constructability/Design Considerations. During final design, the location of the water line running along the south side of Tuolumne Blvd will need to be verified. The sewer may need to shift to the center of the road or the westbound lanes to provide sufficient clearance from the existing waterline.



Legend

- Alignment A
- Alignment B
- Alignment C
- Alignment D
- Alignment E
- Alignment F
- Alignment G
- Alignment H
- Other Proposed Sewer Main
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- PS Proposed Lift Station
- PS Other Lift Stations

N

0 1,000 2,000 Feet

PIPELINE ALIGNMENTS

FIGURE 14

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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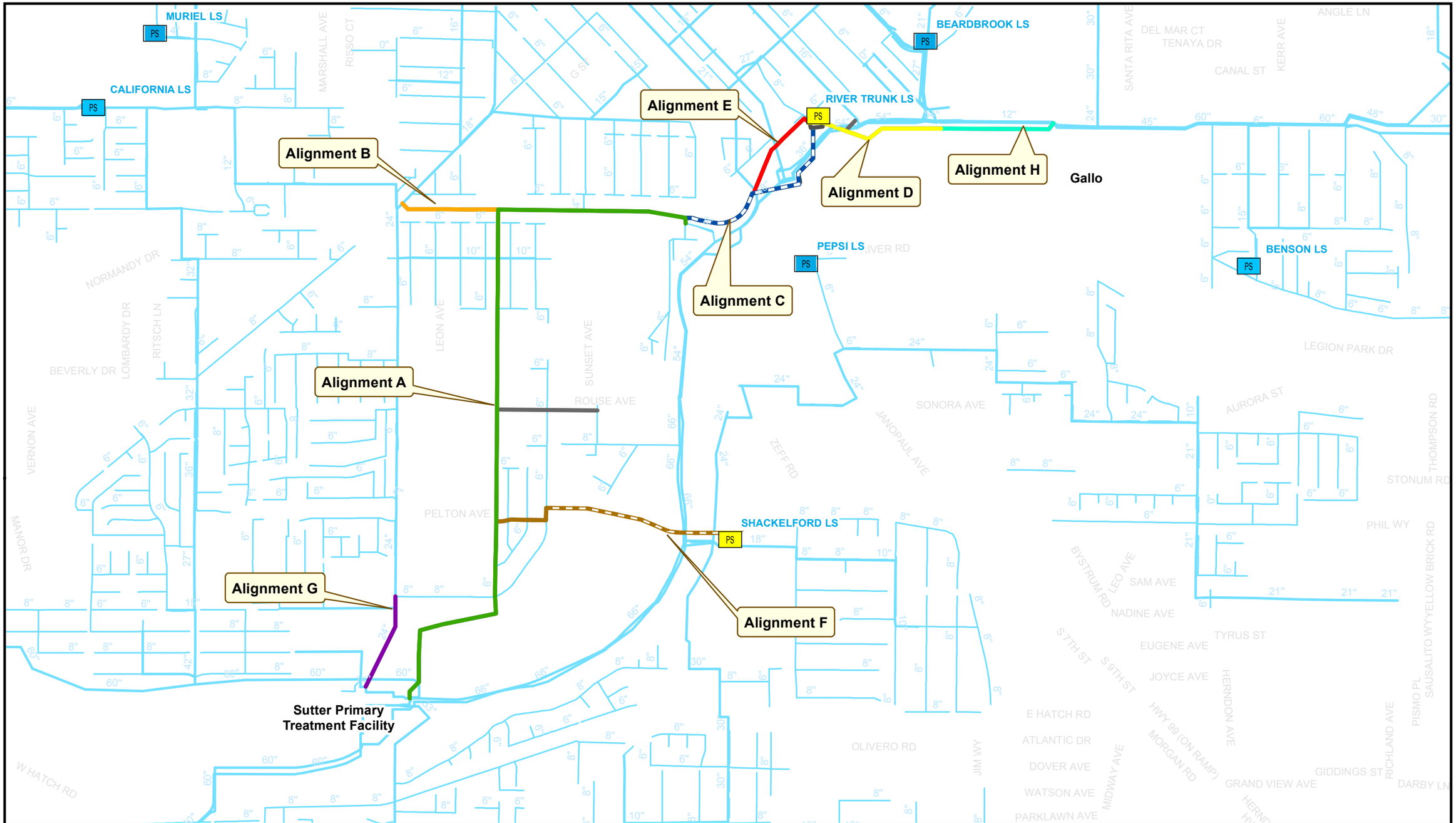
MODESTO CALIFORNIA

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 14 Pipeline Alignments.mxd



Legend

- Alignment A
- Alignment B
- Alignment C
- Alignment D
- Alignment E
- Alignment F
- Alignment G
- Alignment H
- Other Proposed Sewer Main
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- PS Proposed Lift Station
- PS Other Lift Stations

N

0 1,000 2,000 Feet

PIPELINE ALIGNMENTS

FIGURE 14

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 14 Pipeline Alignments.mxd

There are two small local collection systems located south of Tuolumne Blvd and east of Colorado Ave that currently flow to the existing River Trunk. To pick these flows up with the location of the new River Trunk will require reversing flow in some existing pipelines. Preliminary concepts for how to connect these areas are shown on Figure 7.

During final design, consideration will be given to partnering with the County to provide sewer service for the unincorporated areas of the County located adjacent to Colorado Ave.

At the Sutter Plant, flows from the River, Sutter, and West trunks will be combined. The work sequencing and bypass pumping required to construct the improvements will need to be discussed in detail with operations staff during final design. Also, the 35 percent plans were developed using available plans for the Dryden Box and Junction Box No. 1. During discussion with operations staff, both structures may not have been constructed as shown on the plans. Further investigation into the existing configuration of flows between the Dryden Box and Junction Box No. will be conducted during final design to determine how best to connect the new combined Trunk pipeline. This investigation will also confirm whether or not the existing Dryden Box can be used as a future River/CSL diversion structure.

7.2.2 Alignment B – Tuolumne Blvd: Paradise Road to Colorado Ave

Description. Alignment B is a peak wet weather diversion for the existing Sutter Trunk. Sutter Trunk flows will normally continue to flow down the Sutter Trunk. However, during peak wet weather events, flows that top the passive weir in the new diversion structure will be diverted down Tuolumne Blvd to the River Trunk.

Public Impacts. Alignment B is located in the eastbound lanes to allow traffic to be routed to the westbound lanes during construction to minimize impacts to traffic. During final design, work restrictions will need to be coordinated with Modesto High School to minimize impacts to school traffic. Due to the location of the proposed diversion structure in Paradise, detouring through traffic around the section of Paradise between Alturas Avenue and Tuolumne Boulevard may be necessary.

Constructability/Design Considerations. During final design, operational and maintenance strategies will need to be discussed further. Since Alignment B will not see continuous flows and may see very low flows that don't result in a flushing velocity, there is a higher potential for solids deposition and odor problems in the pipe.

7.2.3 Alignment C – River Trunk Force Mains

Description. Alignment C consists of two force mains: a 30 and 42-inch (OD) pipeline. Having two force mains allows the system to maintain flushing velocities through a wide range of flows. The force mains will convey flows from the River Trunk Pump Station to a discharge structure in Tuolumne Blvd.

Public Impacts. The force mains have been routed in the eastbound lanes to allow traffic to be routed to the westbound lanes Tuolumne Blvd crosses under Highway 99 and construction will be adjacent to the on and off ramps for Highway 99. Work restrictions in this area will be coordinated with Caltrans.

Constructability/Design Considerations. Because we will be crossing under Highway 99 with two large pressure pipelines, Caltrans may require the addition of a casing pipe. We will confirm Caltrans design requirements during final design. The force mains will also be crossing under the 7th Street and Union Pacific Railroad (UPRR) Bridges. The design of the crossing will be coordinated with the requirements of the City and UPRR.

The force mains will be crossing a number of existing utilities, namely the existing River Trunk and CSL pipelines, as well as a 96-inch storm drain. The elevations of all of these utilities will be confirmed during final design and the depth of the force mains will be adjusted as necessary to avoid conflict.

7.2.4 Alignment D – Dry Creek Crossing to RTPS

Description. Alignment D is a gravity extension of the Dry Creek crossing that conveys flows to the River Trunk Pump Station.

Public Impacts. Alignment D is located within the floodplain. The pipeline will cross under 9th Street, but no work will be performed within the roadway. Public impacts will be negligible for this portion of work.

Constructability/Design Considerations

A typical jacking shaft work area is approximately 15,000 to 20,000 square feet and a typical reception shaft work area is approximately 8,000 to 10,000 square feet. Alignment D is located in open areas in and above the flood plain where there is sufficient work area for the required shafts. Due to the anticipated groundwater elevation of 40 feet and the required depth of the shafts to install the gravity sewer (shaft floors will range from approximate elevation 26 feet to approximate elevation 22 feet), watertight construction methods will be necessary at all shaft locations. Several systems are available for creating large watertight excavations including steel sheetpiles, secant piles, cutter soil mixing, auger drilled shafts, and sunken concrete caissons. However, given the large plan dimensions and moderate depth of these shafts, and the primarily medium dense to very dense and stiff to hard soils expected, pre-drilled steel sheetpiles, secant piles, cutter soil mixing, or auger drilled shafts will provide the most appropriate and cost-effective shoring system. When watertight shafts are necessary, a thick concrete slab is typically required to prevent groundwater from entering through the bottom of the shaft and to prevent uplift of the finished shaft. The slab can be poured using tremie pipes prior to dewatering, or by dewatering the shaft and then constructing the slab in the dry if bottom stability is not compromised by inflows. One jacking shaft and two reception shafts are anticipated for construction of this alignment.

The east end of the easternmost drive, which extends from south of the corner of Morton Boulevard and 11th Street to just east of the 9th Street bridge, will be shared with the western end of the Dry Creek crossing. This location will be used as a joint jacking shaft for both the Dry Creek crossing and the drive to just east of the 9th Street bridge. The west side of this crossing will be a joint reception shaft with the drive that crosses beneath the 9th Street bridge. The west side of the 9th Street bridge crossing will be a joint jacking shaft with the final trenchless drive to the pump station east of the intersection of B Street and Morton Boulevard. Although it is generally desirable to microtunnel upslope, the cost savings of sharing jacking shafts are significant because jacking shafts are significantly larger than reception shafts, and the issues with tunneling downslope are only marginally higher for drives of this length and slope. A typical jacking shaft for a 48-inch ID pipe is approximately 20 feet wide by 35 feet long whereas a typical reception shaft is 20 feet wide by 20 feet in length.

The risk of settlement-induced damage to structures and facilities overlying the tunnel is a potential concern for most trenchless construction. For the proposed microtunneling crossings west of Dry Creek, the only significant features that could be subject to settlement damage are the foundation piles of the 9th Street bridge. The proposed trenchless crossing of the 9th Street bridge is centered between two sets of bridge piles to minimize settlement risks. This placement results in the maximum possible clearance between the piles and the trenchless construction. Settlement resulting from trenchless construction is typically distributed in an inverted normal probability curve. Therefore, the more horizontal clearance there is between a feature and the tunnel, the less settlement is typically seen. Additional settlement analysis will be required for the 9th Street bridge piles when geotechnical information is available for this location. However, based on the depth of the drive (the crossing will be approximately 42 feet below the ground surface), the soil conditions encountered in Boring B-1, and the horizontal clearance of approximately 130 feet from the edge of the tunnel to the edge of the piles, settlement risk to the 9th Street bridge foundation is likely to be low.

The installation method for the pipe between the RTPS and the influent manhole to the RTPS will need to be further evaluated during design.

7.2.5 Alignment E – B St: Calaveras Ave to RTPS

Description. Flows from Calaveras Ave and 7th Street currently flow to the existing River Trunk south of Tuolumne and B St. Because the new River Trunk will be a force main in this location, it is necessary to reroute flows to the new RTPS. A new manhole will be installed over the existing pipes in Calaveras and 7th Street to minimize disruption to existing flows. Alignment E consists of

Public Impacts. The pipeline was routed in the eastbound lanes to allow traffic to be routed in the westbound lanes. Because this area is more industrial, close coordination with

trucking schedules and access routes will be necessary. Night work could lessen impacts on adjacent businesses.

Constructability/Design Considerations. A portion of Alignment E will need to be constructed through the proposed River Trunk Pump Station site. If the project is constructed in phases, consider including the portion of Alignment E that is located on the pump station site with the construction of the River Trunk Pump Station.

The intersection of 7th and B Streets is congested with existing utilities. The location of existing utilities will need to be verified during final design to confirm available locations for jacking and receiving pits to get under the existing railroad tracks.

7.2.6 Alignment F – Shackelford Forcemain/Gravity: Shackelford PS to Pelton Ave

Description. This alignment will convey flows from the new Shackelford PS to the new River Trunk in Colorado. The recently constructed inverted siphons will be used as force mains to convey flows from the Shackelford PS to the west side of the Tuolumne River. The force main will continue through the Dryden Park Golf Course and terminate in a manhole in Roselawn Avenue where the flow will be conveyed by gravity to the new River Trunk at Colorado and Pelton.

Public Impacts. The most notable impacts will be through the Dryden Park Golf Course. During final design, work restrictions will be discussed with the golf course management staff to determine appropriate work hours. To minimize impacts to the golf course, consideration should be given to allowing night work or modified working hours.

Due to existing utilities, the new gravity sewer in Pelton Avenue is near the centerline of the road. For ease of construction, allowing a road closure to through traffic and detouring traffic to other streets should be considered.

Constructability/Design Considerations. The pipeline through the golf course is proposed as open cut. During final design, coordination with gold course staff will be required to identify the location of the existing on-site irrigation system and any special requirements for surface restoration.

The manhole in Roselawn will be the termination of the forcemain. The design of the manhole should include energy dissipation or other measures to minimize turbulence, odors, and corrosion potential.

At the connection point to the existing inverted siphons west of the Tuolumne River, the existing gravity facilities will need to be demolished and new pressure piping and valving will need to be installed. Since inverted siphon has two barrels, valving will provide the ability to isolate one barrel for inspection and/or cleaning, providing the City with redundancy.

7.2.7 Alignment G – Sutter Ave Rehabilitation

Description. Based on the results of the condition assessment, the Sutter Ave Rehabilitation will be limited to the pipeline between Garden Avenue and MH X within the Sutter Plant and all of the unlined brick manholes. Cured-in-place pipe lining is recommended for rehabilitating the pipeline.

Public Impacts. Traffic impacts on Sutter Avenue will be localized at the existing manholes at Garden Avenue and Robertson Road. One or both of these locations will be used for insertion of the cured in place liner. Garden Avenue has an alternate access from Colorado. The feasibility of using alternate access and road closures will be evaluated during final design.

Constructability/Design Considerations. This work will require bypassing the existing Sutter Trunk flows during installation.

7.2.8 Alignment H – Dry Creek Crossing

Description. Alignment H replaces the existing 48-inch single barrel siphon that crosses Dry Creek with a new trenchless gravity crossing of Dry Creek, allowing the existing siphon to be used for CSL flows, if needed.

The west end of the proposed trenchless crossing of Dry Creek is located southeast of South Morton Blvd and 11th Street. This area is an open field bordered to the east by several large oaks and smaller trees. One of the existing utilities in the area is a pole that is located among the trees on the east side of the field. There are overhead electrical lines that come to the pole from the north and then appear to go underground. We do not currently have information on the location of any underground electrical lines. There are, however, two known electrical vaults among the trees on the east side of the area. To the north of the selected alignment is the existing Beard Brook Siphon and, on the north side of the proposed work area, are four manholes associated with the existing siphon. Finally, on the west side of the area there is a small fenced enclosure.

The east side of the proposed trenchless crossing will terminate in a parking lot owned by the E&J Gallo Winery. The winery uses this fenced-off area for truck parking. There are no known utilities in the area other than the existing Beard Brook Siphon, which is located to the north. This area is located on a terrace between the flood plain and the Gallo Winery and can only be accessed from the south, via a road that circles the Gallo facility.

Public Impacts

Because a portion of the construction for the Beard Brook crossing will occur on private property owned by Gallo, strict construction staging area, site access, and schedule limitations will be established within the final bid documents.

The estimated construction staging area required is shown in the preliminary plans. The final design documents will need to identify allowable traffic routes which should be maintained and coordinated with operations staff at Gallo. By design, impacts to the Gallo property will be minimized. The estimated length of time for the construction of the Beard Brooks Siphon, including open-cut and microtunneling operations is as follows:

- 1 to 2 months for construction of the shafts.
- 2 to 4 months for the microtunneling operations. Construction traffic in the lower truck parking area will be minimal at this time.
- 2 to 4 months for retrieval of the drilling head, construction of open-cut sections, and tie-ins with existing and proposed facilities.

Constructability/Design Considerations. Because there is an approximate 20-foot drop in elevation between the invert of the existing River Trunk and the invert for the proposed gravity sewer, a vortex flow insert will be installed in the last manhole located prior to the lower truck parking area. The vortex flow insert is a proprietary fiberglass structure, manufactured by IPEX, which induces a spiral flow in the manhole. An example vortex flow insert is shown in Figure 15. The spiral flow creates a downdraft that traps gases and forces air into the flow, thus reducing the presence of odors and corrosive conditions within the manhole. At the bottom of the structure, the wastewater flows radially over the insert. The inserts can be specially designed for various inlet and outlet configurations.

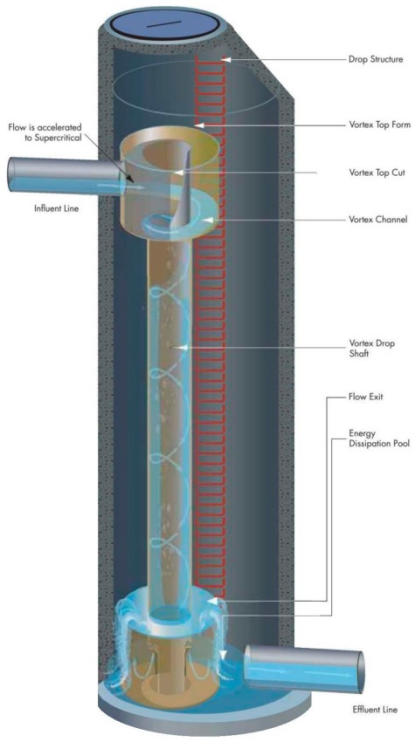


Figure 15 IPEX Vortex Flow Cross-Section (from IPEX brochure)

No manholes are planned to be located within the 100-year floodplain (approximate ground elevation of 70 feet). Along the alignment, the floodplain extends from the Gallo lower truck parking area to Dry Creek Park. Following consultation with City staff, it was decided that a large sewer pipe without access points for 1,500 lineal feet is an acceptable alternative when compared to pressure manhole lids and maintenance access concerns associated with manholes located within the floodplain. The gravity sewer will be constructed with design slopes of 0.5 and 1.5 percent to ensure a minimum velocity of 2 feet per second under all conditions.

The work area on the west side of the crossing is the preferred location for the jacking shaft. There is sufficient space on the west side for a typical jacking shaft work area of approximately 20,000 square feet. This side of the crossing is less developed than the east side, which minimizes construction impacts to the E&J Gallo Winery. The jacking shaft location requires more frequent truck traffic which, were it located on the east side of the crossing, would impact the winery facilities. Further, from a constructability standpoint, it is desirable to microtunnel upslope. Due to the anticipated groundwater elevation and the required depth of the shaft to provide sufficient clearance from Dry Creek, a watertight construction method, as described for Alignment D above, will be required for the jacking shaft. The footprint required for a jacking shaft for 48-inch ID pipe is approximately 20 feet wide by 35 feet long or approximately 35 feet in diameter. The length of the shaft will be determined by the contractor to be compatible with his equipment and the length of the jacking pipe segments.

The east side of the crossing is located in a paved lot that the Gallo Winery uses for truck and trailer parking. In order to minimize construction impacts to the facility, the planned shaft location is in the northwest corner of the parking lot. Typically, a reception shaft work area for a microtunneled crossing requires a minimum of 8,000 sf to 10,000 sf. This space requirement can be met using only the northernmost part of the parking lot. The remainder of the parking lot will be impacted by construction traffic only during shaft construction and MTBM retrieval. The winery's access to, and use of, the remaining portion of the lot can continue during construction. The required reception shaft size for a 48-inch ID pipe is either a rectangular shaft with minimum dimensions of approximately 20 feet by 20 feet or a circular shaft with a minimum diameter of 20 feet. The reception shaft will also require watertight construction due to the groundwater levels and depth of construction.

The majority of the anticipated geotechnical conditions are favorable for a microtunneled crossing, as they primarily consist of medium dense to dense silty sands and stiff to hard clays and sandy clays. However, Boring B-2 encountered a zone of very soft to soft sandy clay at approximate elevation 40 feet that extends to approximate elevation 33 feet. Very soft materials can be problematic for microtunneling machines because encountering a zone of soil that does not have sufficient bearing strength to support the machine can result in the machine sinking or having steering problems.

For the Dry Creek crossing, we assume that a moderate low spot due to the machine sinking would be acceptable because the flow velocities would be high enough to clean a moderate sag in the installed pipeline. However, depending on the extent of the soft zone and the amount the microtunneling machine sinks there could be significant consequences during and after construction. Because jacking pipes are, by necessity, rigid, a large amount of vertical or horizontal deviation over a short distance can cause the joints to separate or, in the worst case, cause the pipe to break. When this occurs, soil and groundwater can enter the pipeline, flood the microtunneling machine, and halt construction. When a microtunneling machine floods, there is little choice but to abandon it in place or to construct a rescue shaft to retrieve it. Both of these courses of action are costly and cause significant schedule delays.

To minimize the risks associated with very soft soil, ideally the microtunneled profile would be designed to avoid the problematic area. However, there are several constrains on this project that may not allow the tunnel alignment to completely avoid the approximately 7 foot thick soft zone. The design profile must balance the need for sufficient clearance below Dry Creek and the costs associated with the depth of the downstream portion of gravity sewer and pump station wet well. The profile of the proposed microtunneled crossing is shown in Volume 2. The profile has been selected so that less than 1 foot of the top of the microtunneling machine will encounter the known zone of very soft clay. Because it is not possible to completely avoid the very soft layer, it is most desirable to encounter it with the top of the machine. This minimizes the risk of losing grade due to the machine sinking.

A preliminary jacking force calculation was performed for the Dry Creek crossing, resulting in jacking forces as high as 1,100 tons. Assuming that 48-inch ID RCP will be installed for this crossing, the approximate capacity of the jacking pipe is 650 tons. The anticipated jacking forces, therefore, exceed the capacity of the pipe by a significant margin. To overcome this, intermediate jacking stations (IJSs) will be required for this project.

An IJS is used to facilitate long drives that would be otherwise limited by high jacking forces by breaking up the axial load into smaller sections. An intermediate jacking station is comprised of a steel cylinder with a ring of small hydraulic jacks installed between two special jacking pipe segments. As jacking forces increase, the contractor can use the hydraulic jacks in the IJS to move the MTBM and sections of pipe ahead of the IJS forward. After the IJS has been completely extended, the remainder of the pipe between the jacking shaft and the IJS is then moved forward using the jacks in the shaft. This allows the drive to be split into sections, which keeps the total thrust applied to a single section of the bore below the allowable value.

Intermediate jacking stations can be used in pipes with an ID of 36 inches or larger, and multiple IJSs can be used on one drive. For the Beard Brook Siphon crossing a minimum of two IJSs will likely be required. For each IJS two special pipe segments are required to connect the IJS to the regular jacking pipe. The jacks are removed from the pipe after the drive is complete; however, the steel cylinder is left in place, on the outside of the special

jacking pipe segments. Therefore, the material used for manufacturing or coating the cylinder must provide the same or better corrosion resistance as the jacking pipe and sleeves.

Another consideration that must be addressed for a microtunnel of this length, particularly for a gravity sewer, is guidance. An MTBM is typically guided using a laser in the jacking shaft that is set to design line and grade. The MTBM has a target in the rear of the machine that the operator monitors continuously during tunneling. Over short distances, this system allows for very high accuracy. However, during longer drives the laser begins to be diffused and refracted by the humidity and temperature gradient that may develop within the tunnel. The smaller the jacking pipe, the more quickly humidity and temperature gradient can impact laser guidance due to the lower volume of air inside the tunnel. The larger the jacking pipe, and therefore the larger the volume of air inside the tunnel, the less impact this has. However, larger pipes are more costly to install and have a negative impact on the hydraulics of the gravity sewer. Installation cost and pipeline performance must be balanced against the constructability of the microtunnel. For this reason, we recommend that 48 inches be the minimum allowable ID for the Dry Creek crossing. Even with this minimum allowable ID, humidity and temperature may still impact the contractor in such a way that it may be necessary to require the use of an alternative guidance method, or to supplement the laser data with a secondary guidance system. Two additional guidance methods that have been successfully used for microtunneling are gyroscope systems and electronic water levels. An electronic water level provides grade information to supplement the information obtained from the laser. A gyroscope system provides the same information that a laser does and can be used alone or as a supplement to the laser data. Each of these systems adds cost, with the gyroscope being the most expensive at perhaps $50,000 to $100,000.

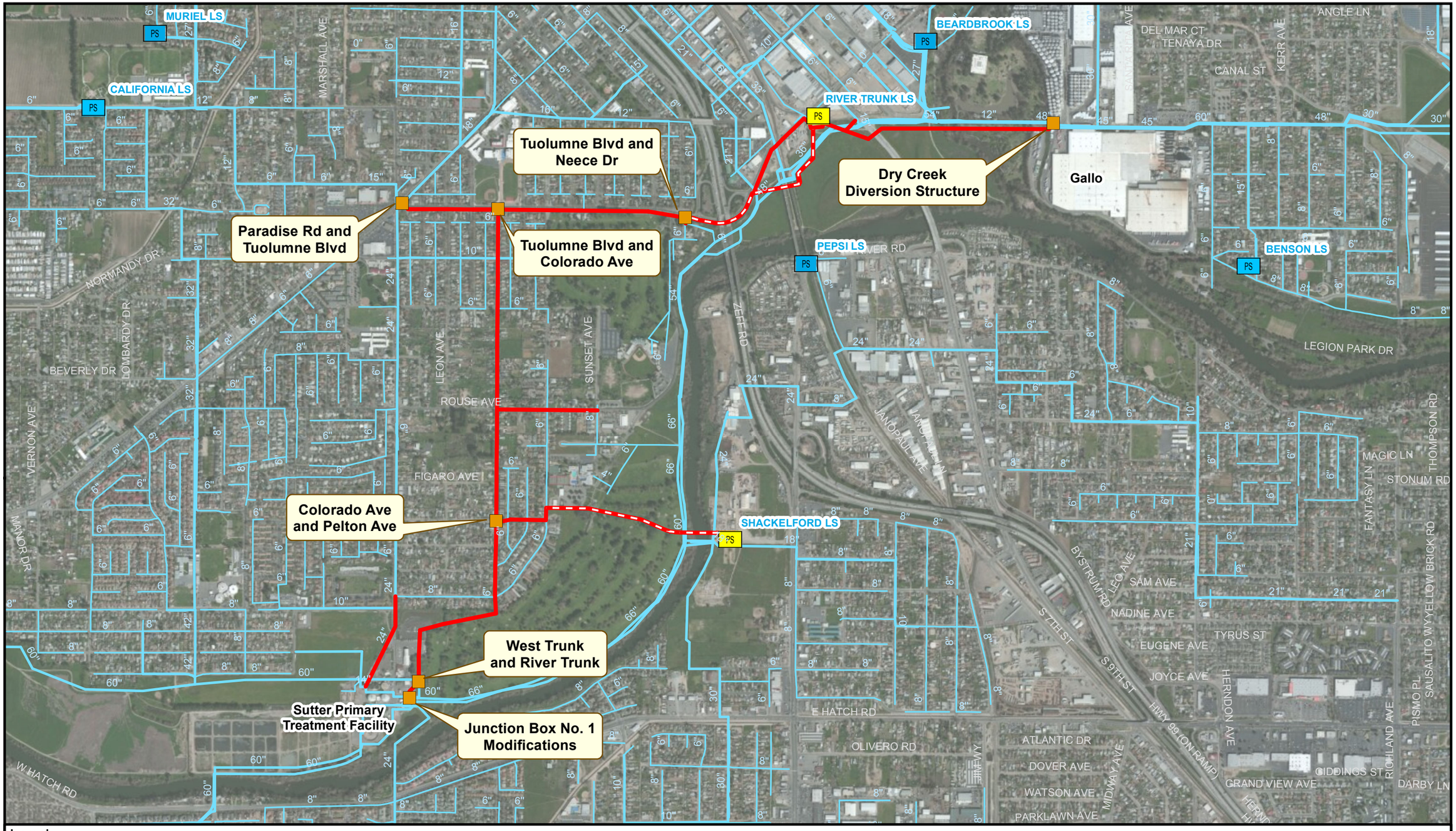
A settlement analysis was performed for the Dry Creek crossing, resulting in a maximum estimated settlement of approximately 0.45 inches. This level of settlement represents a low risk of damage to the surface features, and should not pose an impediment to obtaining a permit for the crossing.

7.2.9 Junction and Diversion Structures

Figure 16 shows the location of each of the structures.

Diversion Structure - Dry Creek

The Dry Creek Diversion Structure is shown on sheet 00CD07 of the 35 percent plans. The intent of this structure is to provide redundancy and reliability. The structure is located just upstream of the existing CSL/River Trunk siphon structure. The new structure will be built over the existing 48-inch pipeline, minimizing the need for bypass pumping. Gates will be installed in the structure on the existing 48-inch siphon and the new 48-inch gravity pipeline.



Legend

- Proposed Gravity Main
- Proposed Force Main
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- PS Proposed Lift Station
- PS Other Lift Stations
- Junction Structure

0 1,000 2,000 Feet

JUNCTION/DIVERSION STRUCTURES

FIGURE 16

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

MODESTO CALIFORNIA

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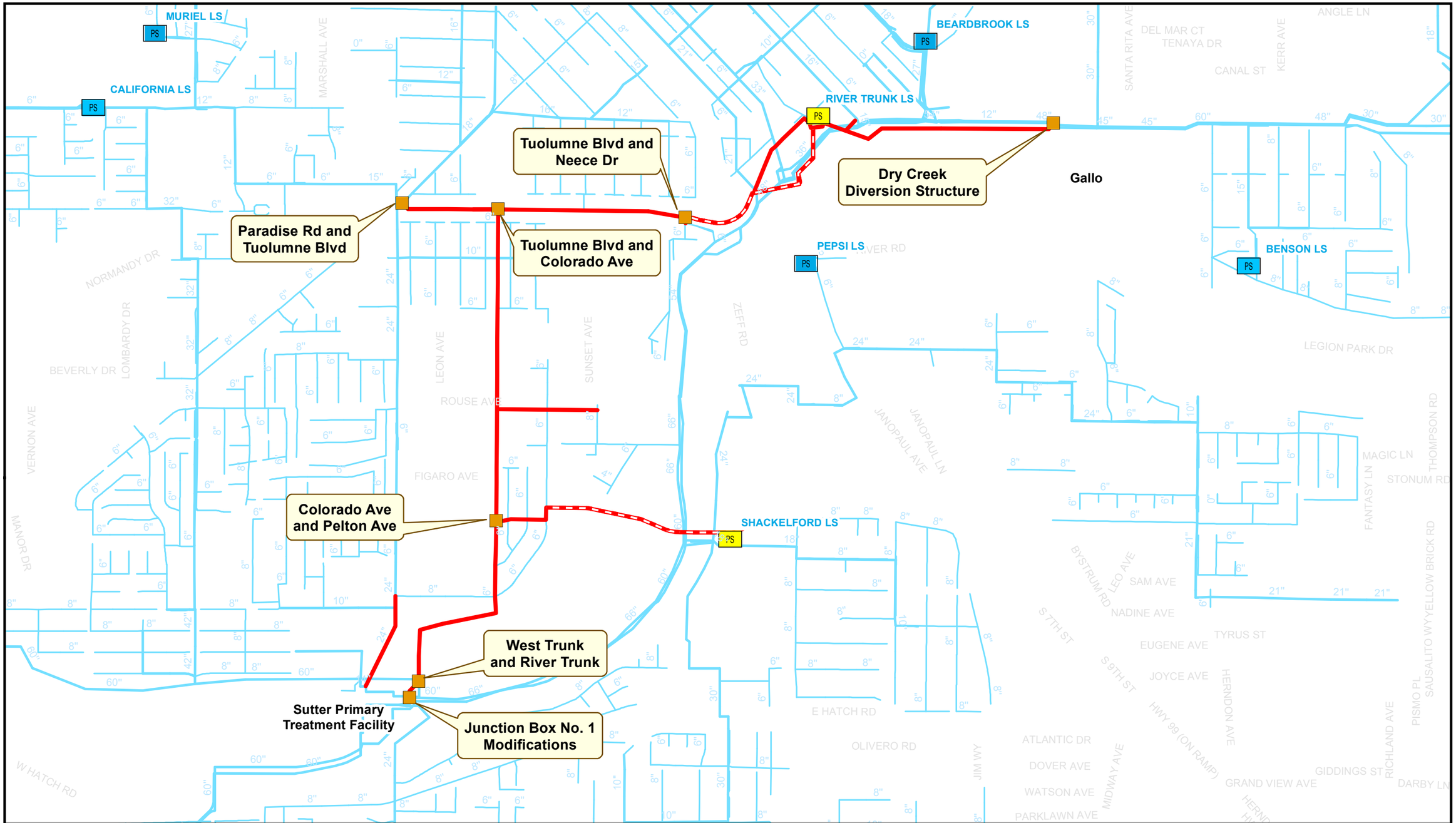


Legend

- Proposed Gravity Main
- Proposed Force Main
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- PS Proposed Lift Station
- PS Other Lift Stations
- Junction Structure

0 1,000 2,000 Feet

JUNCTION/DIVERSION STRUCTURES

FIGURE 16

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 16 - Junction_Diversion Structures.mxd

For normal operation, the gate to the existing 48-inch siphon will be closed and the gate for the new 48-inch gravity will be open. In an emergency, the River Trunk flows could be diverted to the existing River Trunk siphon and conveyed to the plant. The location of the diversion structure was selected to accommodate Gallo's truck traffic operations.

Diversion Structure - Paradise Rd & Tuolumne Blvd

The Paradise Rd & Tuolumne Blvd Diversion Structure is shown on sheet 00CD03 of the 35 percent plans. The intent of this structure is to divert peak wet weather flows from the existing Sutter Trunk east on Tuolumne to the new River Trunk to alleviate capacity deficiencies in the Sutter Trunk. The Sutter Trunk will continue to convey 100 percent of the dry weather flows. Diversion of peak wet weather flows will be achieved by setting the invert of the new effluent 21-inch diameter pipeline along Tuolumne Blvd approximately 8 inches higher than the invert of the existing effluent 24-inch pipeline along Sutter Ave. This will create a passive overflow system that will operate only when required to divert flows and will not require intervention by O&M staff to operate and will minimize maintenance.

Junction Structure - Tuolumne Blvd & Colorado Ave

This junction structure has one out flowing 54-inch diameter pipe going south on Colorado Ave and two inflowing pipes, a 48-inch diameter pipe bringing flows west from the River Trunk Pump Station and 21-inch diameter pipe coming east on Tuolumne Blvd.

The main purpose of this junction structure is to convey all flows down Colorado Ave. Incoming flow will mainly be from the 48-inch diameter pipe bringing flows from the River Trunk Pump Station as flows from the 21-inch diameter pipe will only occur in peak weather conditions.

Junction Structure - Tuolumne Blvd & Neece Dr

This junction structure has one 48-inch diameter outlet pipe going west on Tuolumne Blvd and three influent pipes: 36-inch and 24-inch diameter force mains coming from the River Trunk Pump Station and a 6-inch diameter gravity pipe which is conveying flows that used to tie into the existing River Trunk.

The depth to the invert of the pipes in this junction structure is approximately 5.5 feet. This makes access into the structure limited. For this reason, the manhole cover will be located directly over the 48-inch diameter pipe as this is the most likely spot a blockage would occur.

Junction Structure - Colorado Ave/ Pelton Ave

This junction structure has one 60-inch diameter out flowing pipe going south on Colorado Ave and two inflowing pipes. The inflowing pipes are a 54-inch diameter pipe going south on Colorado Ave and a 27-inch diameter pipe with flows coming east on Pelton Ave.

The flows from Pelton Ave come from the Shackelford Pump Station.

Junction Structure - West Trunk & River Trunk

This junction structure will be constructed over the top of the existing West Trunk and is intended to divert the flows from the Sutter, River, and West Trunks down a proposed 84-inch gravity pipeline to the Junction Box No. 1 facilities.

Junction Box No. 1 Modifications

With the River, Sutter, and West Trunk flows combined in the West Trunk and River Trunk Junction Structure, a new tie-in to Junction Box No. 1 is required. The current concept is to extend Junction Box No. 1 to the west and tie-in to the extension, while maintaining the existing downstream pipe that conveys flow to the headworks. Once the Sutter and West Trunk flows have been combined with the River Trunk flows in the West Trunk and River Trunk Junction Structure, the existing Sutter and West Trunk connections could then be plugged. However, City staff indicated that Junction Box No. 1 and the Dryden Box may not have been constructed as designed. The existing configuration of these facilities will be confirmed during final design and modifications to the current connection plans will be made if needed.

7.3 Construction Methods

Four construction methods have been selected for this project:

Open Cut. Open-cut construction is the traditional method of excavating, bedding, laying, and backfilling a pipeline trench. This method of construction may result in significant surface disruption, leading to substantial impacts on the local residents, traffic, and the environment. Environmentally sensitive habitat is particularly affected by open-cut construction.

If an existing sewer is being replaced in the same alignment, then the wastewater normally flowing through the sewer must be bypassed throughout the construction period. In high groundwater areas, dewatering of the excavated trench and preparation of a stable, suitable trench bottom can be difficult to achieve. The potential to encounter contaminated soils is great, especially in areas where current or former gas stations, pipelines conveying petroleum products, or known contaminated sites are present.

Open-cut construction is a favorable option primarily in residential areas, where a new pipeline alignment is necessary and/or where the depth of the new sewer is not too deep (nominally, less than 20 feet). High groundwater, poor soils (gravels, hard rock, or noncohesive soils), and difficult access are other factors that cause the cost and difficulty of open-cut construction to increase.

Jack and Bore. Bore and jack is a tunneling method that involves auger-drilling equipment to install a steel casing where excavation to install a pipe is not acceptable. A carrier pipe is

then installed inside the casing pipe. Use of an over-sized casing (minimum 36-inch diameter) would allow personnel entry to remove cobbles, boulders, or other obstructions to reduce the need for emergency access shafts. This method has limited line and grade control through use of fins on the lead pipe.

Microtunneling. Microtunneling is a remotely-controlled, guided, pipe jacking process that provides continuous positive control of earth and groundwater pressures at the face of the excavation. The microtunnel boring machine (MTBM) and jacking pipes are pushed into the ground from a jacking shaft to a reception shaft on opposite sides of the crossing as shown in Figure 17. The carrier or product pipe may be jacked directly or installed inside an oversized casing in a separate operation. Pipe materials that can be jacked directly into place include steel pipe, vitrified clay pipe (VCP), reinforced concrete pipe (RCP), polymer concrete pipe (PCP), and centrifugally cast fiberglass reinforced polymer mortar pipe (CCFRPMP).

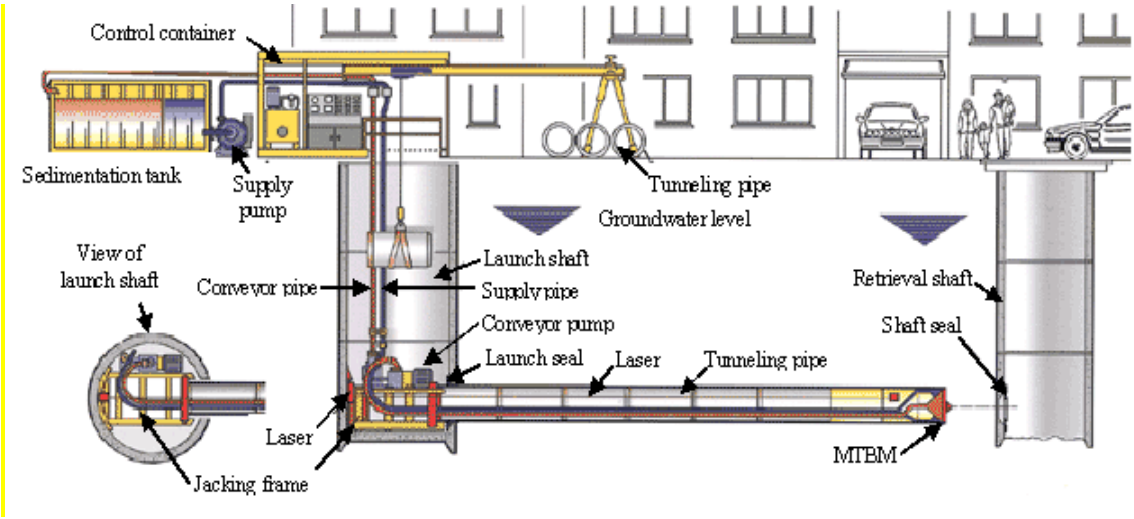


Figure 17 Schematic of a Typical Microtunneling Operation (Courtesy of Herrenknecht)

A cutterwheel excavates material at the face as the machine is jacked forward. The excavated material is mixed with slurry and pumped to the surface for separation and spoil removal. Due to this slurry removal system and remote control operation, the microtunneling process does not require routine personnel entry into the pipe.

Microtunneling machines have a closed face, as shown in Figure 18, limiting the size of rocks or other objects that can be ingested. Most machines are only capable of handling cobbles and boulders less than or equal to 20 to 30 percent of the outside diameter of the shield. In addition, large quantities of smaller cobbles can stall an MTBM by clogging the crushing chamber with rocks before they can be crushed and ingested. Therefore, microtunneling is not a preferred method when large quantities of cobbles and boulders or other objects are anticipated.



Figure 18 72-inch Akkerman Microtunneling Machine

Microtunneling is the preferred construction method when high groundwater levels are anticipated, few (or no) cobbles and boulders are anticipated, and when surface settlements must be minimized. Slurry pressure and mechanical face pressure are used to support the face of the excavation when ground conditions are loose or soft. In high groundwater conditions the slurry excavation system prevents inflow of water into the pipeline. Microtunneling is typically used in a wide variety of soil types, including rock and stable soils to loose, flowing, or otherwise unstable soils.

Pipes from 12 to approximately 108 inches in diameter have been installed using microtunneling. Drive lengths of over 3,000 feet have been completed, though typical drive lengths are 800 feet or less. This is due to the fact that jacking forces increase with drive distance, and may limit practically achievable drive distances. When installing pipe larger than approximately 36 inches, intermediate jacking stations can be used to achieve longer drive distances. However, for pipes smaller than 30 inches, intermediate jacking stations cannot be used.

Microtunneling provides continuous control of line and grade by use of a guidance system and steering jacks. The guidance system typically consists of a reference laser mounted in the jacking shaft that transmits its beam onto a target mounted inside the articulated section of the MTBM. This information and other operational performance information are transmitted through wire cables to the MTBM control cabin at the surface where the MTBM is remotely controlled. Through continuous monitoring and control of the MTBM, tolerances of plus or minus one to two inches are typically achievable.

Jacking shafts for microtunneling are typically 12 to 16 feet wide by 24 to 32 feet long. Reception shafts are typically 12 to 16 feet square. A work area of approximately 15,000 to 20,000 square feet is required at the jacking shaft. The work area at the reception shaft can be smaller, but are typically a minimum of 8,000 square feet. Off-site staging areas can be used to reduce work areas at each shaft.

Cured in Place Pipe (CIPP). Cured-in-place pipe (CIPP) lining involves the placement of a soft felt material, impregnated with thermosetting resin, inside the sewer line to be rehabilitated. The impregnated liner is then filled with hot water and held at a temperature above 180°F until the felt and resin chemically react, curing to form a new structural pipe inside the old pipe. Steam and ultra violet light curing methods are also available.

The only excavation required for CIPP projects is to complete an external reinstatement of laterals. An extensive staging area is required at the upstream end of each reach to be lined, and wastewater bypassing typically must be provided for more than eight hours as the liner is installed and cured. As a "trenchless" rehabilitation method, surface disruption, and associated impacts on the local neighborhood or environmentally sensitive areas is minimized.

Major factors impacting the thickness of the CIPP liner are the extent of deterioration of the existing pipe, "ovality" (a determination of whether the host pipe has lost its round shape), the depth of cover, and the groundwater level. Liners more than 1-inch thick are very rare, so the resulting loss in pipeline diameter is usually less than 2-inches.

Table 20 below identifies the selected construction method for each reach of the project.

Table 20 Selected Construction Methods
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project
City of Modesto

Alignment	Construction Method
A	Open Cut
B	Open Cut
C - STA C10+00 to C25+20 and STA C28+00 to C36+08.94	Open Cut
C – STA C25+20 to C28+00	Jack & Bore
D – STA D9+62 to D10+00	Open Cut
D – STA D10+00 to D26+35.85	Microtunneling
E – STA E10+00 to E16+55 and STA E17+88 to E25+51.30	Open Cut
E – STA E16+55 to E17+88	Jack & Bore
F	Open Cut
G	Cured In Place Pipe
H – STA H23+02 to H25+44.51	Open Cut
H – STA H10+50 to H23+02	Microtunneling
Existing River Trunk	Cured In Place Pipe

7.4 Stakeholder Coordination

Other than the City of Modesto, the other primary stakeholder for this project is Gallo. During the preliminary design phase, project team members worked closely with the engineering personnel at Gallo to identify constraints and conditions that Gallo would require to minimize or eliminate interruptions to their operations and to develop design concepts that satisfied those constraints. Two stakeholder meetings were scheduled and held with Gallo.

Stakeholder Meeting No. 1 (5/27/2014) was held at Gallo's engineering office. Attendance included Joseph Tune (Gallo's facilities engineer) as well as City of Modesto staff and members of the design team from Carollo and Black Water. This introductory meeting covered the following topics:

- Stakeholder introductions and roles.
- Project description.
- Gallo Constraints.
- Process for coordinating with Gallo.

Key developments from this meeting included the following:

- The northern portion of the lower truck/trailer parking area is available as a staging area.
- Gallo has scheduled annual events in the park in early June and September. Construction schedules need to avoid work at the site during these periods.
- Connection to the 48-inch sewer should be as far away from the rails and truck routes as possible so as to avoid disrupting Gallo operations.
- Gallo asked for a minimum 1-month review period of the preliminary and progress designs.
- Mr. Tune also asked for a more detailed project description which was provided in April.

Stakeholder Meeting No. 2 (8/19/2014) was held at Gallo's "Engineering War Room". Attendance included the same individuals as Stakeholder Meeting #1, several Gallo executives, and personnel from Bennett Trenchless Engineers. This Stakeholder meeting addressed the following topics:

- A summary of the overall project.
- Conceptual layouts of the recommended Beard Brook crossing alternative, potential staging areas on Gallo property, and projected construction period. The potential for an intermediate jacking pit and staging area in the park area of the Gallo property was of particular interest to the attendees.

- Benefits associated with the recommended alternative, which include reduced odors, reduced City operation and maintenance requirements, increased redundancy to the CSL, and less disruption to Gallo property and operations during construction when compared to the other options considered.
- A description of the microtunneling construction method.
- A summary of the next steps to complete the preliminary design report and estimated timeline for conducting a third stakeholder meeting.

The third stakeholder meeting will be scheduled following completion of the Draft PDR. Key discussion items for the third stakeholder meeting will include:

- Findings from the geotechnical investigation.
- The Draft Preliminary Design Report.
- More details regarding the projected construction staging areas and locations of the jacking and reception shafts.
- Confirming construction constraints to be included in final design documents.
- Projected timing for construction.

7.5 Easement Acquisition and Permitting Requirements

7.5.1 California Environmental Quality Act Requirements

A Master Environmental Impact Report (MEIR) for the City's Wastewater Collection System Master Plan was certified by the City Council and filed on March 13, 2007. Under Sections 15177 and 15178 of the California Environmental Quality Act (CEQA) Guidelines, any subsequent CEQA review for projects identified in the Master Plan and considered under the MEIR, should be limited to site and project specific impacts. Neither the Master Plan nor the MEIR considered the River Trunk Pump Station and Shackleford Pump Station Projects. Thus, the City will be required to demonstrate whether the project is sufficiently consistent with the Master Plan and MEIR, and whether the previous CEQA review is still applicable. To be within the MEIR scope, the following should be true: the project shall not have additional significant effects on the environment that were not addressed as significant effects in the MEIR and no new additional mitigation measures or alternatives are required. The initial study environmental checklist (Initial Study) is used to determine whether the project is within the scope of the MEIR. When the Initial Study supports this conclusion, the City may issue a finding of conformity.

Once the preferred alternative is finalized and a Project Description is prepared, the City will complete an Initial Study and work towards making the findings of conformity

The Initial Study will be prepared per Title 14 CCR §15367, §15378, §15002, and §15382 by the City's CEQA consultant. The Initial Study will take approximately four months to

complete prior to consideration for approval by the City Council. If the Initial Study concludes that there is no substantial evidence that the project may cause a significant effect on the environment, the lead agency (City) will file either a negative declaration or mitigated negative declaration. If there is substantial evidence that the project may cause a significant effect on the environment, an Environmental Impact Report will be necessary, requiring an additional 6 to 8 months to complete.

7.5.2 NPDES Permit Requirements

The National Pollutant Discharge Elimination System (NPDES) requires a General Permit for storm water discharges that are associated with construction activities encompassing areas greater than one acre, or to new construction of Linear Utility Projects such as this one. The contractor will be required to file a Notice of Intent (NOI) with the State Water Resources Control Board (SWRCB) and to develop a Storm Water Pollution Prevention Plan (SWPPP) that meets the NPDES General Permit Conditions addressing sedimentation and erosion concerns.

7.5.2.1 Notice of Intent (NOI)

Per the City of Modesto 2006 Standard Specifications on Sediment and Erosion Control, an NOI is required to be submitted to the City of Modesto Land Development Engineering Department. The NOI informs the SWRCB that the project is within the scope of regulations, but, unlike an individual permit application, it does not convey detailed information. For construction activities, the NOI will provide the following information:

- Brief description of the project.
- Estimated timetable for major activities.
- Estimate of the number of acres where soil will be disturbed.
- Certification that the project SWPPP complies with approved state or local erosion and sediment control plans or storm water management plans.

7.5.2.2 SWPPP

The United States Environmental Protection Agency (US EPA) identifies six phases of SWPPP for construction activities. They are:

- Site evaluation and design development.
- Assessment.
- Control selection and plan design.
- Certification and notification.
- Construction/implementation.
- Final stabilization/termination.

The SWPPP will include best management practices (BMPs) that address erosion and sediment control issues during construction. The City has adopted and approved the use of the California Stormwater Quality Association's Stormwater Quality Best Management Practices Handbook for construction, and BMPs from the Handbook will be included in the SWPPP. The SWPPP will also be used to satisfy requirements to obtain encroachment permits from the City and County.

7.5.3 Other Permit & Easement Requirements

During preliminary design, the permit matrix developed as part of the Alternatives Evaluation process was refined for the selected project. Table 21 identifies the anticipated permits, temporary construction easements (TCE), and public utility easements (PUE).

Table 21	**Permit and Easement Requirements River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project City of Modesto**
PERMITS	
Stanislaus County Department of Public Works – Encroachment Permit	
California State Lands Commission –Approval of improvements under General Lease	
Union Pacific Railroad – License Agreement	
Caltrans District 10 – Encroachment Permit	
US Army Corps of Engineers – Nationwide Permit #12	
California Department of Fish and Wildlife – Streambed Alteration Agreement	
Central Valley Flood Protection Board – Encroachment Permit	
San Joaquin Valley Air Pollution Control District – Construction Notification Form	
US EPA – Endangered Species Act (dependent on funding source)	
EASEMENTS	
E&J Gallo Winery - TCE & PUE *(Align H)*	
WH Breshears Inc. – TCE & PUE *(Align C)*	
Shaibi Yehia Ahmed Qassem (TE)/Kasim Fatime (TE) – TCE & PUE *(Align C)*	
Southwest Hide Co & Modesto Holding Co – TEC & PUE (Align F)	

A detailed list of anticipated permits and easements and a map showing where each permit or easement is required is provided as Appendix E.

7.6 Preliminary Construction Cost Estimate

Carollo developed costs based on the 35 percent drawings for the River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project. Table 22 presents estimated construction and project costs for the project.

Table 22 Project Cost Summary
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project
City of Modesto

Project Element	Construction Cost[1,2]	Engineering, Legal and Administrative Cost[4]	Owner's Reserve for Change Orders[5]	Project Cost[6]
48" Gravity Sewer along Tuolumne Blvd (Alignment A)	$2,569,000	$514,000	$128,000	$3,211,000
54" Gravity Sewer along Colorado Ave (Alignment A)	$6,918,000	$1,384,000	$346,000	$8,648,000
60" Gravity Sewer: Colorado Ave to Sutter Treatment Facility (Alignment A)[8]	$5,953,000	$1,191,000	$298,000	$7,442,000
21" Gravity Sewer along Tuolumne Blvd (Alignment B)	$910,000	$182,000	$45,000	$1,137,000
Dual 24" and 36" Forcemains along Floodplain and Tuolumne Blvd (Alignment C)	$4,654,000	$931,000	$233,000	$5,818,000
Beard Brook North Gravity Alignment (Alignment D & H)	$13,573,000	$2,715,000	$679,000	$16,967,000
36" and 48" Gravity Sewer: B St to Pumping Station (Alignment E)	$1,657,000	$331,000	$83,000	$2,071,000
Shackelford 14" Forcemain and 18" Gravity Sewer (Alignment F)	$1,555,000	$311,000	$78,000	$1,944,000
24" Rehabilitation along Sutter Ave (Alignment G)	$427,000	$85,000	$21,000	$533,000
48" River Trunk Rehabilitation	$11,255,000	$2,251,000	$563,000	$14,069,000
River Bank Armament	$3,734,000	$747,000	$187,000	$4,668,000
CSL Diversion Structures[7]	$448,000	$90,000	$22,000	$560,000
Shacklelford Pump Station (4.2 mgd)	$2,391,000	$478,000	$120,000	$2,989,000
River Trunk Pump Station (54.5 mgd)[3]	$26,787,000	$5,357,000	$1,339,000	$33,483,000
Total	**$82,831,000**	**$16,567,000**	**$4,142,000**	**$103,540,000**

Notes:
(1) Construction Cost includes 20% estimating contingency, 10% Contractor Overhead and Profit, 9% General Conditions, and Sales Tax at a rate of 7.625% applied to half of the direct cost.
(2) Construction is based on today's dollars and does not include escalation.
(3) Construction Cost for the River Trunk Pump Station includes a 25% estimating contingency since the design concept is more conceptual than the other project elements
(4) Engineering Legal and Administrative Cost is calculated as 20% of the Construction Cost
(5) Owner's Reserve for Change Orders is calculated as 5% of the Construction Cost
(6) Project Cost is the total of the Construction Cost, Engineering, Legal, and Administrative Cost, and Owner's Reserve for Change Orders
(7) The CSL Diversion Structures are currently being designed under a different project.
(8) This alignment is adjacent to unsewered portions of unincorporated County. During final design, partnering with the County to provide sewer service for these areas will be considered. Funding opportunities associated with this work will also be evaluated.

The structure of the cost estimate is broken down into the following two components:

- **Direct Costs –** Includes all costs associated with labor, materials, and equipment necessary for the construction of each facility or pipeline. These are considered hard costs that have a tangible end product (e.g., wet well, force main, gravity sewer). In the estimate, the direct costs are shown as "Direct Construction Cost" and "Contingency."

- **Indirect Costs –** Includes all costs that are not readily seen in the end product but are costs included with the contractors' bids. Examples include overhead, profit, taxes, bonds, insurance, and mobilization. In the estimate, the indirect costs are shown as "General Contractor Overhead, Profit & Risk," "Sales Tax," and "General Conditions."

Carollo's cost model is built using quantity takeoffs and unit costs for each facility. These unit costs are derived from internal databases (e.g., R.S. Means and Richardson's database) for materials and installation of common construction items (piping, concrete, earthwork, etc.) and quotes for equipment and certain materials. This cost estimate based on the 35 percent design is considered a Class 3 estimate by the Association for the Advancement of Cost Estimating (AACE). A Class 3 estimate has the following characteristics:

- Design between 10 and 40 percent completion.

- At a minimum, process flow diagrams, preliminary P&IDs, preliminary site plans with elevations, developed layout drawings and utility equipment lists are used as the basis for developing the cost.

- End usage of the estimate by the City is to establish the basis for the City's budget authorization, appropriation, and/or funding.

- Actual bids are expected to fall between +30 percent and -15 percent of the "Total Estimated Construction Cost." This means that bids can be expected to fall within a range of 30 percent over the estimate to 15 percent under the estimate.

Once the direct construction costs are calculated, the indirect costs are added to the direct costs as percentages or multipliers. These indirect costs include the following:

- **Sales Tax** – Includes sales tax on materials. Half of the direct costs are assumed to consist of materials that are taxable. A tax rate of 7.625 percent was used.

- **Overhead, Profit, and Risk** – Includes overhead for the contractor's main office (office staff, building lease, supplies, benefits, etc.), profit, and risk. Values typically range from 7 to 18 percent. A value of 10 percent was used.

- **General Conditions** – Includes the costs associated with mobilization, demobilization, bonds, insurance, field and office management, and temporary facilities. General conditions have been set at 9 percent.

The total construction cost includes all labor, materials, and equipment that go directly into the construction of each facility including all costs associated with bonding, insurance, mobilization, demobilization, field and office management, and temporary facilities.

A contingency is included as part of these construction costs. The contingency is a percentage that is used to account for elements of the design not accounted for in the estimate. As the design reaches 100 percent completion, the contingency is replaced in part with known unit costs for individual equipment or material components. Values for the contingency typically range from a few percent to 30 percent, depending on the level of design completion. A value of 20 percent was used for this estimate with the exception of the RTPS. Because the circular RTPS design is more conceptual than other project components, a 25 percent contingency was used.

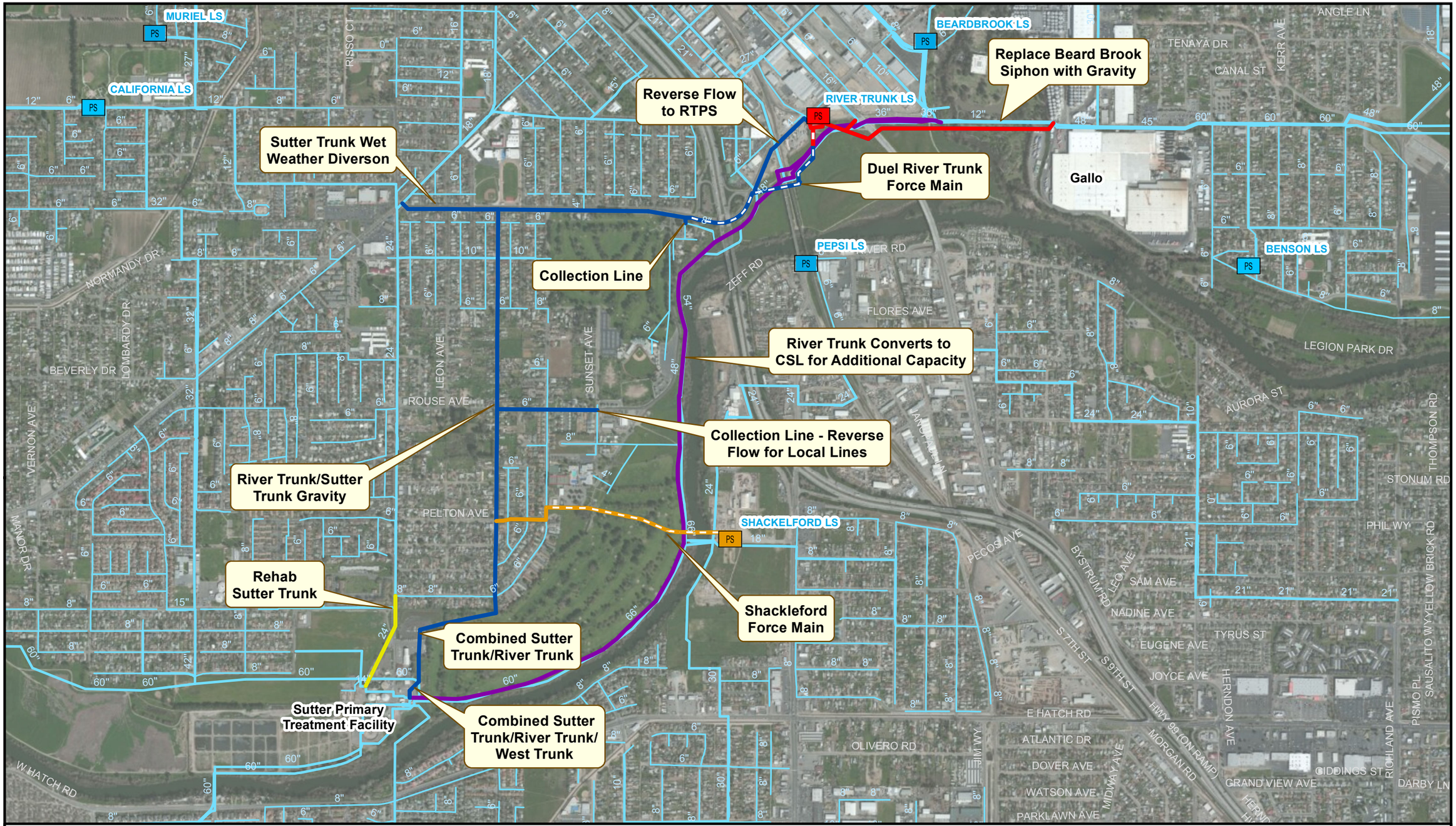
To provide project costs for budgeting purposes, the estimate also includes soft costs. Soft costs are the non-construction related costs incurred by the owner. The soft costs include an allowance for engineering, legal, and administrative (ELA) costs and an owner's reserve for change orders. These allowances are based on the following:

- **ELA** - ELA is typically estimated at 15% to 40% of the total construction cost. ELA includes the owner's expense for engineering and legal fees as well as the owner's internal administrative costs. These costs also often include environmental, easement acquisition, and bid advertising. A value of 20 percent was used for ELA for this project.
- **Owner's Reserve for Change Orders** - A value of 5 percent was used for the "Owner's Reserve for Change Orders." This is the cost that the City holds in reserve to address unexpected costs due to new conditions discovered during construction (e.g., buried obstructions or interferences) or elements of the design that change during construction.

The total of the direct costs, indirect costs, and soft costs are summed to provide the "Total Project Cost."

7.7 Implementation Schedule

To reduce initial capital expenditures, the project can be phased, but will need to be closely coordinated with the City's existing infrastructure and the cannery flows to minimize disruptions to service and maximize available capacity in the existing system. The timing of project implementation and phasing will be further developed in conjunction with City staff during final design to coordinate construction and associated costs with available City funds. The project can be broken into five discrete phases as shown on Figure 19. A



Legend

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- PS River Trunk LS (Phase 3)
- PS Shackleford LS (Phase 5)
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- PS Other Lift Stations

N

0 1,000 2,000 Feet

carollo

PROJECT PHASING

FIGURE 19

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

MODESTO CALIFORNIA

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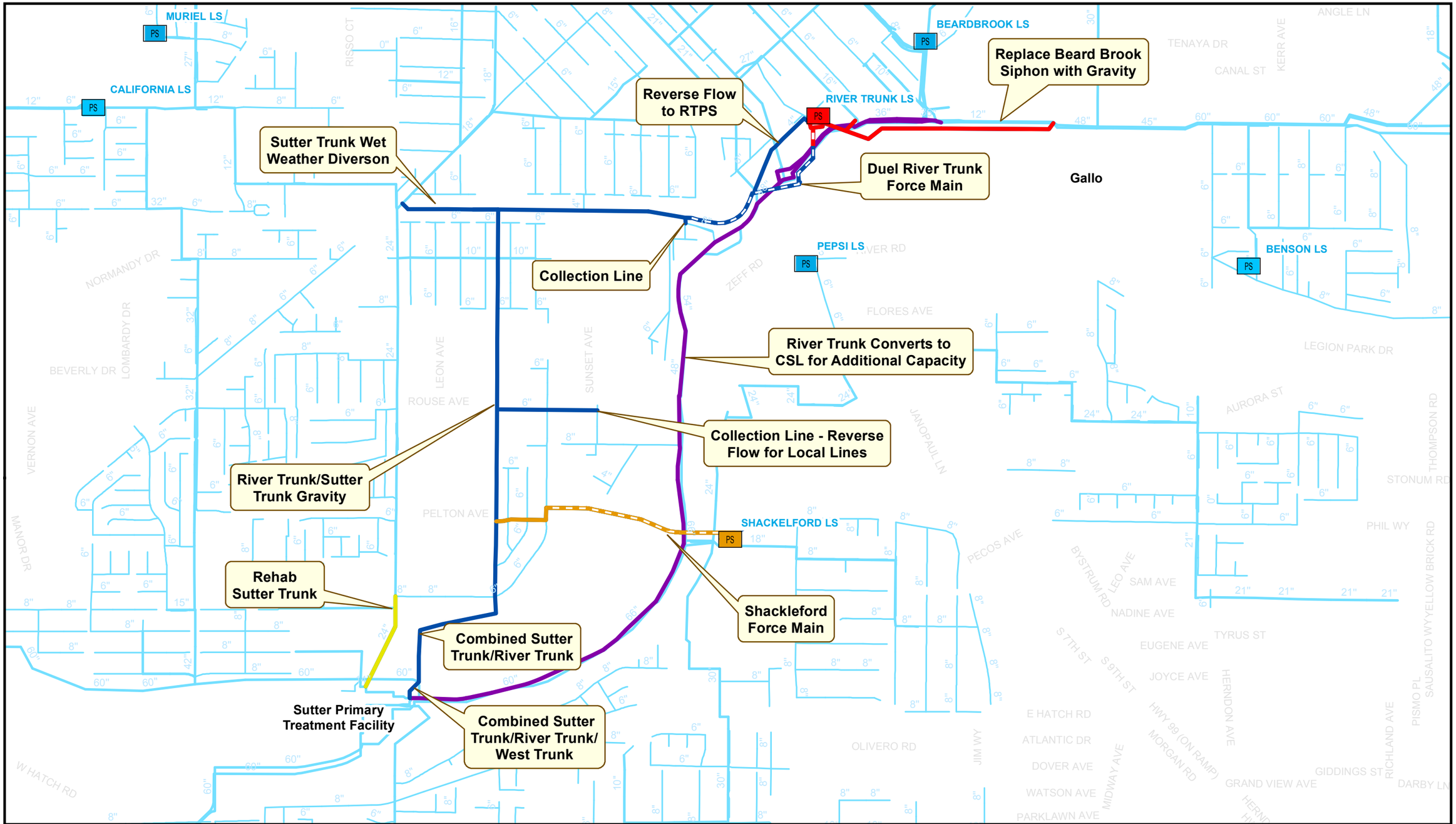

Legend

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- River Trunk LS (Phase 3)
- Shackleford LS (Phase 5)
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Other Lift Stations

0 1,000 2,000 Feet

PROJECT PHASING

FIGURE 19

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed_4_23_15\Figure 19 - Project Phasing.mxd

proposed implementation schedule for the five phases is shown on Figure 20. A description of each package is provided below.

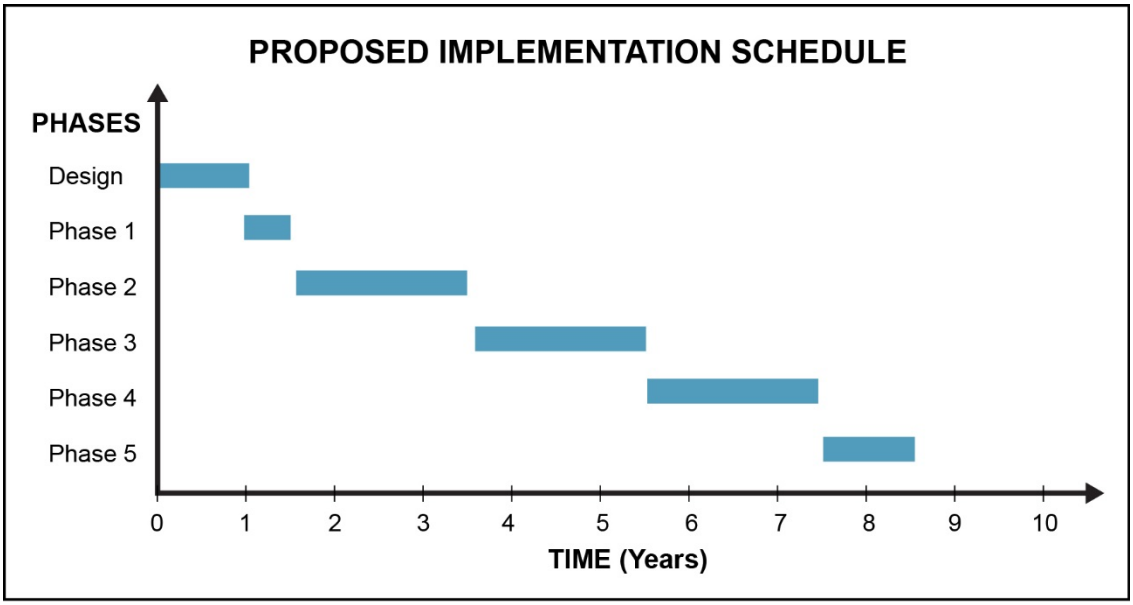

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Figure 20 Proposed Implementation Schedule

Phase 1 - Sutter Trunk Rehabilitation. The portion of the Sutter Trunk identified for rehabilitation (Garden to the Sutter Plant) is in fair to poor condition. Based on the condition assessment results, rehabilitation of the identified pipelines and the brick manholes is recommended within the next 5 years.

Phase 2 - River Trunk Rehabilitation. Corrosion is present on the interior of the pipeline throughout the entire length of the River Trunk. The City has made emergency repairs to the structural failure at the Gallo property permanent repairs for that location and the pipeline upstream of the failure are currently in design and expected to be completed in 2015. Rehabilitation of the remaining River Trunk is recommended within the next 5 years. Armoring the riverbank to prevent future riverbank erosion and exposure of both the CSL and River Trunk would also be completed as part of Phase 2.

River Trunk Realignment.

The River Trunk Realignment would be broken into three phases

Phase 3. To eliminate the monthly maintenance required at the Beardbrook Siphon, and the existing access and odor issues on the Gallo property, Phase 3 includes construction of the new gravity trunk from Gallo to the new River Trunk Pump Station (Alignments D & H), the River Trunk Pump Station, the portion of Alignment E that crossing through the pump station site, and a portion of the River Trunk force mains (Alignment C). Phase 3 would include a junction structure on the existing River Trunk pipeline, which would serve as a

temporary connection to the existing River Trunk pipeline. The junction structure would become a stranded asset, as it would not be used in the final configuration.

Phase 4. Phase 4 would follow Phase 3 and include construction of Alignment A, Alignment B, the remainder of Alignment C, and Alignment E. This work would also include combining the Sutter and West Trunk flows with the River Trunk flows at the Sutter Plant and the expansion of the existing Junction Box No. 1.

Phase 5. Phase 5 would follow Phase 4 and include the construction of the Shackelford Pump Station and associated force main and gravity sewer (Alignment F) to tie-in to Alignment A at the intersection of Colorado and Pelton.

The cost to implement each phase of the project is provided in Table 23.

7.8 35 Percent Plans and Specifications

7.8.1 35 Percent Plans

The basis for development of the 35 percent Plans is the recommended alternative from the Alternatives Analysis TM (Appendix 2). While four potential pump station sites were evaluated during preliminary design, the 35 percent Plans are based on the Morton site, which is preferred by the City since the land is City owned. The 35 percent Plans are provided as Volume 2 of this PDR.

7.8.2 Proposed List of Technical Specifications

Based on the 35 percent design, a list of anticipated technical specifications (Division 2 through Division 17) was developed. The proposed list of technical specifications is provided as Appendix F. During final design, project specific technical specifications will be developed in CSI format.

Table 23 Implementation Cost by Phase
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Line Improvement Project
City of Modesto

Element	Phase 1 Rehabilitation of Lower Sutter Trunk	Phase 2 Rehabilitation of River Trunk	Phase 3 River Trunk Pump Station and Forcemains	Phase 4 Gravity Sewers for River Trunk Realignment	Phase 5 Shackleford Pump Station and Forcemain	Total Project Cost
48" Gravity Sewer along Tuolumne Blvd (Alignment A)				$3,211,000		**$3,211,000**
54" Gravity Sewer along Colorado Ave (Alignment A)				$8,648,000		**$8,648,000**
60" Gravity Sewer: Colorado Ave to Sutter Treatment Facility (Alignment A)				$7,442,000		**$7,442,000**
21" Gravity Sewer along Tuolumne Blvd (Alignment B)				$1,137,000		**$1,137,000**
Dual 24" & 36" Forcemains along Floodplain and Tuolumne Blvd (Alignment C)			$1,163,600	$4,654,400		**$5,818,000**
Beard Brook North Gravity Alignment (Alignment D & H)			$16,967,000			**$16,967,000**
36" & 48" Gravity Sewer: B St to Pumping Station (Alignment E)			$207,100	$1,863,900		**$2,071,000**
Shackelford 14" Forcemain and 18" Gravity Sewer (Alignment F)					$1,944,000	**$1,944,000**
24" Rehabilitation along Sutter Ave (Alignment G)	$533,000					**$533,000**
48" River Trunk Rehabilitation(3)		$14,069,000				**$14,069,000**
River Bank Armament		$4,668,000				**$4,668,000**
CSL Diversion Structures(4)			$560,000			**$560,000**
Shacklelford Pump Station (4.2 mgd)					$2,989,000	**$2,989,000**
River Trunk Pump Station (54.5 mgd)			$33,483,000			**$33,483,000**
Total Project Cost(1,2)	**$533,000**	**$18,737,000**	**$52,381,000**	**$26,956,000**	**$4,933,000**	**$103,540,000**

Notes:
(1) Total Project Cost includes 20% estimating contingency, 10% Contractor Overhead and Profit, 9% General Conditions, and Sales Tax at a rate of 7.625% applied to half of the direct cost, 20% Engineering, Legal, and Administrative Cost, and 5% Owner's Reserve for Change Orders.
(2) Project Cost is based on today's dollars and does not include escalation.
(3) Construction Cost for the River Trunk Pump Station includes a 25% estimating contingency since the design concept is more conceptual than the other project elements
(4) The CSL Diversion Structures are currently being designed under a different project, so the costs will likely not be a part of the Phase 3 package.

APPENDIX A – GEOTECHNICAL STUDY (35 PERCENT)

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services
Sacramento • Modesto • Pleasanton • Rocklin • Ukiah

File: 14-159.1
November 25, 2014

Mr. Tim Loper
Carollo Engineers, Inc.
7580 North Ingram
Fresno, CA 93711

Subject: DRAFT GEOTECHNICAL STUDY (35%)
River Trunk Realignment, Beard Brook Siphon, and Cannery Segregation
Modesto, California

Dear Mr. Loper,

Crawford & Associates, Inc. (CAInc) is pleased to submit this (35%) Draft Geotechnical Design Study for the City of Modesto River Truck Realignment Project. This is based on our 15% design study and additional explorations at key locations along the selected alignment. CAInc prepared this report in accordance with our May 2014 agreement.

Thank you for selecting us to be on your design team. Please call if you have questions or require additional information.

Sincerely,

CRAWFORD & ASSOCIATES, INC.,

Shawn Leyva, MS
Project Engineer

Benjamin D. Crawford, PE, GE
Principal Geotechnical Engineer

Attachments:
Log of Test Borings
Preliminary Geology/Geotechnical Study (15%)

INTRODUCTION

Scope of Services

To prepare this memo, CAInc performed the following:

- Meet with the design team to review the preliminary plans and discuss the project design needs, goals, and schedule;
- Discussed our previously prepared Preliminary Geology/Geotechnical Study (15%) design report with the design team;
- Discussed potential boring locations for this phase of the project with the design team;
- Drilled, logged, and sampled three explorations along the Beard Brook Siphon alignment (Gallo Winery Park to Beard Brook Park);
- Drilled, logged, and sampled one exploration near the intersection of Avalon Avenue and Colorado Avenue; and
- Discussed the results of our fieldwork and prepared this memo for 35% design.

Selected Alignment

Carollo Engineers (Carollo) previously developed four alternatives to upgrade and improve the River Trunk, Beard Brook Siphon, and Cannery Segregation Diversion Structures. The alternatives were evaluated during an Alternative Evaluation Workshop between Carollo and the City of Modesto. Alternative No. 9A was selected based on project goals, cost considerations and technical challenges. Based on our review of the 15% design report prepared by Carollo, key features of Alternative No. 9A include the following:

- Rehabilitation of the existing Sutter Trunk,
- Replacement of the existing River Trunk with a new pump station, force main, and gravity trunk,
- Replacement of the existing Beard Brook Siphon with a new gravity sewer beneath Dry Creek,
- Reroute Shackelford Siphon to the new River Trunk gravity sewer, and
- Utilization of the existing River Trunk facilities for future Cannery Segregation Line capacity needs.

SUBSURFACE EXPLORATION

At Carollo's and Bennet Trenchless' request we performed four borings at key Geotechnical locations where trenchless installation methods will be considered (Beard Brooke Siphon) and at a deep sewer location near the intersection of Avalon Avenue and Colorado Avenue. More explorations will be completed during future design phases. Below we provide a summary of the soil conditions encountered.

To obtain preliminary data on the subsurface conditions, CAInc retained Geo-Ex to drill four test borings between September 25 and September 26, 2014 to depths ranging from 41.5 to 61.5 ft below ground surface (bgs). Geo-Ex used a CME 55 drill rig equipped with an automatic hammer and rotary wash capabilities. CAInc 's project engineer, Mr. Shawn Leyva, and project manager, Mr. David Castro, PE, logged the test borings consistent with the Unified Soil Classification System (USCS), and the Caltrans 2010 Logging Manual. At the completion, the test borings were backfilled with cement grout.

We show the test boring locations on the attached Log of Test Borings (LOTB) sheet.

Subsurface Conditions

Below we summarize the encountered subsurface conditions. CAInc did not perform laboratory testing during this phase, therefore the soil information present in this report and on the attached log of testing borings is preliminary. In general, the soil conditions encountered match the soil survey and geological maps we reviewed during preparation of our 15% design memo.

Beard Brook Park (B-1)

At the south edge of Beard Brook Park, the soils can generally be characterized as very stiff to hard, non- to low- plasticity, silty sand, sandy silt with varying amounts of fine-grained soils to a depth of about 21 feet bgs (elevation 41 ft[1]). These soils are underlain by medium dense to very dense, fine to coarse grained, sand with silt to a depth of about 61.5 feet bgs (elevation 1.5 ft).

Gallo Winery Park (Center, B-2)

Near the center of the Beard Brook Siphon alignment, the soils can generally be characterized as stiff to hard, medium plasticity lean clay with sand to a depth of about 23 feet (elevation 48 ft) underlain by hard sandy silt to a depth of about 35 feet bgs (elevation 34 ft). These soils are underlain by soft, sandy lean clay and poorly graded

[1] Elevations provided by Northstar Engineering Group, Inc

sands to depths explored (elevation 14 ft). We encountered a 5 ft thick layer of medium dense silty sand from an elevation of about 26 to 21 ft.

Gallo Winery Park East Side (B-3)

At the east side of the park (B-3), the soils can generally be characterized as medium-dense to dense, fine to coarse grained, poorly graded sand, sandy silt, and low plasticity silt with sand to a depth of about 20 feet bgs (elevation 36 ft) underlain by medium-dense to dense, poorly graded sand with silt to a depth of about 41.5 feet bgs (elevation 14.5 ft).

Avalon and Colorado Avenue (B-4)

At the corner of Avalon Avenue and Colorado Avenue (B-4), the soils can generally be characterized as medium-dense to very dense, fine to coarse grained, sandy silt, silty sand, and poorly graded sand to a depth of about 29 feet bgs (elevation 46 ft) underlain by very dense poorly graded sand, silty sand and very stiff, medium-plasticity silt and silty clay with varying amounts of sand to a depth of about 51.5 feet bgs (elevation 23.5 ft).

Groundwater

Based on our review of existing groundwater information in the project area, ground water within the project limits will likely be relatively uniform and ranging from an elevation of about 30 to 40 ft mean sea level (MSL). Groundwater will likely be impacted by the fluctuations in the nearby Tuolumne River and Dry Creek.

Groundwater will be measured at various locations during future phases of the project.

GEOTECHNICAL CONSIDERATIONS

Preliminary Seismic Study

Ground Motion

CAInc used the Caltrans ARS Online (web-based) tool to calculate both deterministic and probabilistic acceleration response spectra for the Beard Brook Siphon area based on criteria provided in Appendix B (LOTB) of Caltrans Seismic Design Criteria. We did not perform a seismic evaluation for Avalon and Colorado due to the high blow counts and lack of expected groundwater. Additional seismic modeling will be completed during future phases of the project.

The deterministic spectrum is determined as the average of median response spectra calculated using ground motion prediction equations developed under the “Next Generation Attenuation” (NGA) project. These equations are applied to all faults considered active in the

last 750,000 years (late-Quaternary age) that are capable of producing a moment magnitude earthquake of 6.0 or greater.

The probabilistic spectrum is obtained from the USGS (2008) National Hazard Map for 5% probability of exceedance in 50 years. The design spectrum is based on the larger of the deterministic and probabilistic spectral values. Deterministic and probabilistic spectra account for soil effects by using the average shear wave velocity in the upper 100 ft of the soil profile.

Based on Caltrans ARS Online (V2.3.06), and the 2012 Caltrans Fault Database, the nearest deterministic seismic source is the Great Valley 07 (Orestimba), with associated parameters shown in Table 3. We used a latitude of 37.630812° N and longitude of -120.987401° W.

Table 3: Fault Data

Fault Parameters	Great Valley 07
Fault Identification Number (FID)	138
Maximum Moment Magnitude (M_{max})	6.7
Site-to-Fault (R_{RUP}) Distance (km/mi)	25.78/16.01
Style of Faulting	REV
Fault Dip (degrees)	15
Dip Direction	West

Based on our boring data, SPT N_{60} blow count values, and correlations outlined in the Caltrans "Geotechnical Services Design Manual," we assign the site two separate small strain shear wave velocity (V_{S30}) equal to 352.5 meters per second (Site Class D, dense soil layer) and 222.0 meters per second (Site Class D, soft soil layer) for the upper 100 ft of the soil profile. Each strain shear wave velocity yielded the same result. Since the site is located further than 15 kilometers (9.3 miles) from the Great Valley 07 fault, we did not have to apply an adjustment factor for near-fault effects consistent with Caltrans procedures.

We used the above information to develop probabilistic response spectra for the site and compared that to the Caltrans minimum deterministic response spectrum that assumes a maximum moment magnitude 6.5, vertical strike-slip event occurring at a distance of 7.5 miles.

Using the Caltrans ARS Online tool, we then compared the deterministic results with the probabilistic response spectrum based on data from the 2008 United States Geological

Survey (USGS) National Seismic Hazard Map for a 5% in 50 year probability of exceedance (975 year return period).

We recommend a design spectrum based on the USGS 5% in 50 years hazard (2008) response spectra across the period spectrum from 0 to 5 seconds. We assign the site a Maximum Moment Magnitude (M_{max}) of 6.6 with a Peak Ground Acceleration (PGA) of 0.32g for the soft soil layer (B-2) and 0.29g (B-1 & B-3) for the harder soil layers.

Liquefaction

Liquefaction can occur when loose to medium dense, granular, saturated soils (generally within 50 feet of the surface) are subjected to ground shaking. In our Preliminary Geology/Geotechnical Study for 15% design we indicated that certain areas along the pipeline alignment will likley be impacted by liquefiable soils. For this phase of the project we performed liquefaction analysis on the subsurface conditions encountered in the Beard Brook Siphon explorations (specifically Boring B-2). Based on the information obtained during our fieldwork, expected groundwater elevations, assumed fines content, and the above seismic information we consider the potential for liquefaction along the Beard Brook Siphon to be low.

We expect to encounter liquefiable soils at other locations along the project alignment, especially near the Tuolumne River floodplain. Additional liquefaction analysis will be complete during future phases of the project.

Beard Brook Siphon

At each end of the proposed Beard Brook Siphon (Borings B-1 and B-3) we encountered firm, dense to very dense silty sand, sandy silt and poorly graded sands to depths explored. Near the center of the potential alignment (Boring B-2) we encountered about 35 ft (surface to elevation 34 ft) of stiff to hard, lean clay with sand and sandy silt underlain by soft sandy lean clay and loose poorly graded sand to the depths explored. We encounter a layer of medium dense silty sand from an elevation of 26 to 21 ft between the softer/loose zones in Boring B-2.

We did not measure groundwater during this phase of the project, however we expect the groundwater elevation will be influenced by the water surface elevation in Dry Creek and the Gallo Park pond.

Based on our conversations with the design team and review of the proposed Beard Brook Siphon alignment, the soft clays and loose sands are located within the planned alignment and will likely impact the trenchless installation. Additional explorations should be performed during future phases of the project to better define the extent of

these soft/loose layers. However, avoiding or improving these zones should be considered at this phase of the project.

Avalon and Colorado Avenue Intersection

According the preliminary pipe profiles the planned 60-inch sewer trunk line at the Avalon and Colorado Avenue intersection will be installed approximately 21.5 ft to 26.5 ft below existing grade (elevations 54 ft to 49 ft). Soils that we encountered within 30 ft of the surface were medium dense poorly graded sand, silty sand and sandy silt. Based on our experience in Modesto these materials will likely cave during excavation and require a detail shoring program. Nearby residences and utilities will likely make trench sloping in this area difficult, if not impossible.

Based on our soil exploration we expect the soils to be readily excavated with conventional equipment however based on the proposed sewer depth a longer reach (arm) excavator might need to be used. Based on the preliminary investigation we do not expect ground water to be encountered in this area.

ADDITIONAL GEOTECHNICAL SERVICES

Additional explorations, laboratory testing, and analysis will be necessary to provide design level recommendations for the project.

LIMITATIONS

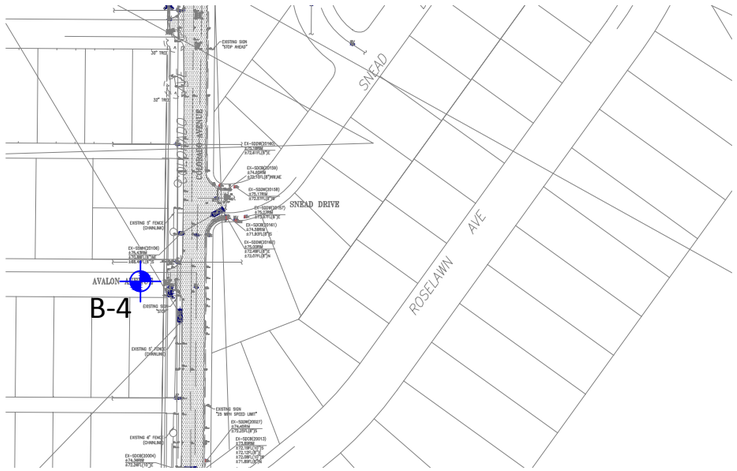
CAINC performed services in accordance with generally accepted geotechnical engineering principles and practices currently used in this area. Where referenced, we used ASTM or Caltrans Standards as a general (not strict) *guideline* only. We do not warranty our services. Additional exploration, laboratory testing, and analysis is required to provide design level recommendations for the project. Do not use or rely on this report for final design or different locations or improvements without the written consent of Crawford & Associates, Inc. (CAInc).

Our scope for this report did not include evaluation of on-site hazardous material, flood potential, biological pollutants or laboratory testing.

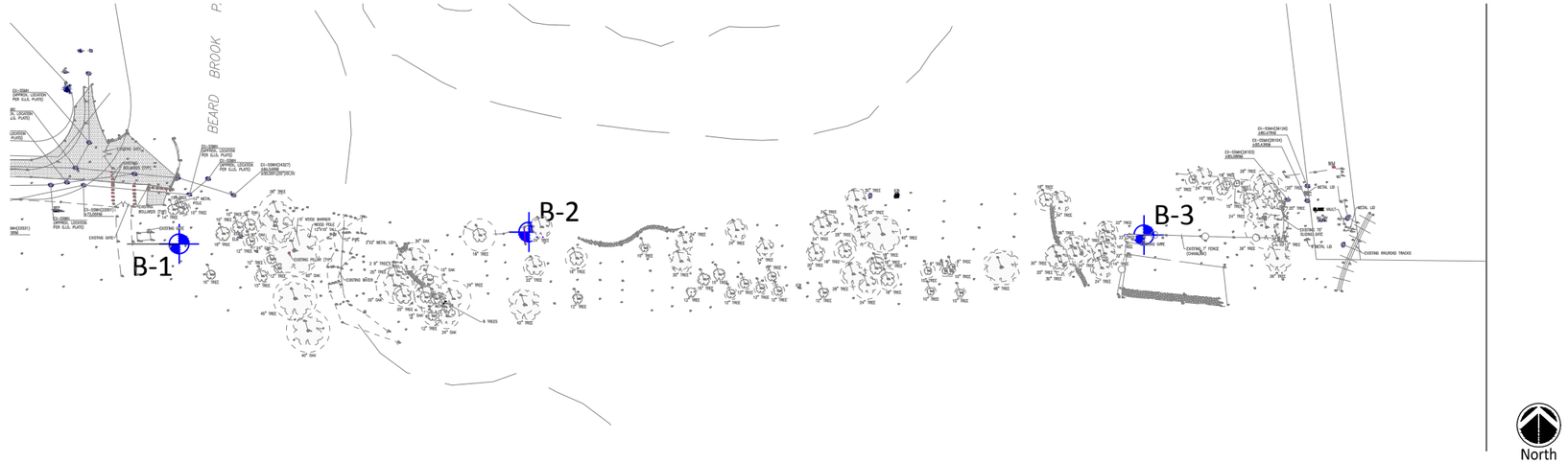
CAInc relied on existing information prepared by others for nearby improvements. We assume the information in these reports, boring logs, and laboratory results are correct.

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

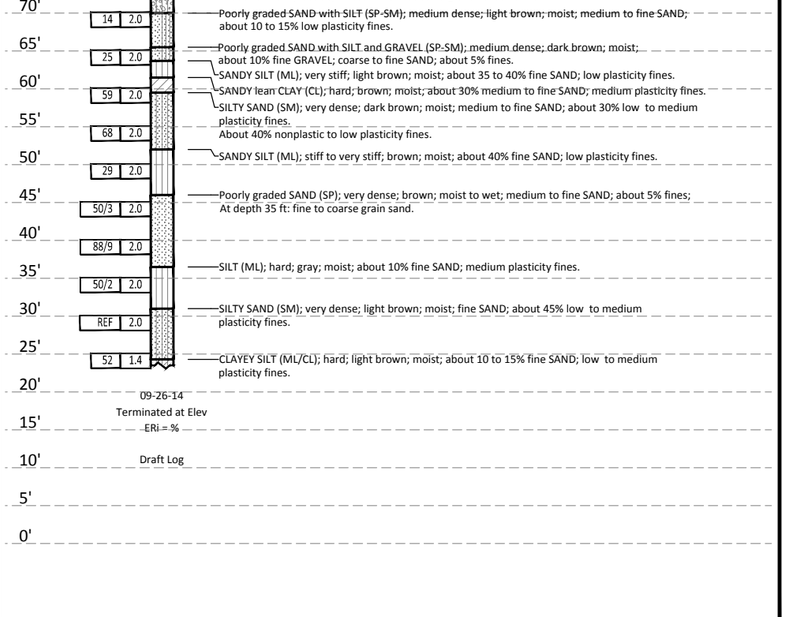
Log of Test Borings



PLAN (B-4) 1"=200'

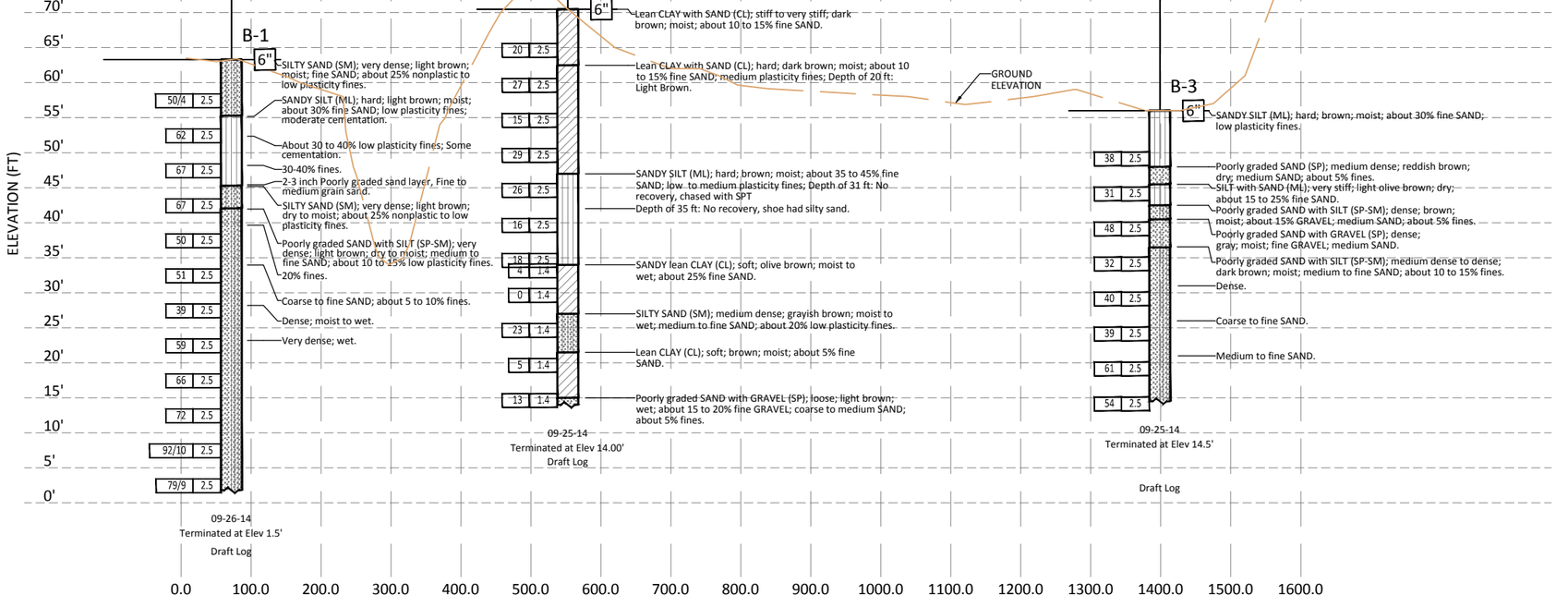


PLAN (B-1, B-2, B-3) 1"=200'



PROFILE (B-4)

Horizontal Scale: 1"=200'
Vertical Scale: 1"=20'



PROFILE (B-1, B-2, B-3)

Horizontal Scale: 1"=200'
Vertical Scale: 1"=20'

NOTES:
1. Field classification of soils was in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010). See Log of Test Borings No. 2, "Soil Legend".
2. Standard Penetration tests were performed using in accordance with ASTM D 1586-99 using a hammer operated with an automated drop system. Drill rods were 1 5/8-inch diameter "A"-rods; sampler was driven with stainless steel liners.
3. "2.4 inch sampler": ID=2.4 inch, OD=2.9 inch. "2.0 inch sampler": ID=2.0 inch, OD=2.5 inch. Both driven in same manner as SPT ("1.4 inch") sampler.
4. If laboratory tests are not shown as being performed, the soil descriptions presented in the LOTB are based solely on the visual practices described in this Manual.
5. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with the Caltrans Soil & Logging, Classification, and Presentation Manual (June 2010). Where less than 0.5 inches of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated.
6. Consistency of soils shown in ( ) where estimated.
7. Ground water surface (GWS) elevations in the borings indicated on the Log of Test Boring Sheets reflect the fluid level in the borings on the specified date.
8. Ground water surface elevations are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services
1165 Scenic Drive, Suite B
Modesto, CA 95350

Project Mgr.	BDC	10/27/14
Project Eng.		
Designer		
Checked By		
Drawn By	SJC	10/27/14
	By	Date

City of Modesto
River Truck Realignment

Modesto, CA

DRAFT
Log of Test Borings

Project No.	14-159.1
Scale	As Noted
Date	10/27/14

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

PRELIMINARY GEOLOGY/GEOTECHNICAL STUDY (15%)

File: 14-159.1
August 11, 2014

Mr. Tim Loper
Carollo Engineers, Inc.
7580 North Ingram
Fresno, CA 93711

Subject: **PRELIMINARY GEOLOGIC/GEOTECHNICAL MEMORANDUM**
River Trunk Realignment, Beard Brook Siphon and Cannery Segregation Diversion Structure Project
Modesto, California

Dear Mr. Loper,

CAInc has completed a Preliminary Geologic/Geotechnical Memorandum for the subject project in accordance with our agreement. This memorandum is based on existing geologic and subsurface information and is intended for use in preparation of the Feasibility Study (15% Design). Further geotechnical study, including selected test borings and laboratory tests, will be completed for the Preliminary Design Report (35% Design) phase.

To prepare this Memorandum, CAInc completed the following:

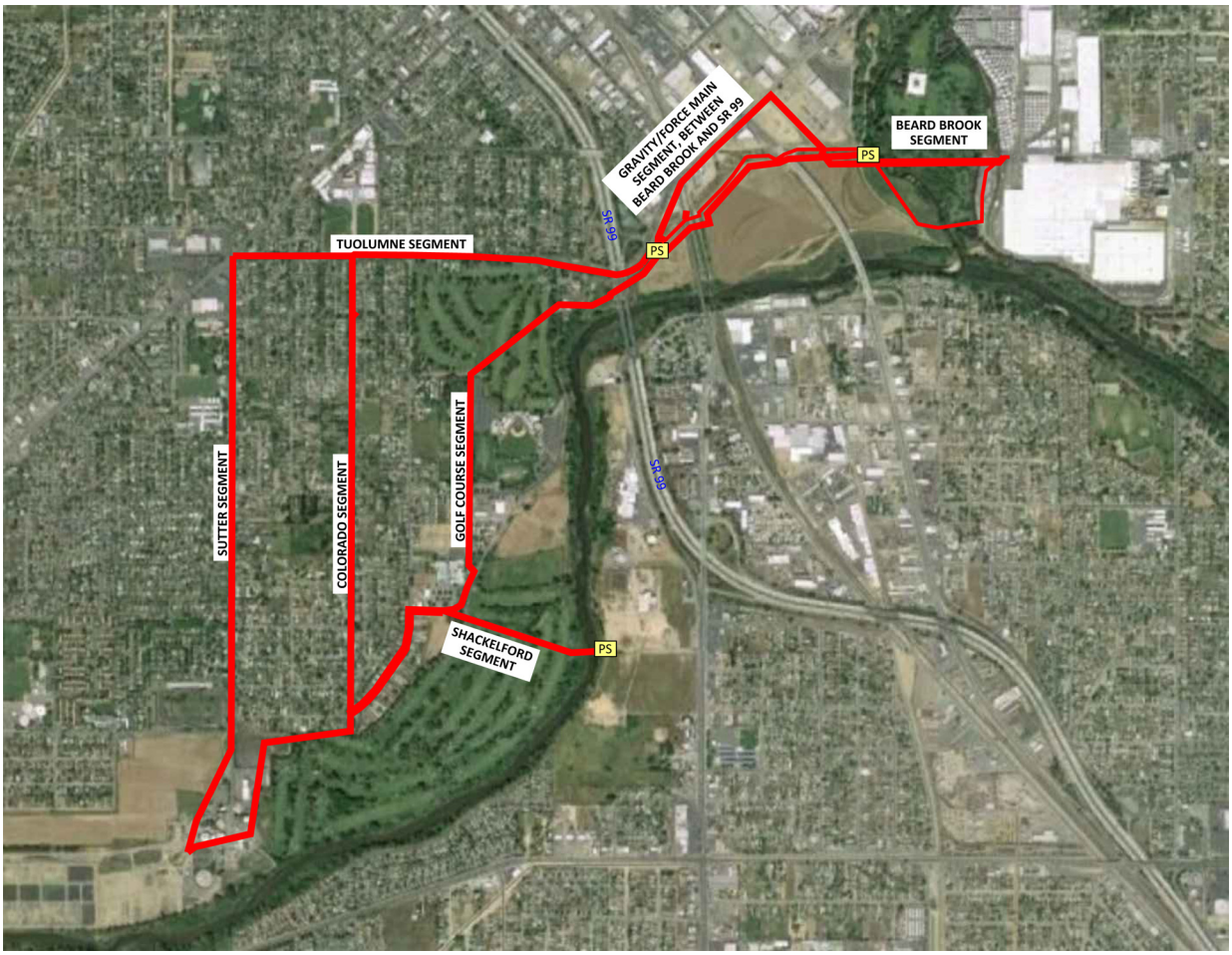
- Discussed the project with Carollo Engineers and reviewed preliminary plans showing alternative pipeline alignments.
- Reviewed published geologic/soils mapping and seismic data.
- Reviewed available subsurface data from selected nearby projects.
- Conducted a site review to assess the existing site conditions.

PROJECT AND SITE DESCRIPTION

The project includes the development of alternatives to address flow capacity deficiencies and aging infrastructure for the River Trunk, Sutter Trunk, Cannery Segregation Line (CSL) and Beard Brook Siphon facilities.

The design team is currently considering various alternative segments using existing and proposed pipelines to achieve the project objectives. The various segments being considered are shown below in Figure 1.

Figure 1 - Vicinity Map

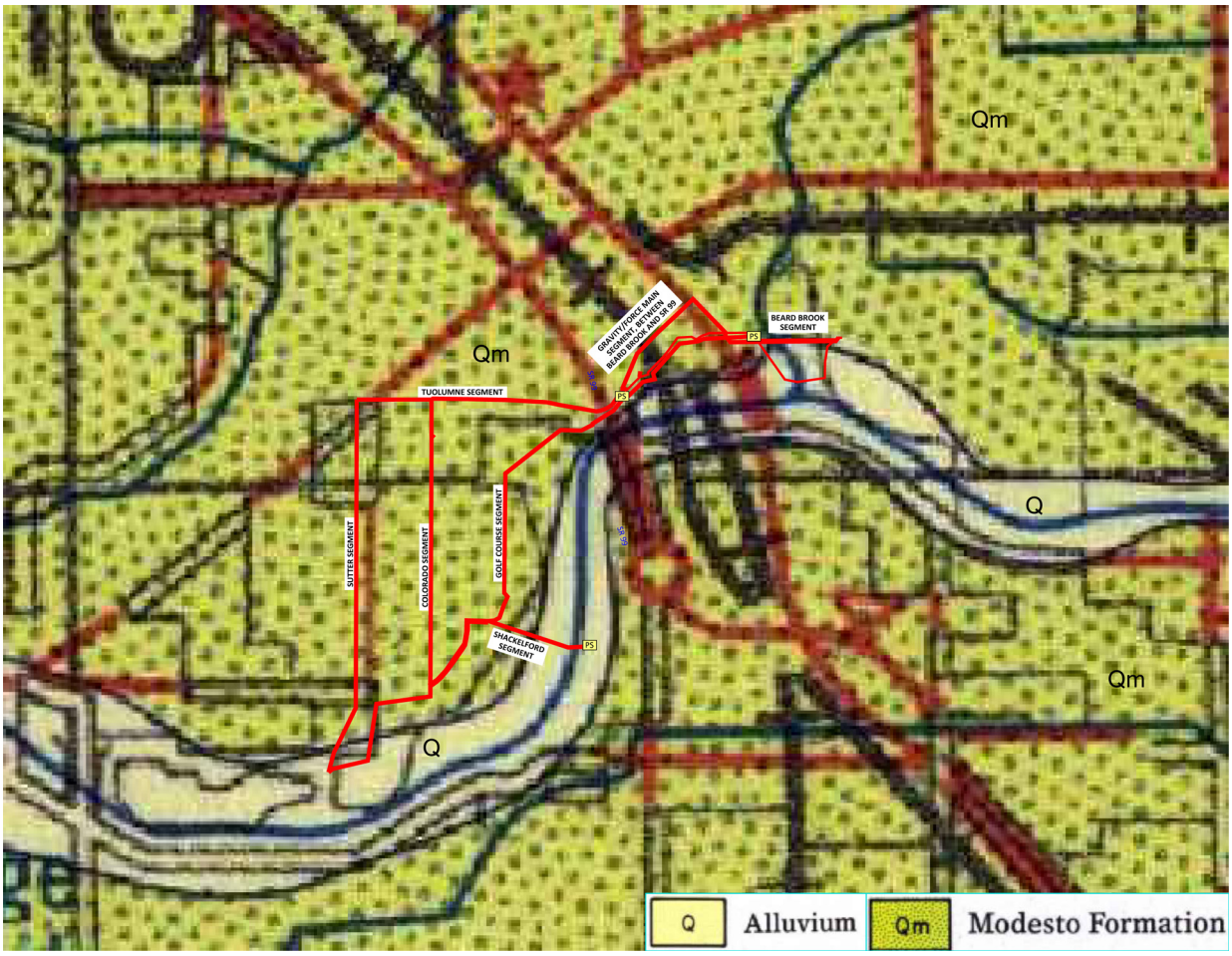


GEOLOGIC SETTING

The site is shown on published geologic mapping[1] to be underlain by Quaternary alluvium near the Tuolumne River; these soils are typically unconsolidated, non-marine sand, silt and clay. Late Pleistocene sediments are mapped away from the river and underlying the Quaternary alluvium; these soils are mapped as Modesto Formation, comprised mostly of semi-consolidated, non-marine sand and silt. Figure 2 shows the regional geology.

[1] Wagner, D.L., et al., 1991, *Geologic Map of the San Francisco – San Jose Quadrangle,* California Geologic Survey.

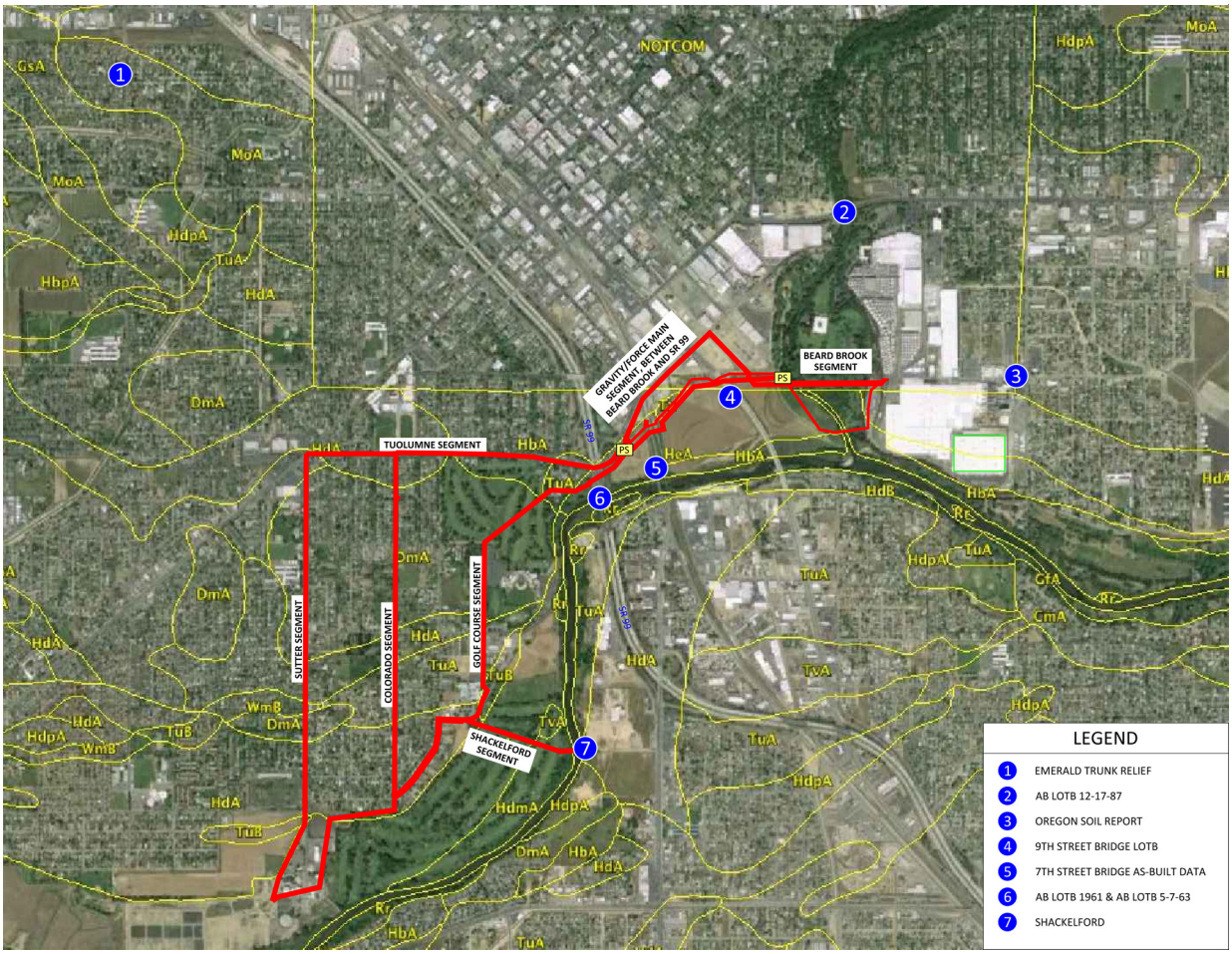
Figure 2 - Geologic Map



SOIL SURVEY

The USDA soil survey shows the near surface soils within the project area to be classified as Handford (H_bA, H_dA, H_eA), Dinuba (D_mA), and Tujunga (T_uA) soil units. These units consist of low plasticity sandy silt (ML), and fine to medium grained silty sand (SM). Figure 3 shows the soil survey map.

Figure 3 - Soil Survey



SUBSURFACE DATA

Several sources of subsurface data were reviewed for this project. These include:

- Log of Test Borings, SR99 Bridge @ Tuolumne River, 1961 & 1963
- Log of Test Borings, 7th Street Bridge @ Tuolumne River, January 2000.
- Log of Test Borings, 9th Street Bridge @ Tuolumne River, 1954 and 1999 Geotechnical Explorations.
- 2009 Log of Test Borings for the Shackelford Pipeline Tuolumne River Crossing
- Emerald Trunk Sewer Rehabilitation Project, 2010
- Percolation and R-value Testing Report for the Gallo Glass Company, February 2013
- Log of Test Borings, Yosemite Blvd @ Tuolumne River, 1987

Locations of these data sources are shown on the Soil Survey Map, Figure 3.

A review of the subsurface conditions at these sources shows sediments consistent with the published geologic and soils mapping. In general, the soils near the Tuolumne River consist of loose sand and gravel to depths of approximately 20-30 feet (consistent with unconsolidated alluvium), underlain by dense sand and silt (consistent with Modesto Formation deposits). Away from the river, the data shows mostly medium dense to dense sand and silt (likely Modesto Formation), underlying a shallow surface unit (generally less than 5 ft thick) of loose soil (young alluvium or disturbed soils).

Based on these data, we estimate the River Trunk project area and the Cannery Segregation Diversion Structures are underlain predominately by medium dense to dense silt and sand (Modesto Formation sediments) and the Beard Brook Siphon by loose, river alluvium.

GROUNDWATER

Based on the subsurface, our experience in the area, and regional data reviewed for this memorandum, groundwater levels approximate the level of the Tuolumne River at locations adjacent to the river and elsewhere are at depths of about 30-50 feet below ground surface (bgs). These levels are consistent with published groundwater data[2] that shows area ground water at relatively uniform levels ranging from approximately elevation 35 to 45 feet mean sea level (MSL). In general, groundwater is shallowest in Western Modesto and deepens to the east.

Adjacent to the Tuolumne River, groundwater will likely be impacted by seasonal river fluctuations. Locally, ground water may occur as shallow, perched water, especially in the winter months. Overall groundwater levels may be dependent on variable factors such as precipitation, irrigation and pumping of wells.

SITE SEISMICITY

The site does not lie within or adjacent to an Alquist-Priolo Earthquake Fault Zone for fault rupture hazard and no known active faults are mapped within or through the project area.

According to the United States Geological Survey (USGS) web site (www.usgs.gov), the closest Quaternary fault is the Great Valley Fault 07 Fault (Orestimba), located approximately 15.5 miles southwest of the project site. The Great Valley Fault has a maximum moment magnitude of 6.7.

Based on the USGS Probabilistic Seismic Hazards Mapping Ground Motion web site, a maximum peak horizontal ground acceleration (PGA) on the order of 0.24g can be expected in the general project area for a seismic event with a 10% probability of exceedance in 50 years (design basis earthquake). We show the 2013 California Building Code (CBC) and ASCE 7-10 seismic design parameters below for a location near the center of the project area, assuming Site Class D soils.

[2] California Department of Water Resources and Burow et al.,2004

Seismic Design Parameters

Site Class	D
S_s – Acceleration Parameter	0.963
S_1 – Acceleration Parameter	0.347
F_a – Site Coefficient	1.115
F_v – Site Coefficient	1.706
S_{MS} – Adjusted MCE* Spectral Response Acceleration Parameter	1.074
S_{M1} – Adjusted MCE* Spectral Response Acceleration Parameter	0.592
S_{DS} – Design Spectral Acceleration Parameter	0.716
S_{D1} – Design Spectral Acceleration Parameter	0.395
T_L – Long-Period Transition Period**	12 sec

* Maximum Considered Earthquake
** Figure 22-12, ASCE 7-10

PRELIMINARY CONCLUSIONS

Pipe/Structure Support

In general, we expect soil support for the proposed pipelines and diversion structures is available within native, undisturbed materials. Typical pipe support on a minimum of 4-inches of granular bedding (and in accordance with the pipe manufacturer's recommendations) is considered reasonable for preliminary design. Based on this limited review, we do not anticipate extensive areas of soft, unsuitable pipe subgrade, although local areas of soft subgrade can occur under conditions of fine-grained soils and shallow groundwater. Typical mitigation in such areas may include replacement of unsuitable subgrade with ¾-inch minus crushed rock (minimum of 6 inches), enclosed in geotextile filtration fabric.

Native soils appear to be mostly granular, but may contain a significant amount of fines (passing #200 sieve). These soils may not meet the City of Modesto's specifications for bedding or pipe zone backfill.

Support for the diversion structures is expected to be available within undisturbed, native soils for concrete mat or strip footings, or on a compacted granular base (minimum of 6 inches of Class 2 baserock), if necessary. For preliminary design, assume foundations embedded a minimum of 24 inches below the ground surface and a minimum of 12 inches into firm native soil or compacted fill/backfill.

Excavation/Stability

Based on the mapped geologic conditions and our preliminary review of subsurface conditions, we expect the soils underlying the alignments to be readily excavated with conventional equipment (backhoe and moderate size excavator). For project planning and design, anticipate temporary trench sloping and shoring in accordance with Type C soil requirements (per OSHA), which includes sloping at a 1.5:1 (H:V) gradient or flatter.

Groundwater/Dewatering

Based on the anticipated groundwater elevations and pipe excavations generally less than 25 feet deep, we do not expect groundwater to impact the project along the majority of the alignments. For planning and preliminary design purposes, assume isolated sump pumping will be adequate to control localized seepage into excavations.

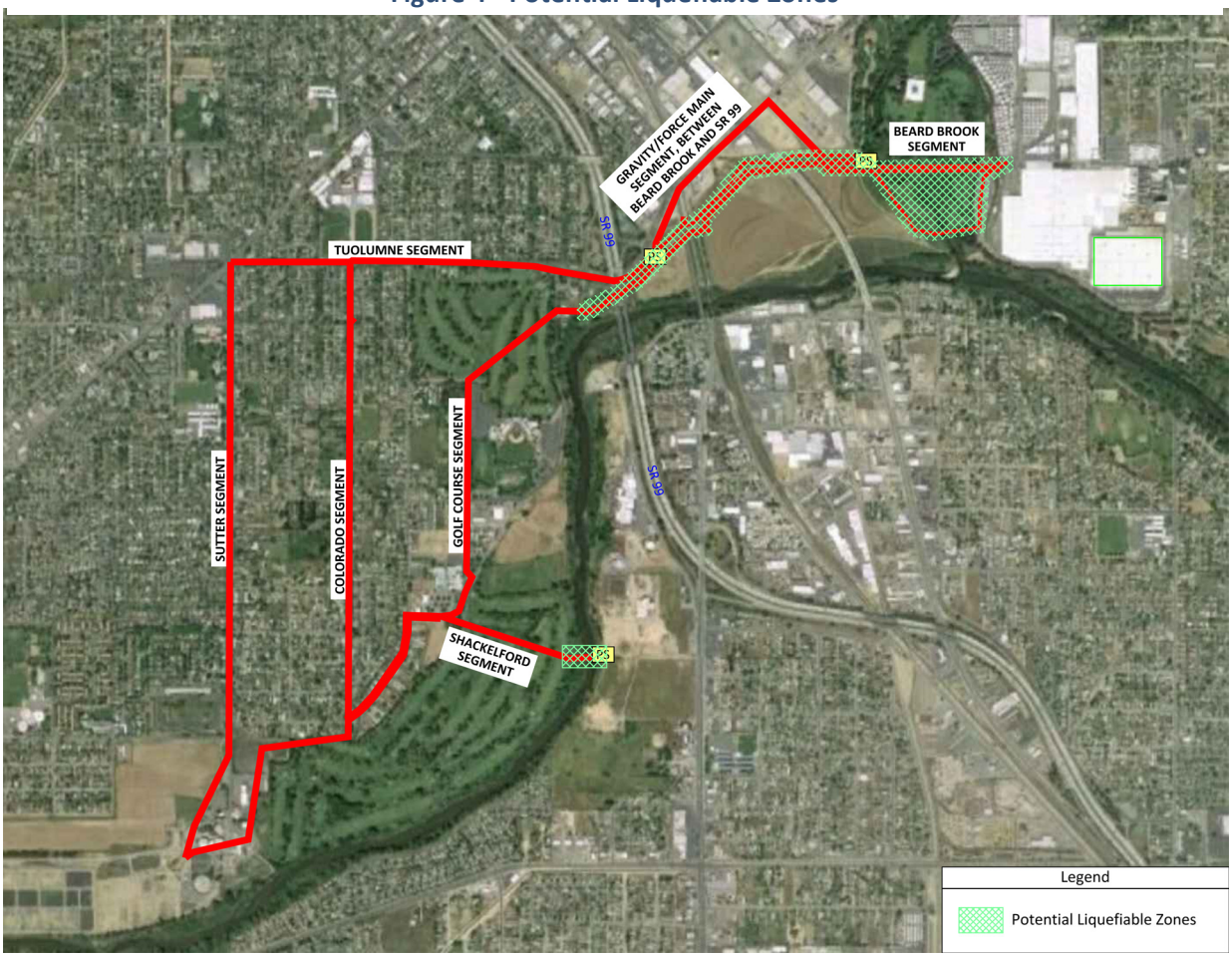
Where excavations exceed 25 feet, or at locations near the Tuolumne River, dewatering may be required. In these areas, more extensive dewatering (such as dewatering wells and/or additional sumps) may be required depending on final pipe depth, installation methods, and groundwater elevations at the time of construction.

Liquefaction

Liquefaction can occur when loose to medium dense, granular, and certain soft, fine grained, saturated soils (generally within 50 feet of the surface) are subjected to ground shaking. Based on our preliminary review of the anticipated soil and groundwater conditions, we estimate some project areas have the potential for soil liquefaction and will require further consideration/analysis during project design. Liquefaction will likely impact the Beard Brook Segment, the Gravity/Force Main between Beard Brook and SR 99, and the eastern portions of the Golf Course (Shackelford) Segments.

We show the estimated areas of potential liquefaction on Figure 4.

Figure 4 - Potential Liquefiable Zones



Additional Study

CAInc will complete test borings and laboratory testing as part of the Preliminary Design Report (35% Design). This will include four borings at key crossing locations such as Beard Brook crossing, SR99 crossing, 7th Street/UPRR crossing, 9th Street crossing, and/or at other key locations to help with the PDR. Laboratory testing is expected to include moisture content, dry density, sieve analysis, plasticity index, unconfined compression tests, soil corrosivity and R-value. This study will be summarized in a Preliminary Design Geotechnical Report.

Additional study will be completed for final design (PS&E) once a final alignment is selected and other project details are defined. This (design-level) study will include additional test borings, laboratory testing and engineering analysis. A final Geotechnical Report will be completed for this phase of study.

LIMITATIONS

CAInc prepared this report based on existing data in the project vicinity and is not intended for project design. Further study, including site-specific exploration and testing, is anticipated in future phases of the project. This report should be reviewed and modified if the project or site conditions change or if further data is made available.

Thank you for selecting CAInc to be on your design team. Please call if you have questions or require additional information.

Sincerely,

Crawford & Associates, Inc.

Benjamin D. Crawford, PE, GE
Principal Geotechnical Engineer

APPENDIX B – POTHOLING PLAN

POTHOLE LOCATIONS

CITY OF MODESTO

RIVER TRUNK REALIGNMNET, BEARD BROOK SIPHON AND CANNERY SEGREGATION LINE IMPROVEMENT PROJECT

NUMBER	SHEET	UTILITY	STA	COMMENT
Plan and Profile Sheets				
1	00P07	Gas	A69+80	There is a Gas Valve next to the alignment. Does the NG line turn perpendicular and then run alongside the new pipe?
2	00P09	Water	A96+00	Check horizontal distance from new alignment.
3	00P14	SD	C25+40	Ex 96" SD is very close to jack and bore vetically.
4	00P18	Water	E16+60	Water line croses alignment at shallow angle.
5	00P23	NG	G10+00	NG line very close to connection.
6	00P23	NG	G19+00	NG lines are very close horizontally to alignment.
7	00P24	SS	G19+80	SS runs parallel to alignment.
8	00P24	NG	G20+60	NG lines are very close horizontally to alignment.

APPENDIX C – CONDITION ASSESSMENT TM (TM2)



01/12/15



01/12/15

CITY OF MODESTO
WASTEWATER COLLECTION SYSTEM IMPROVEMENTS

RIVER TRUNK, SUTTER TRUNK, BEARD BROOK SIPHON, AND CANNERY SEGREGATION LINE

CONDITION ASSESSMENT TECHNICAL MEMORANDUM

DRAFT

January 2015

2700 YGNACIO VALLEY ROAD, SUITE 300 • WALNUT CREEK, CALIFORNIA 94598 • P. 925.932.1710 • F. 925.930.0208
pw://Carollo/Documents/Client/CA/Modesto/9551A00/Deliverables/CA_TM

CITY OF MODESTO
WASTEWATER COLLECTION SYSTEM IMPROVEMENTS

RIVER TRUNK, SUTTER TRUNK, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

TECHNICAL MEMORANDUM

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RIVER TRUNK, SUTTER TRUNK, BEARD BROOK SIPHON, AND CANNERY SEGREGATION LINE PROJECT

1.0 INTRODUCTION

The objective of this technical memorandum (TM) is to document the condition assessment of selected portions of the Sutter Trunk Sewer, the River Trunk Sewer, and the Cannery Segregation Line (CSL). The condition assessment was performed in conjunction with the Preliminary Design Report (PDR) to identify capital improvement projects related to sewer rehabilitation, and evaluate alternative wastewater flow routing schemes.

2.0 TRUNK SEWER DESCRIPTIONS

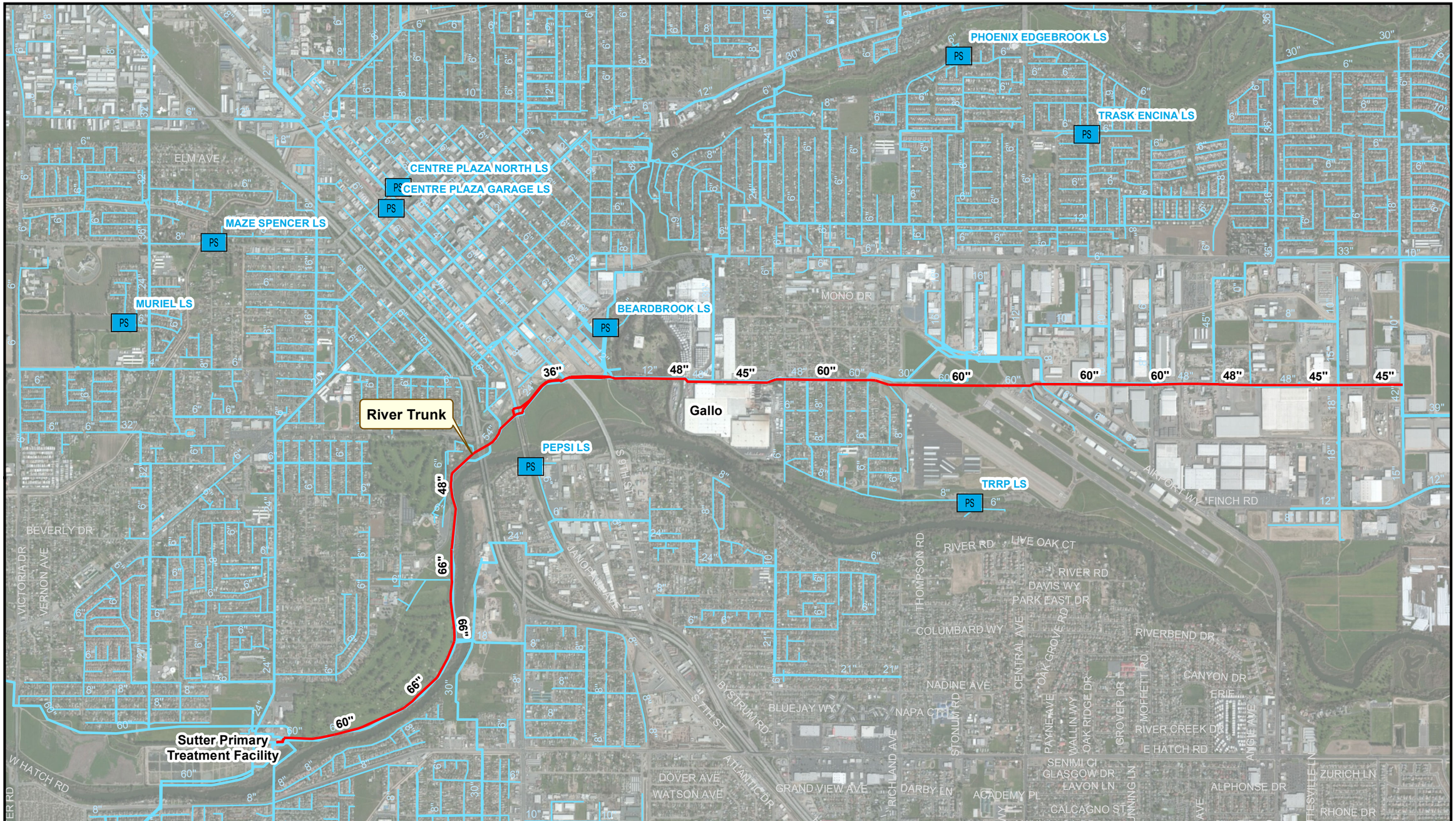
This section describes the existing River Trunk Sewer, Sutter Trunk Sewer, and the CSL.

2.1 River Trunk

Originally constructed in the 1940's, the River Trunk is approximately five miles long, and conveys flows from six major tributaries of the City's collection system. All segments of the River Trunk were constructed of unlined reinforced concrete pipe (RCP) material. Figure 1 presents the River Trunk alignment. The River Trunk begins near the intersection of Beard Avenue and Nathan Avenue and flows west along Nathan Avenue and Oregon Drive to Beard Brook Park. Pipeline sizes range from 45 to 60 inches in diameter. At the Beard Industrial District, the River Trunk crosses Dry Creek through a single 48-inch diameter, inverted siphon. Between Beard Brook Park and the Union Pacific Railroad (UPRR) crossing, the River Trunk alternates as single and parallel segments with segments varying between 24-inches and 48-inches in diameter. West of the UPRR crossing, a 48-inch diameter pipeline runs west along the Tuolumne River and increases to a 60-inch diameter pipeline in the lower reaches near the Sutter Avenue Primary Treatment Facility (SAPTF).

2.2 Sutter Trunk

The Sutter Trunk was constructed in the 1965. All segments of the Sutter Trunk were constructed of unlined RCP material. The Sutter Trunk begins near the intersection of Jefferson and 8th Street and runs south of Jefferson Street, Paradise Avenue, and Sutter Avenue down to the SAPTF. The Sutter Trunk is approximately 13,000 linear feet long and ranges in size from 16 to 24-inches in diameter. It should be noted that portions of the Sutter Trunk have been rehabilitated. Figure 2 presents the existing Sutter Trunk alignment.



Legend

PS Lift Station

River Trunk

Other Pipelines

8" and Smaller

Greater than 8"

carollo

0 1,500 3,000 Feet

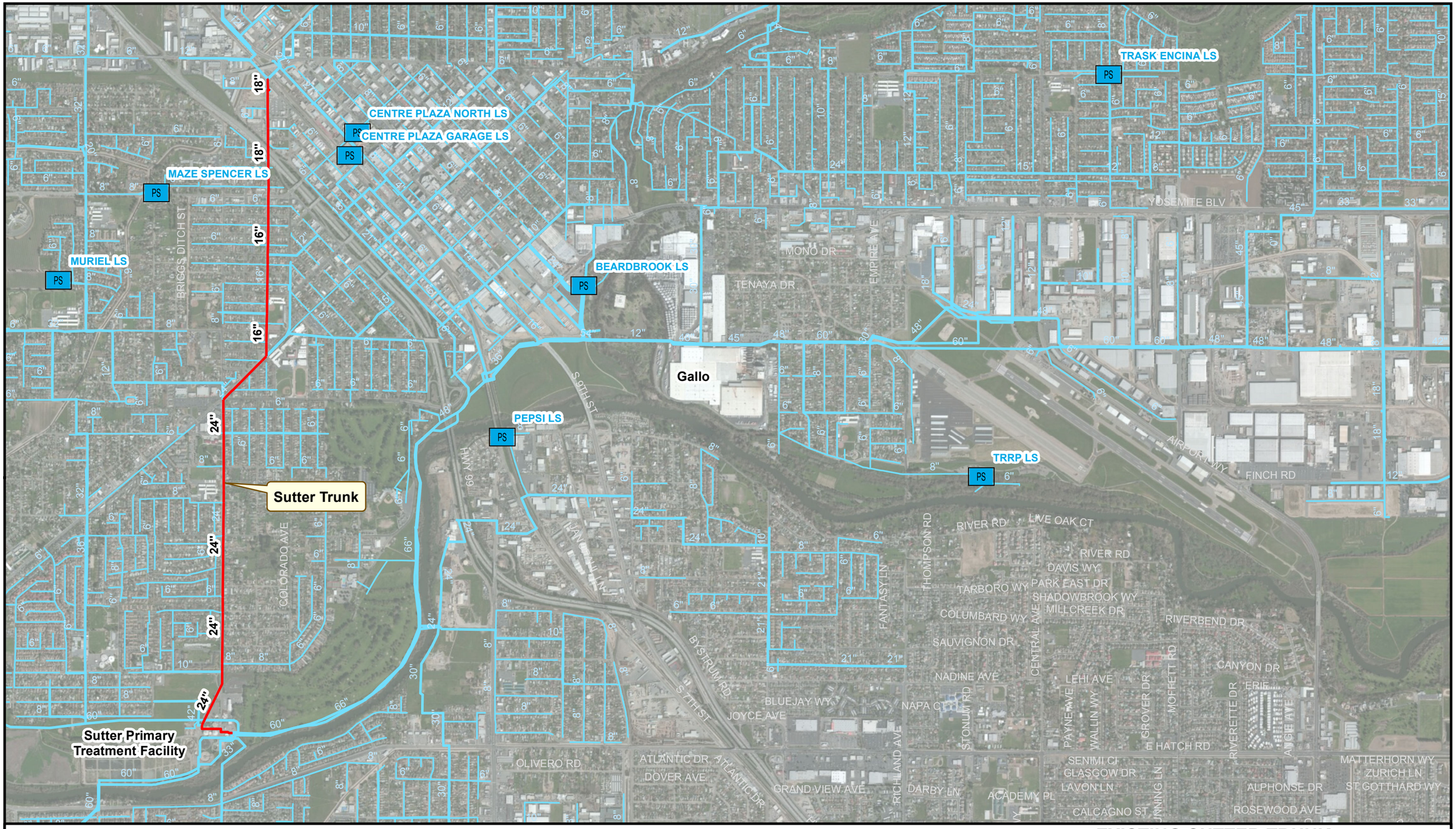
EXISTING RIVER TRUNK ALIGNMENT

FIGURE 1

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 03 - Existing River Trunk Alignment.mxd



Legend

PS Lift Station

Sutter Trunk

Other Pipelines

8" and Smaller

Greater than 8"

N

0 1,500 3,000 Feet

EXISTING SUTTER TRUNK ALIGNMENT

FIGURE 2

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 04 - Existing Sutter Trunk Alignment.mxd

2.3 Cannery Segregation Line (CSL)

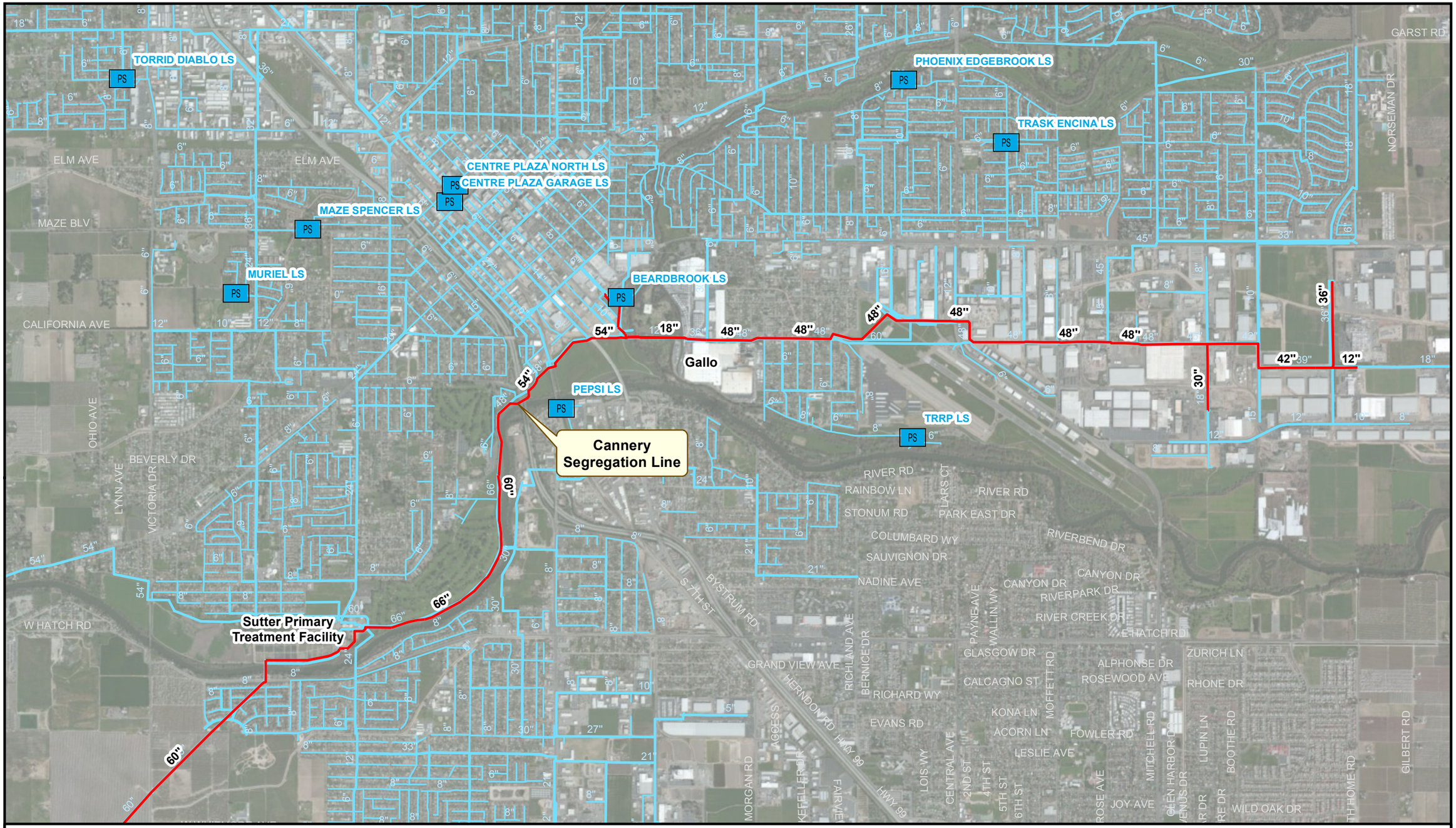
The CSL was originally one of the two twin River Trunk sewers. In 1998, it was dedicated to conveying only industrial wastewater that is separated from domestic wastewater. Figure 3 illustrates the pipeline routing. The CSL begins at the Sutter Avenue Plant as a 66-inch diameter pipe and parallel to the River Trunk and the Tuolumne River. The CSL crosses beneath Highway 99 and the UPRR. The CSL crosses under Dry Creek in a 12-inch, 18-inch, and 24-inch diameter triple barrel inverted siphon, where it continues east in Oregon Drive. Between Dry Creek and Garner Road, the diameter ranges between 12-inches and 48-inches. The total length of this pipeline is approximately 12-miles. All segments of the CSL were constructed of unlined RCP material. In 2007, California experienced a wet winter that created record flows in the Tuolumne River. High river flows eroded the bank of the river and exposed a portion of the CSL. The City implemented emergency repairs by adding erosion protection (rip-rap) along the affected area of the river bank. Recently, as part of this condition assessment, other areas of the River Trunk were found to be exposed.

2.4 Corrosion of Concrete Pipes

The trunk sewers evaluated are constructed of RCP, which is susceptible to corrosion attack on the pipe interior.

The process of corrosion is illustrated in Figure 4. Hydrogen sulfide gas inside the pipeline, forms relatively weak thiosulfuric and polythionic acids, and carbon dioxide from the air forms carbonic acid. These acids work together to slowly lower the pH of the concrete. When the pH of the concrete drops to 9, Thiobaccillus bacteria form a slime layer on the sewer walls. The slime layer reacts with oxygen and hydrogen sulfide gas to form sulfuric acid. Sulfuric acid weakens the concrete through two different mechanisms.

The acid reacts with the calcium in the concrete and allows it to be removed in solution. The sulfuric acid also reacts with calcium hydroxide in the concrete, which converts to ettringite (gypsum). Ettringite is an expansive material with virtually no strength. These two mechanisms are referred to as Microbiologically Induced Corrosion (MIC).



Legend

PS Lift Station

Cannery Segregation Line

Other Pipelines

8" and Smaller

Greater than 8"

N

0 1,900 3,800 Feet

carollo

EXISTING CANNERY SEGREGATION LINE

FIGURE 3

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 05 - Existing Canary Segregation Line.mxd

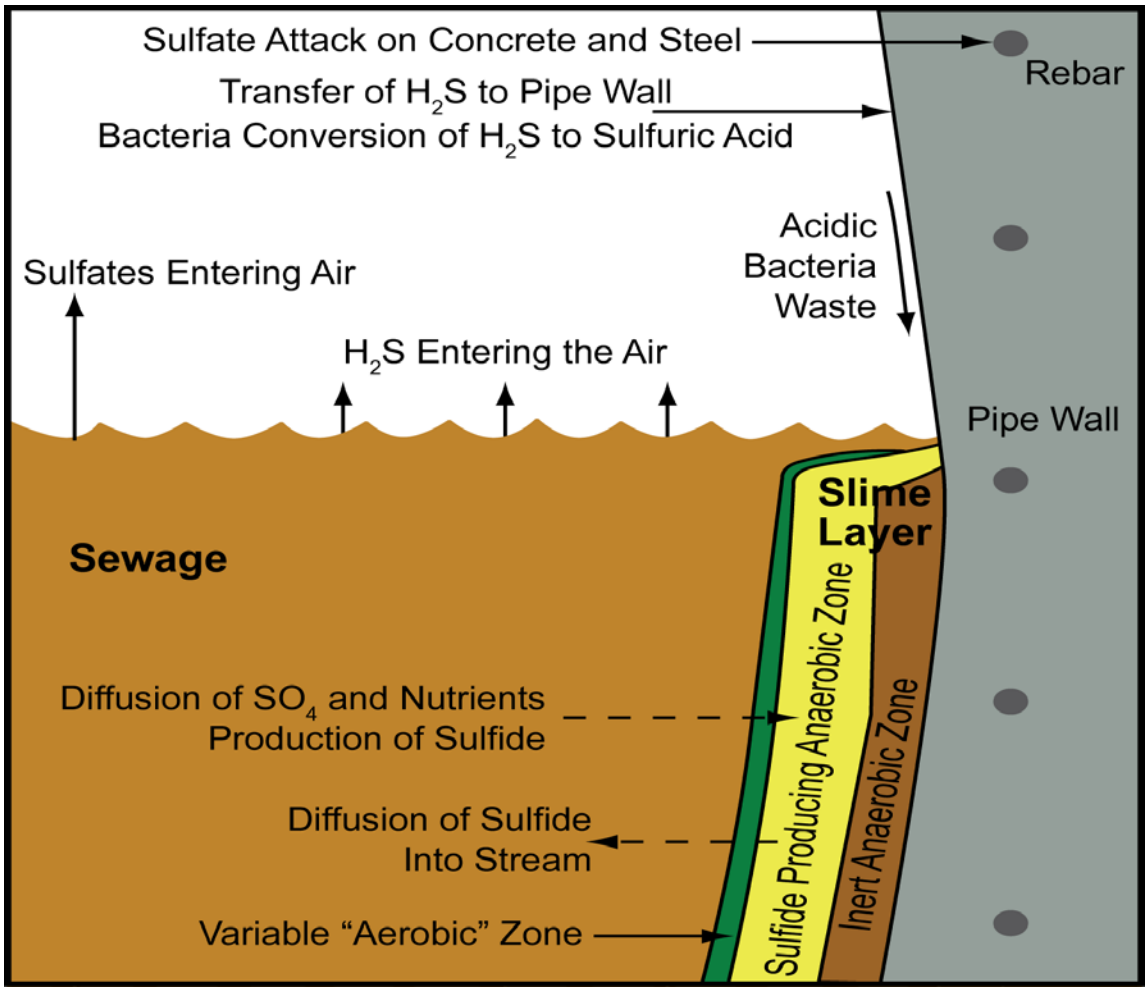


Figure 4 MIC Cycle in Municipal Sewers

Corrosion typically does not occur uniformly along a pipe length. The degree of corrosion varies according to the alkalinity of the cement; the variations of the aggregate; wastewater strength; and turbulence in the wastewater which releases hydrogen sulfide to the air space.

3.0 FIELD INVESTIGATION APPROACH

To control costs, the field investigation was limited to the lower reaches of the three trunk sewers, approximately 50-percent of the entire length. However, the conditions found in this limited investigation are expected to be representative of the entire length of the trunk sewers. The portions of the trunk sewers assessed included the following:

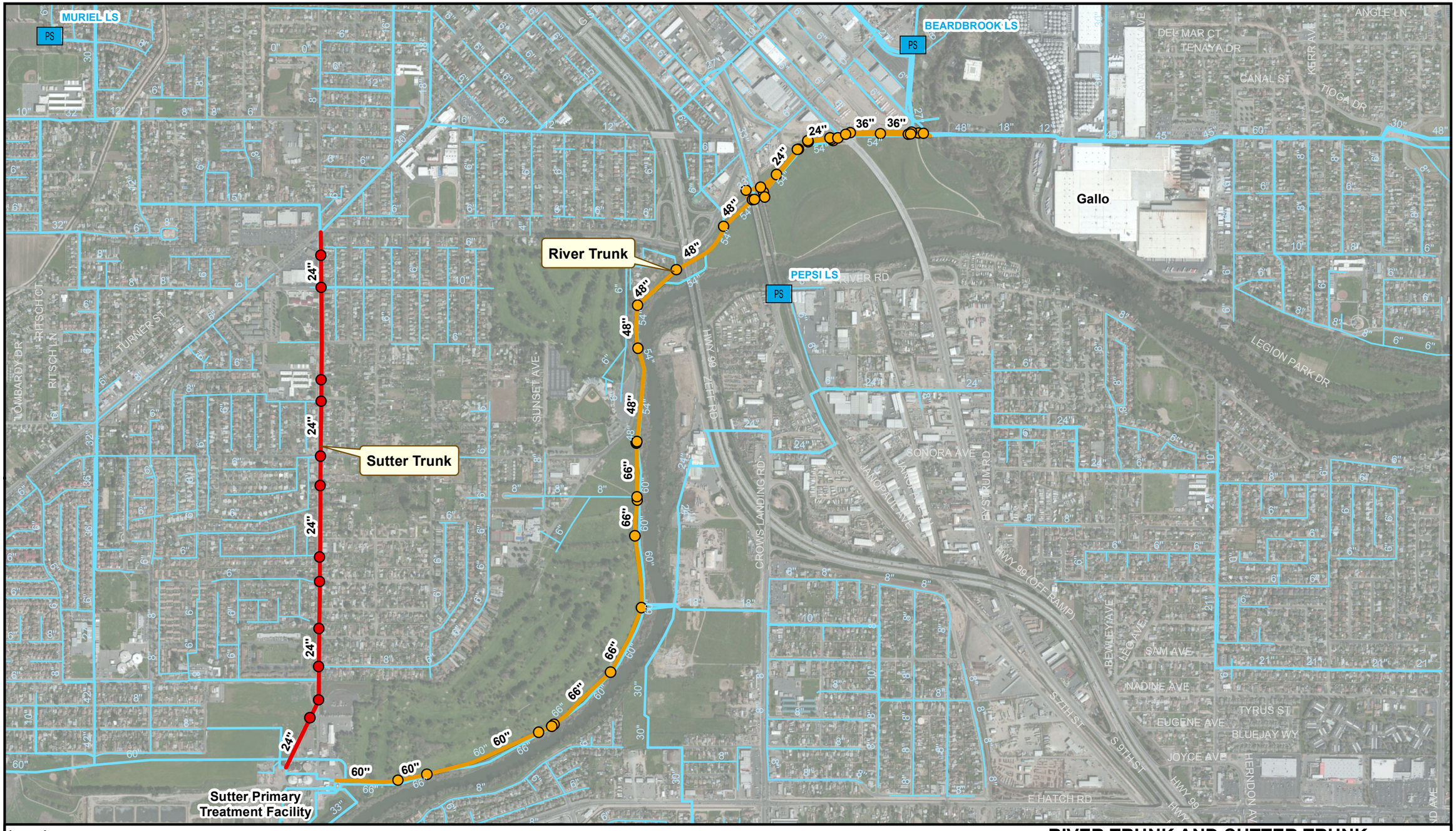
- River Trunk:
  - Length = Approximately 14,496 lineal feet starting at the SAPTF and continuing upstream.
  - No. of Manholes = Approximately forty (40) each within the identified length above.
- Sutter Trunk:
  - Length = Approximately 6,493 lineal feet starting at the SAPTF and continuing upstream.
  - No. of Manholes = Approximately fifteen (15) each within the identified length above.
- CSL Pipeline:
  - Length = Approximately 6,662 lineal feet starting at the SAPTF and continuing upstream.
  - No. of Manholes = Approximately twenty-six (26) each within the identified length above.

Figure 5 delineates the pipe segments assessed for the River Trunk and Sutter Trunk. Figure 6 presents the portion of the CSL that was assessed.

3.1 Closed Circuit Television (CCTV) Inspection Methodology

CCTV inspection was performed by L.R. Paulsell Consulting for the River Trunk and Sutter Trunk. Condition assessment for the CSL was based on the City's recent CCTV inspection. L.R. Paulsell Consulting's inspection used the R.S. Technical robotic inspection equipment. The robotic camera is mounted on a tracked rover.

Figure 7 shows the CCTV remote vehicle. The camera can pan 285 degrees and rotate 360 degrees while providing a 40:1 optical/digital zoom with automatic and remote focus capabilities to improve the visual inspection of defects. Utilizing the pan/tilt/zoom feature and a high-resolution camera, the unit can obtain detailed views of pipe defects above the water surface.



Legend

- River Trunk
- Sutter Trunk
- PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"

Project Alignment

- SUTTER
- RIVER

N

0 1,000 2,000 Feet

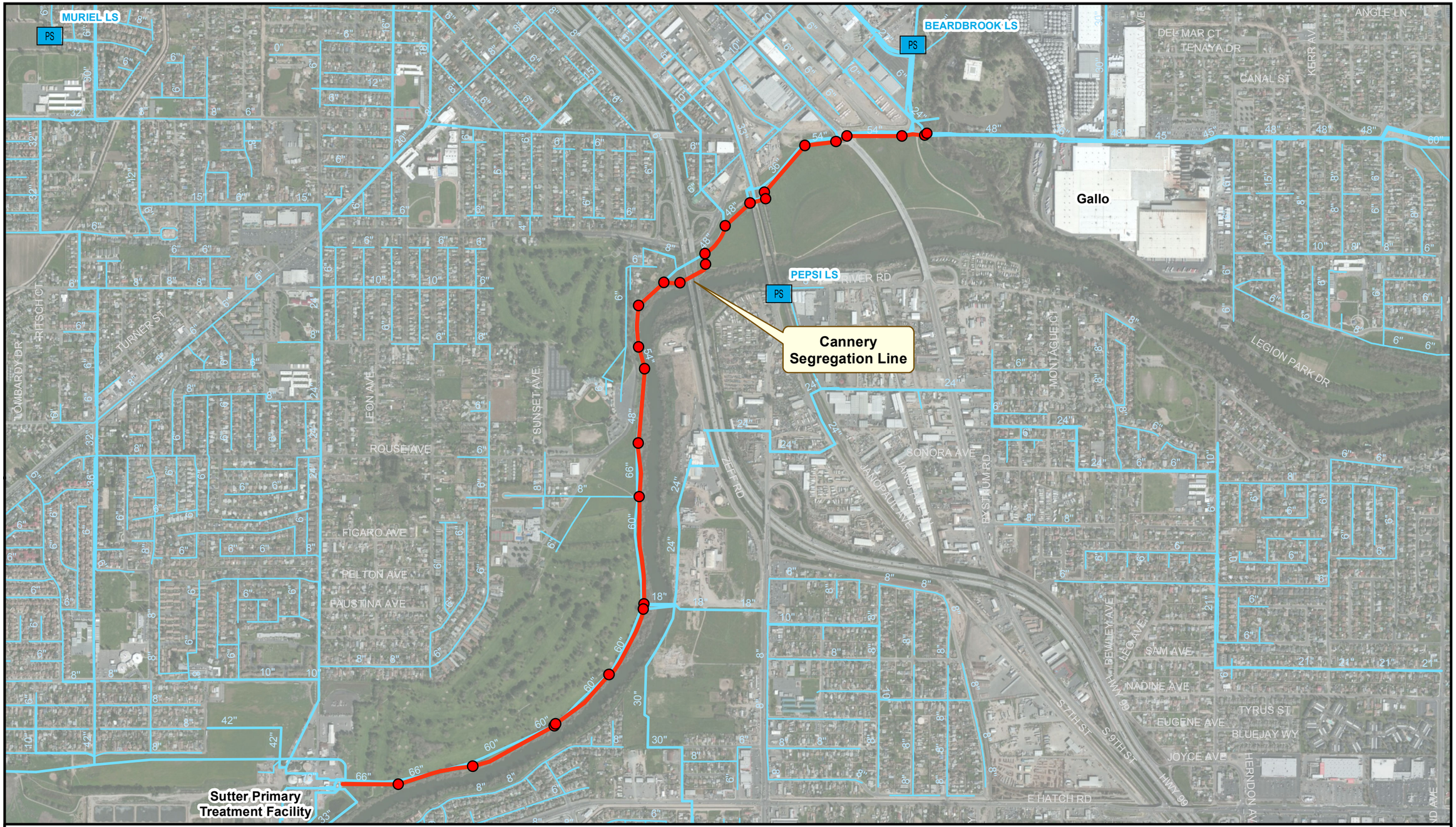
carollo

RIVER TRUNK AND SUTTER TRUNK PROJECT ALIGNMENTS

FIGURE 5

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 07 - Project Alignment Sutter & River.mxd



Legend

- PS — Lift Station
- Cannery Segregation Line

Other Pipelines

- 8" and Smaller
- Greater than 8"

Project Alignment

- CANNERY

0 1,000 2,000 Feet

CANNERY SEGREGATTION LINE TRUNK PROJECT ALIGNMENT

FIGURE 6

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 08 - Project Alignment Cannery.mxd



Figure 7 CCTV Setup

The data produced by CCTV inspection consists of digital videos of the inspected pipe and still images of selected defects. The CCTV technician inputs the identified defects, appurtenances, general pipe conditions, flow levels, weather conditions, dates, and a running distance log in the video. Each defect is coded and given a severity based on the inspected condition. Figure 8 shows a still photo from the CCTV video in the crown of the pipe.



Figure 8 Sutter Avenue CCTV Snapshot

3.2 Manhole Inspection Methodology

The manholes in the River Trunk, Sutter Trunk, and CSL were inspected manually for shallow manholes and with CCTV equipment for deep manholes. Equipment was lowered into the manhole and defects were coded similar to the trunk line inspection. Still photos were taken of the coded defects.

3.3 Methodology for Defining Sewer Defects and Condition Grades

The City adopted the National Association of Sewer Service Companies (NASSCO) standard system for identification and coding of pipeline defects. NASSCO provides uniformity in terminology and in the degree of structural and Operation and Maintenance (O&M) defects using the Pipeline Assessment and Certification Program (PACP) and Manhole Assessment and Certification Program (MACP). The inspection and condition grading of the pipelines and manholes for this project were performed by personnel trained and certified in the NASSCO PACP and MACP.

A pipe segment is defined as a piece of pipe from one pipe joint to the next pipe joint. A pipe reach is comprised of a number of pipe segments that begin and end with a manhole or inspection access point. The overall condition of a pipe reach was determined by evaluating the structural and O&M defects of the individual segments and normalizing them for each access to termination reach.

The NASSCO PACP system classifies condition grades for various pipe defects as well as guidelines for predicting when the pipe defects could fail. Table 1 is taken from the NASSCO PACP Grading System Coding Matrix.

Table 1 NASSCO PACP Condition Grade Codes

Condition Grade	Estimate of Time to Failure
5	Pipe has failed or will likely fail in next five years
4	Pipe will probably fail in 5 to 10 years
3	Pipe may fail in 10 to 20 years
2	Pipe unlikely to fail for at least 20 years
1	Failure unlikely in the foreseeable future

The following describes the methodology for evaluating the condition of the trunk sewer. The evaluation is based on three independent factors: the Segment Grade Score, the Overall Pipe Rating, and the Pipe Ratings Index.

Segment Grade Score - Each pipe segment was assigned a segment grade score using the condition grade coder. The number of occurrences of each pipe condition grade is multiplied by the respective pipe condition grade number to calculate the segment grade score. For example, six Grade 5 defects would be 6 times 5 and equates to a Segment Grade 5 score of 30. If a pipe segment has no defects of a particular grade, then the Segment Grade Score for that grade would be zero.

Overall Pipe Rating - The overall rating of the reach was calculated by adding the five Segment Grade Scores. Structural Pipe Ratings are calculated using only structural defect grades and O&M Pipe Ratings are calculated using only O&M Defect Grades.

Pipe Ratings Index - This is an indicator of the distribution of defect severity. The Pipe Ratings Index is calculated by dividing the Pipe Rating by the number of defects. For example, the Structural Pipe Ratings Index would be the Structural Pipe Rating divided by the number of structural defects. Likewise, the O&M Pipe Ratings Index would be the O&M Pipe Rating divided by the number of O&M defects. A pipe segment with a Pipe Rating of zero would have a Pipe Ratings Index of zero. A higher Pipe Ratings Index indicates a higher level of defects within the pipe.

Below is an example of the calculations for a typical pipe reach.

$$\boldsymbol{Pipe\ Rating\ Index\ =\ Pipe\ Rating / number\ of\ defects}.$$

The Pipe Ratings Index can be used as a tool for benchmarking pipe condition between one inspection and subsequent inspections of the same pipe. Generally, pipe reaches with a Pipe Ratings Index between 4 and 5 should receive immediate rehabilitation. If the Ratings Index is between 3 and 4, rehabilitation can be deferred, but should be planned to occur before five years has passed. Sewers with a Pipe Ratings Index of 3 or lower should be re-inspected on a predetermined interval to ensure continued service life.

The PACP coding system is rigid in its assignment of ratings to defect codes. If a reach has a Pipe Ratings Index of 3 for example, but contains a point defect(s) with a Segment Grade of 5, immediate rehabilitation of the point defect(s) may be warranted.

As discussed in the methodology, the River Trunk, Sutter Trunk and CSL pipeline and associated manhole facilities were inspected using the NASSCO PACP and MACP inspection methods. Each pipe was scored using the segment grade score, the Overall Pipeline Rating, and the Pipeline Rating Index. The Pipe Rating Index was used to quantify the results from the pipeline scoring and is presented in the Section 4.0.

4.0 DATA COLLECTION

Field investigations of the pipeline were conducted from September 15, 2014 to September 26, 2014. The following summarizes the investigation procedures.

4.1 River Trunk

The CCTV inspection was performed on September 24-26, 2014. The majority of the inspections were held in the early morning to midday. Inspection team inspected 3,687 feet of the 14,496 feet of the River Trunk, and 29 of the 40 manholes. The inspection length was limited because high water levels blocked visual access. In addition, sewer manholes could not be accessed due to surcharging, locked manholes, or improperly constructed

manholes. However, given the similar structural condition seen in the majority of the pipeline, the confidence of these inspections is enough to give an accurate recommendation. The results from the CCTV inspections are shown in the following sections.

4.2 Sutter Trunk

The entire length of the Sutter Trunk (6,439 feet) was inspected including all 15 manholes. The inspection started on September 15-18, 2014 and most of the inspections took place in the early morning and extended to midday. The pipeline was fully accessible for inspection.

4.3 CSL Pipeline

The CSL pipeline inspection was performed in November 8-10 of 2010 by Nor-Cal Pipeline Services. Inspection was performed on 9,010 ft of the CSL. Some pipeline segments were not accessible due to heavy sediment present in the invert of the pipe. The sediment blocked progress of the CCTV equipment, so the inspections were completed from the opposite end of the pipe. In addition, all of the 26 manholes were inspected on the CSL line from the Gallo Property to the SAPTF.

5.0 CONDITION ASSESSMENT RESULTS

The following section summarizes the findings from the CCTV and manhole inspections of the River Trunk, Sutter Trunk, and CSL pipeline. The CCTV log sheets showing the defect information recorded by CCTV inspections in the field is included in Appendix A, video recordings are available in DVD format.

Inspection of the trunk sewer manholes was performed for most of the manholes in the three pipeline segments that were inspected. The evaluation identified corrosion, broken frames, cracked covers, evidence of surcharging, and manholes that could not be accessed. High-resolution photographs were provided showing the problem areas in the manholes. Appendix B shows a summary of the manhole information, general condition, and major defects associated with each manhole as taken from the manhole condition assessment forms. The inspection forms and photos are found in Appendix C in DVD format.

5.1 River Trunk Condition Assessment

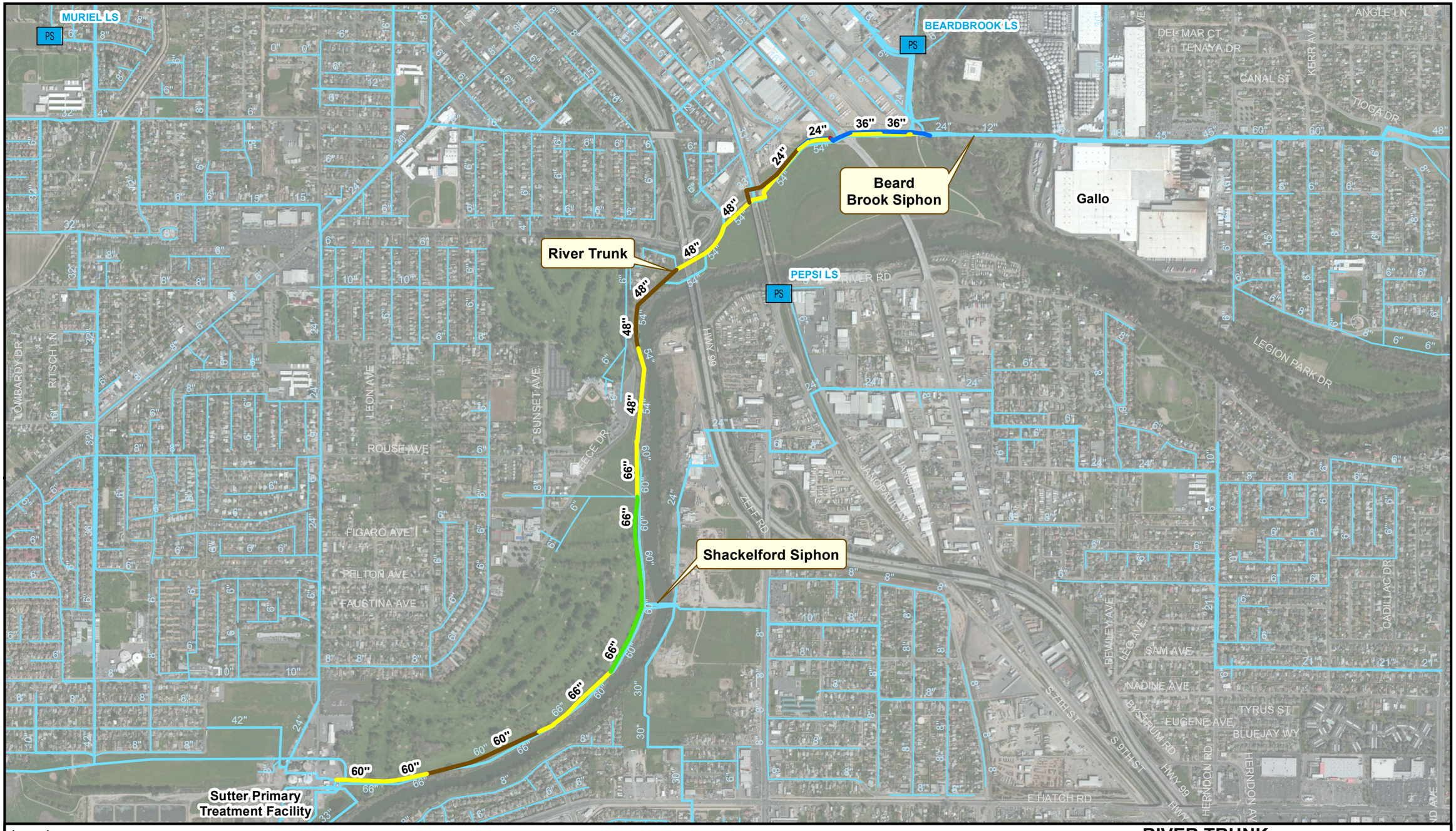
A number of pipe segments were not available for inspection because of inaccessible manholes, manholes missing entirely, high water, and some manholes completely surcharged. In areas blocked by high water levels, zoom camera inspections were performed with a high resolution camera.

5.1.1 Pipeline Rating

Corrosion is present throughout the River Trunk above the water level. Exposed aggregate in the concrete is present for the entire length inspected caused by MIC. One segment is very severe with corrosion and exposed reinforcing steel in the crown of the pipe. This indicates a likelihood of structural failure in the near future. The general results and a summary of the NASSCO PACP structural and maintenance scoring are as follows:

- 20 of the 30 pipeline segments are in Grade 3 structural condition with surface aggregate projecting or visible.
- 1 of the 30 pipeline segments is in Grade 5 structural condition with a broken pipe.
- 1 of the 30 pipelines is in Grade 1 maintenance condition due to settled deposits.
- 1 of the 30 pipelines is in Grade 2 maintenance condition due to heavy settled deposits.
- 1 of the 30 pipelines is in Grade 3 maintenance condition due to heavy compacted concrete deposits causing up to 20-percent flow blockage.

Figure 9 and Figure 10 present the associated structural and maintenance defects along the inspected alignment. See Appendix D for the River Trunk Condition Ratings Summary.



Legend

NASSCO PACP PIPE RATING

- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5

PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"
- Not Able to Inspect

N

0 1,000 2,000 Feet

carollo

RIVER TRUNK
STRUCTURAL CONDITION ASSESSMENT SUMMARY

FIGURE 9

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 12 - River Trunk Structual Condition Assessment.mxd



Legend

NASSCO PACP PIPE RATING

- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5

PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"
- Not Able to Inspect

N

0 1,000 2,000 Feet

carollo

RIVER TRUNK
MAINTENANCE CONDITION ASSESSMENT SUMMARY

FIGURE 10

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 12 - River Trunk Maintenance Condition Assessment Summary.mxd

5.1.2 Manhole Rating

The following is a summary of the River Trunk sanitary sewer manholes defects:

- SSMH 0333090905 has a broken cover and was inaccessible.
- SSMH 323091225 has a 24-inch connection at a higher elevation than the pipe, preventing inspection of the manhole and pipeline.
- SSMH 323091509 has an abundance of overgrowth preventing access.
- SSMH 0333090902 has the bench and channel partially eroded away.
- SSMH 054090711 has extra deep manhole grade rings preventing inspection of the sewer.
- SSMH 054091107 was not found.
- SSMH 054091402 never had the crown of pipe cut to allow access to the sewer.
- SSMH 054091305 crown opening was too small for sewer inspection.
- There are multiple manholes with the covers stuck on and inaccessible.
- There are multiple manholes with surcharging present.
- There are multiple manholes with missing cover bolts (see Appendix B for details).

Figure 11 presents the location of the identified River Trunk manholes with significant defects or issues.

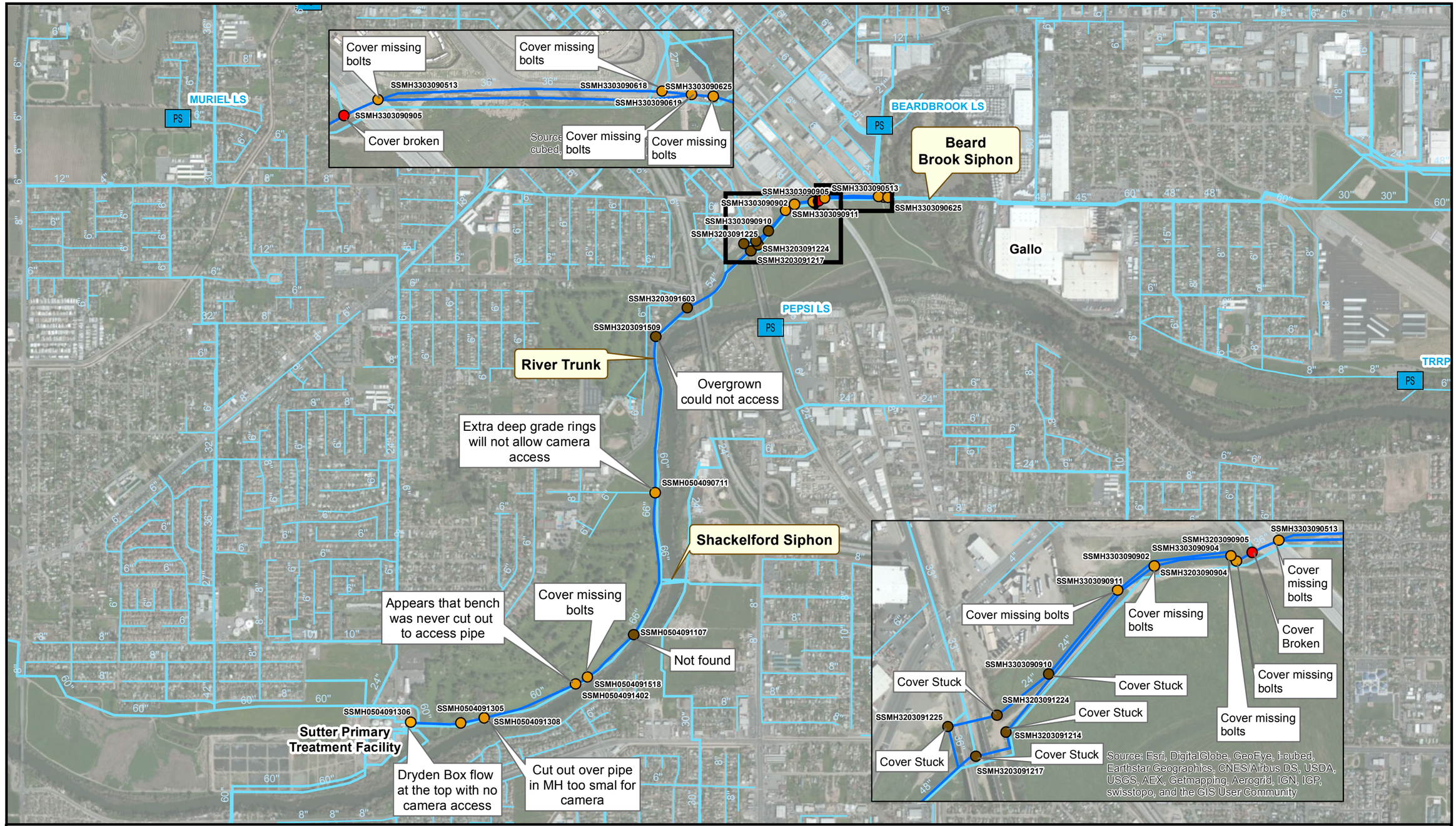
5.2 Sutter Trunk Condition

Moderate structural defects and significant maintenance related defects were found throughout the entire length. Medium corrosion is present with projecting aggregate in the lower portions of the trunk sewer caused by MIC. There are multiple locations with settled deposits throughout the trunk sewer. The following provides details of the condition assessment.

5.2.1 Pipeline Rating

The General results and a summary of the NASSCO PACP structural and maintenance scoring are as follows:

- Approximately 85-percent of the trunk sewer has been rehabilitated with an unknown pipe material.



Legend

- PS — Lift Station
- River Trunk

Other Pipelines

- 8" and Smaller
- Greater than 8"

Manhole Defciencies

- Maintenance
- Inaccessible
- Structural

N

0 1,000 2,000 Feet

RIVER TRUNK
MANHOLE CONDITION ASSESSMENTS

FIGURE 11

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 14 - River Trunk Manhole Condition Assessment.mxd

- 2 of the 15 segments are in Grade 2 structural condition due to surface spalling of the lined pipeline and a slight sag in the pipe.
- 2 of the 15 segments are in Grade 3 structural condition due to MIC corrosion with surface aggregate projecting present in the unlined lower portion of the trunk sewer.
- 3 of the 15 segments are in Grade 2 maintenance condition due to settled deposits causing up to 10-percent flow blockage.
- 3 of the 15 segments are in Grade 3 maintenance condition due to settled deposits causing up to 20-percent flow blockage.

Figure 12 and Figure 13 show the associated structural and maintenance defects within the alignment. See Appendix E for the Sutter Trunk Condition Ratings Summary.

5.2.2 Manhole Rating

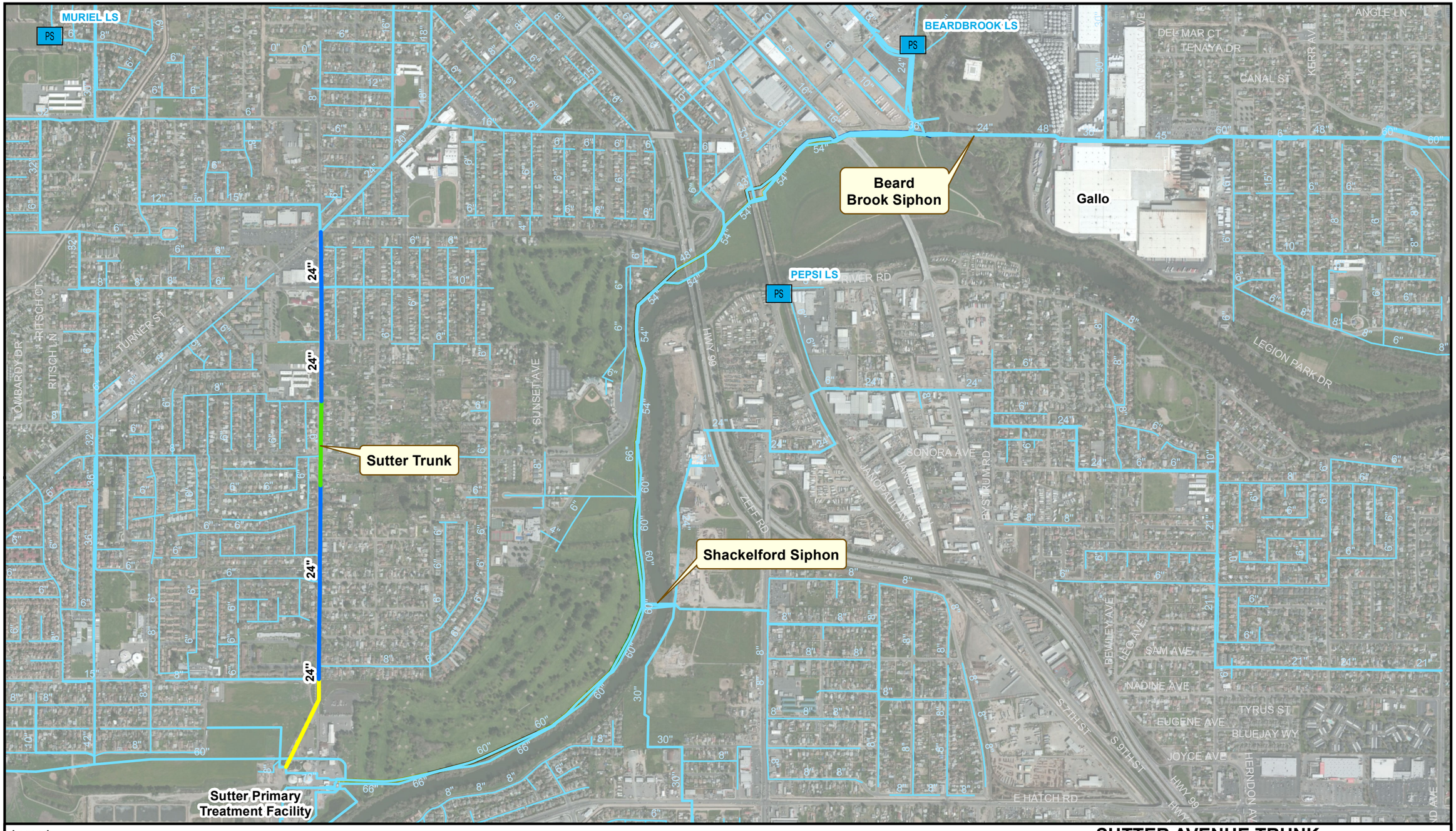
All 13 manholes on the Sutter Avenue Trunk segment were inspected. The following defects were found:

- SSMH 054090103 and SSMH 064090808 show signs of MIC corrosion.
- SSMH 054090905 has a broken frame.
- SSMH 054091301 and SSMH 054091301A have cracked frames.
- SSMH313091311, SSMH 064090811, SSMH054090904, and SSMH 054091301 are unlined brick manholes or brick manholes with a failing lining.

Figure 14 presents the location of the identified Sutter Trunk manholes with significant defects or issues.

5.3 CSL Pipeline Condition

The CSL Pipeline was inspected by Nor-Cal Pipeline Services in November of 2010. These inspections were used for the evaluation of the pipeline. The CSL pipeline was identified as exhibiting light corrosion and showing visible aggregate along the interior surface caused by MIC. There are numerous locations with heavy settled deposits. In addition, there are a few instances with root intrusions present that may allow for future structural defects. Recent inspections performed by City staff indicate that there are pipeline segments that have been exposed without cover over the pipe. These segments leave the pipeline exposed to the elements and are highly susceptible to potential catastrophic failures.



Legend

NASSCO PACP PIPE RATING

- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5

PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"
- Not Able to Inspect

N

0 1,000 2,000 Feet

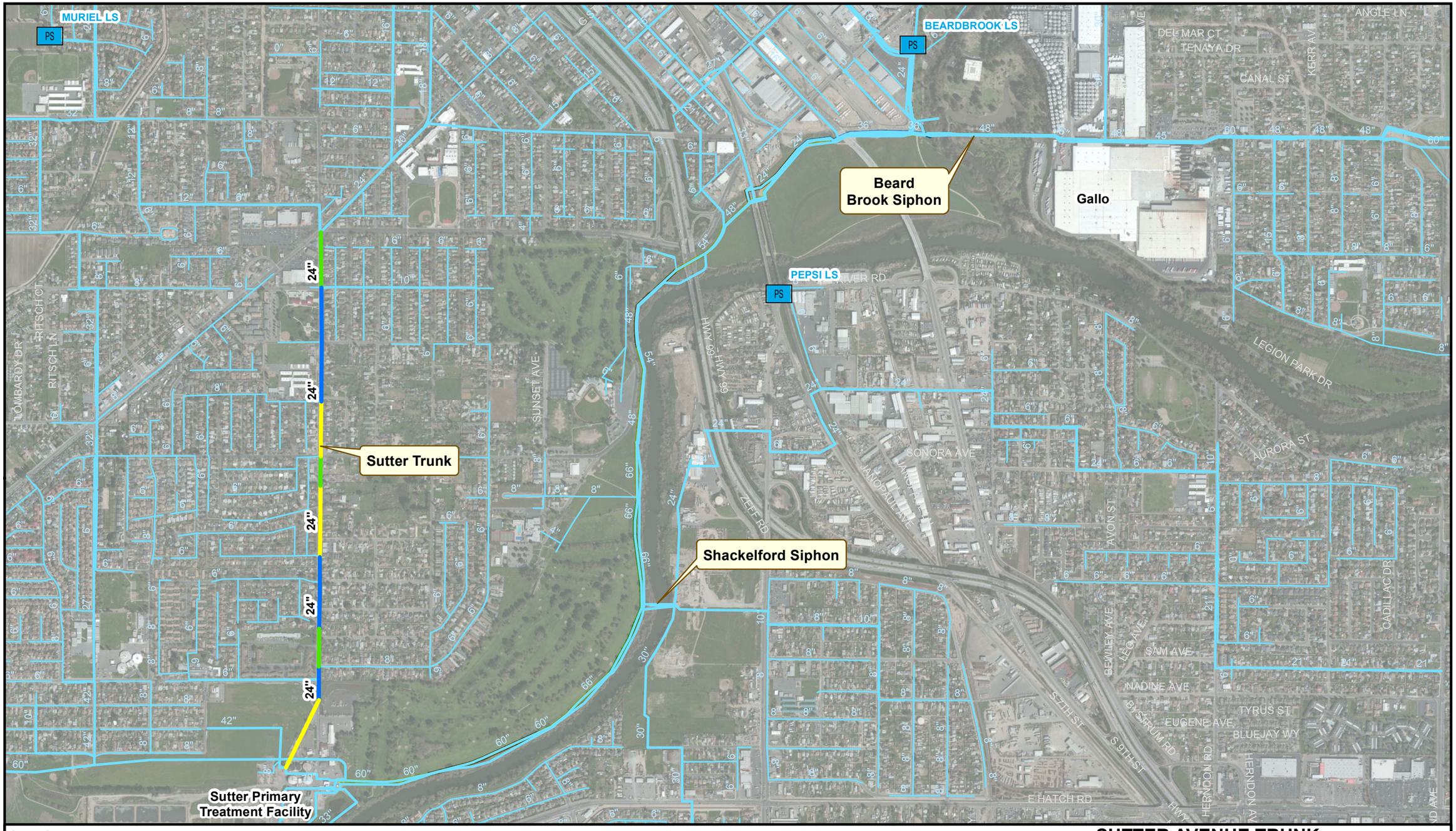
SUTTER AVENUE TRUNK
STRUCTURAL CONDITION ASSESSMENT SUMMARY

FIGURE 12

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 15 - Sutter Avenue Structual Condition Assessment.mxd



Legend

NASSCO PACP PIPE RATING

- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5

PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"
- Not Able to Inspect

N

0 1,000 2,000 Feet

SUTTER AVENUE TRUNK
MAINTENANCE CONDITION ASSESSMENT SUMMARY

FIGURE 13

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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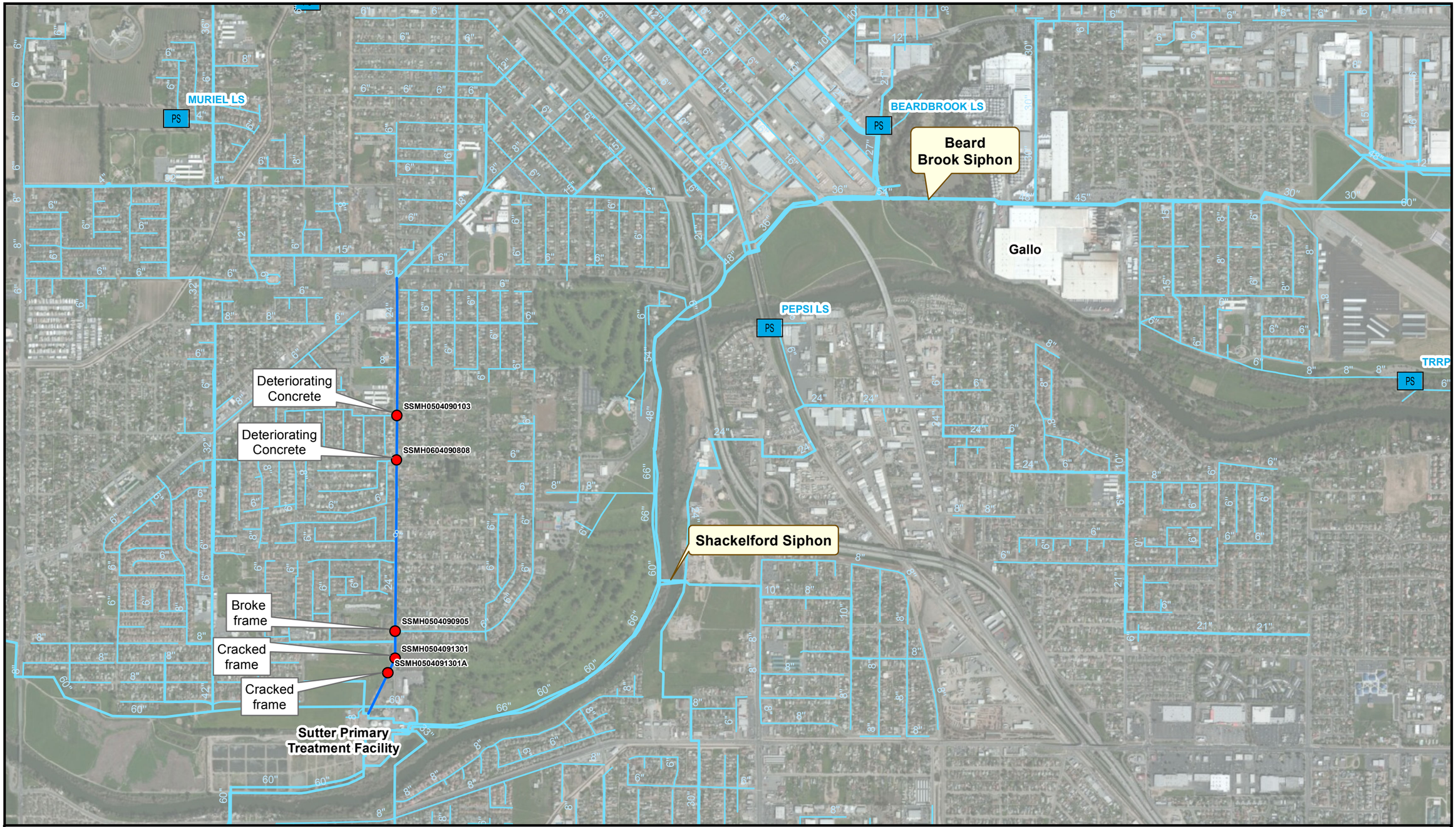
C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 16 - Sutter Avenue Trunk Maintenance Condition Assesment Summary.mxd



Legend

PS Lift Station

Sutter

Other Pipelines

8" and Smaller

Greater than 8"

Manhole Defciencies

Maintenance

Inaccessible

Structural

N

0 1,000 2,000 Feet

carollo

SUTTER TRUNK
MANHOLE CONDITION ASSESSMENTS

FIGURE 14

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 17 - Sutter Trunk Manhole Condition Assessment.mxd

5.3.1 Pipeline Rating

General results and a summary of the NASSCO PACP structural and maintenance scoring are as follows:

- All of the 26 segment showed structural Grade 2, light MIC deficiencies.
- 23 of the 26 segments are in maintenance Grade 2 condition due to settled deposits.
- 1 of the 26 segments is in Grade 3 condition due to heavy settled deposits causing up to 20-percent flow blockage.

Figure 15 and Figure 16 present the associated structural and maintenance defects along the inspected CSL pipeline alignment. See Appendix F for the CSL Condition Assessment Results Summary.

5.3.2 Manhole Rating

The following significant defects were found:

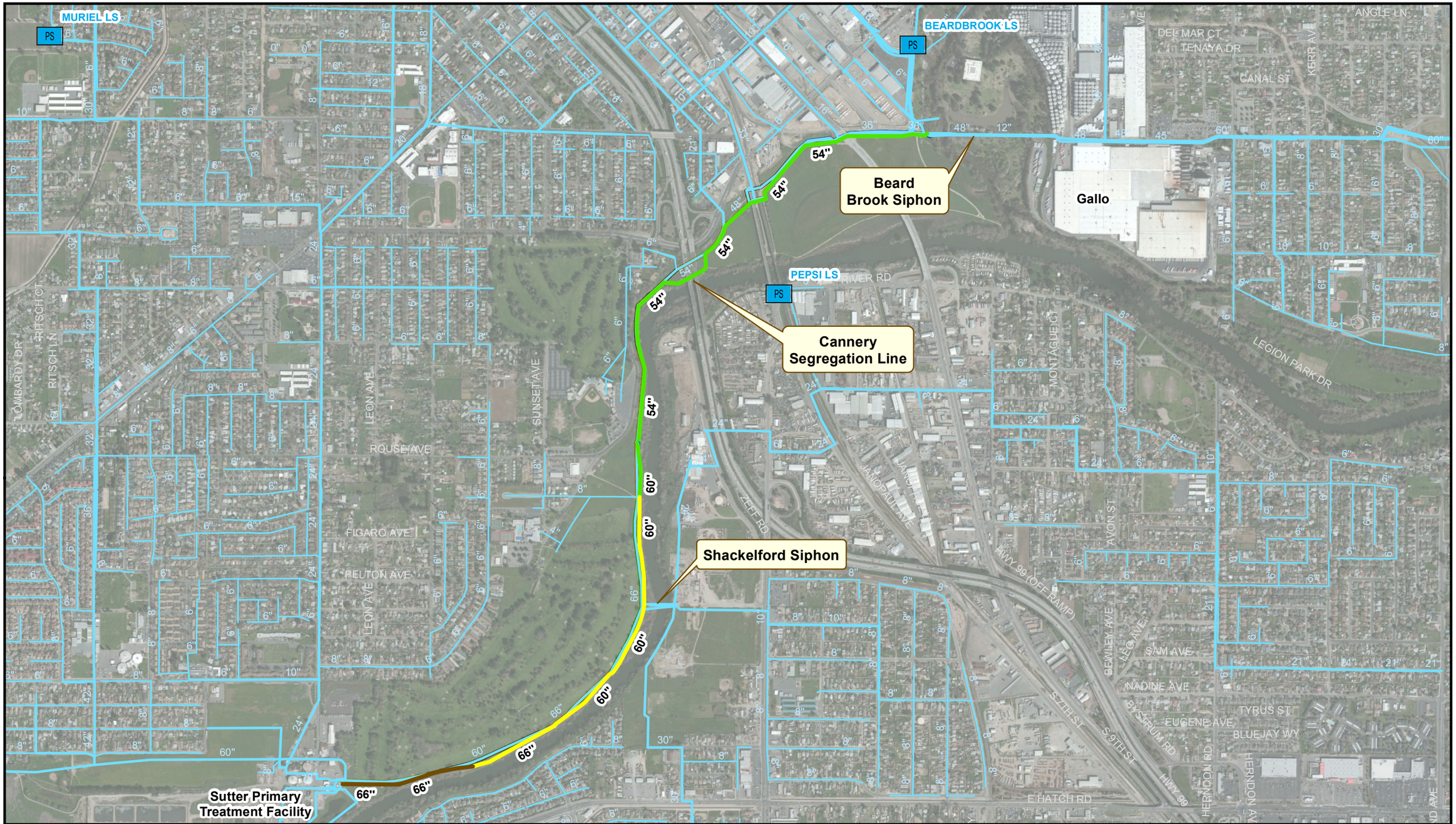
- SSMH 323091510 shows signs of MIC corrosion on the frame.
- SSMH 054091516, SSMH 054091101, and SSMH 054091108 show signs of surcharging.
- SSMH 054091105 is in fair condition due to the channel filled with concrete.

Figure 17 presents the location of the identified CSL Pipeline manholes with significant defects or issues.

6.0 CONCLUSION

It has been determined that most of the pipelines inspected are in good to fair structural condition (Grade 2 to Grade 3). While segments with Grade 3 defects do not need an immediate repair, the condition can escalate to Grade 4 or 5 quickly. It is important for the City to begin planning for the rehabilitation of these pipelines before rehabilitation becomes ineffective or no longer feasible.

Only one segment was found in structural Grade 5 condition. This reach on the River Trunk has a section of broken pipe and exposed corroded rebar. There are a number of structural Grade 3 sewers showing signs of MIC corrosion with projecting aggregate on both the River Trunk and Sutter Trunk Sewers. In addition, all three alignments show a number of maintenance issues including heavy settled deposits and some concrete deposits from deteriorating pipelines. The following sections describe the details of each of the sewer reaches.



Legend

NASSCO PACP PIPE RATING

- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5

PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"
- Not Able to Inspect

N

0 1,000 2,000 Feet

carollo

CANNERY SEGREGATION LINE
STRUCTURAL CONDITION ASSESSMENT SUMMARY

FIGURE 15

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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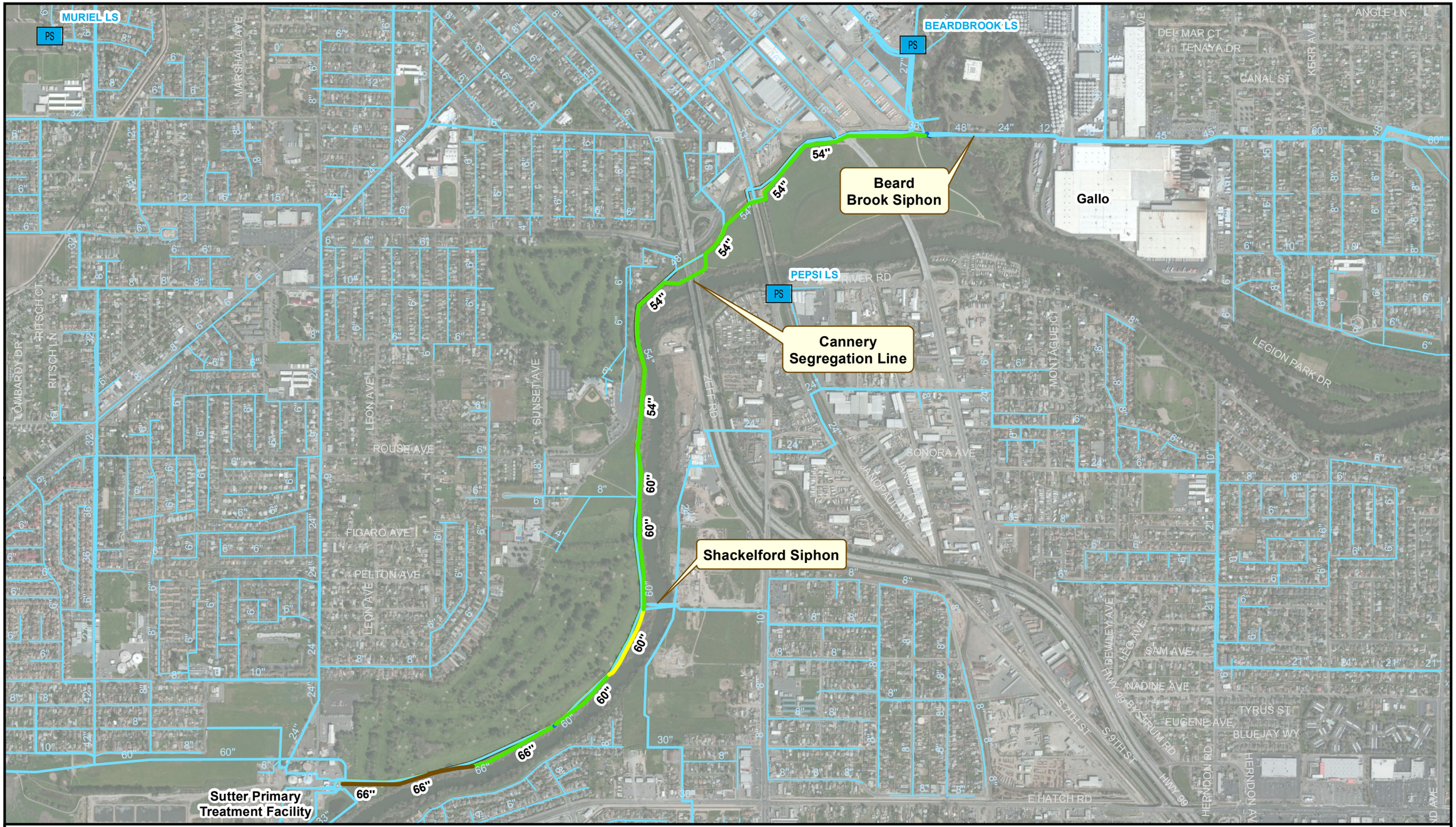


Legend

NASSCO PACP PIPE RATING

- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5

PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"
- Not Able to Inspect

0 1,000 2,000 Feet

carollo

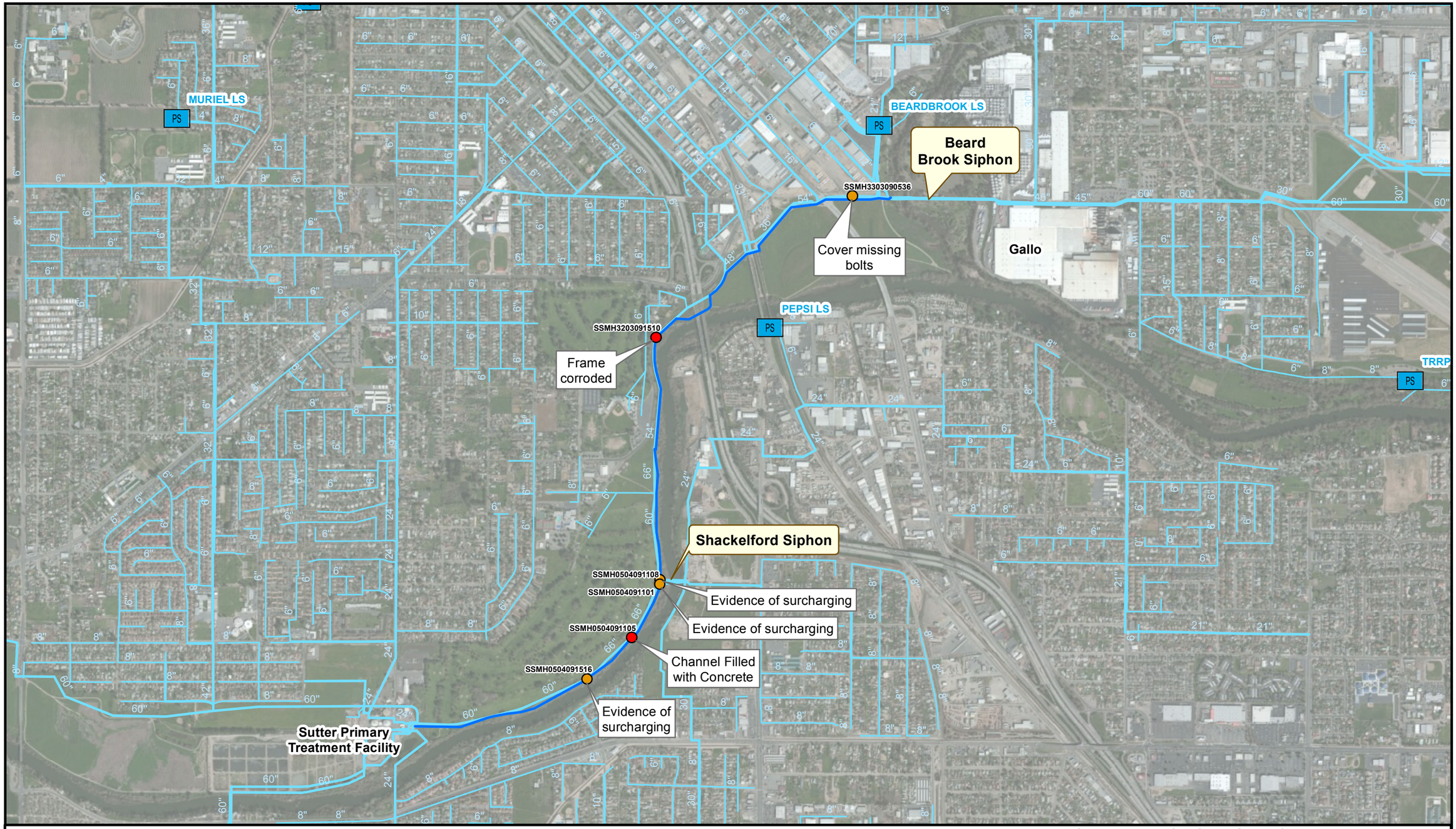
CANNERY SEGREGATION LINE MAINTENANCE CONDITION ASSESSMENT SUMMARY

FIGURE 16

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 19 - Cannery Segregation Line Maintenance Condition Assesment Summary.mxd



Legend

- PS — Lift Station
- Cannery Segregation Line

Other Pipelines

- 8" and Smaller
- Greater than 8"

Manhole Defciencies

- Maintenance
- Inaccessible
- Structural

N

0 1,000 2,000 Feet

CANNERY SEGREGATION LINE MANHOLE CONDITION ASSESSMENTS

FIGURE 17

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 20 - CSL Manhole Condition Assessment.mxd

6.1.1 River Trunk

The River Trunk typically experiences high flows, and because of these high flows, the pipeline is constantly exposed to the MIC process. The following summarizes the major concerns:

- The CCTV inspection revealed the majority of pipe segments with exposed surface aggregate showing minimal pipe wall loss.
- One segment was determined to be Grade 5 and in need of immediate repair.
- Structural defects are primarily due to corrosion associated with MIC throughout the sewer.
- Several pipe segments have significant amounts of sediment in the pipe with flow restrictions of approximately 5-20 percent present.
- There are numerous locations with root intrusions. However, there are no significant blockages at this time due to the root intrusions. A number of the manholes are in poor condition. There are currently, broken frames, corroded walls, broken covers, eroded bench, and a number of missing cover bolts.

There are significant defects present throughout the River Trunk pipeline and has a high probability of failure within the next 10-20 years. However, with the varying rate of corrosion throughout the pipeline, criticality of the pipeline, and recent failures of upstream portions of this pipeline, it has been determined that this pipeline is on the verge of being a Grade 4 and should be repaired much sooner. The Grade 5 segment with the broken pipe and corroded rebar requires immediate attention.

6.1.2 Sutter Trunk

The majority of the Sutter Trunk has been rehabilitated using an unknown fiberglass material. The lined segment of pipeline (from Paradise to Garden) was determined to be in good condition. The lower portion of the Sutter Trunk near the treatment plant is the only section not to have been rehabilitated and is in fair structural condition showing signs of MIC (Grade 3). There are three structurally deficient manholes with cracked frames and evident corrosion. In addition, there are four brick manholes in need of an epoxy liner.

6.1.3 CSL Pipeline

The condition assessment data indicates that the majority of the pipeline is in good condition. However, there have been recent discoveries by the City indicating exposed segments of the pipeline leaving the pipe vulnerable to failure. Figure 18 shows the segment of exposed pipe. The biggest concern with the CSL is the exposed pipeline segments and capacity restrictions from settled deposits.



Figure 18 Exposed Section of CSL Pipeline

In general, the following was noted:

- The majority of the pipeline shows signs of light MIC corrosion with visible aggregate throughout the alignment; however, these are not severe cases of corrosion.
- The entire alignment contains heavy settled deposits 5 to 20 percent obstruction. These deposits can continue to accumulate and cause significant restrictions within the trunk sewer.
- Segments of the pipeline are exposed near the river without cover and need erosion control improvements.
- The manholes on this pipeline have a few instances of corrosion and surcharging, but are generally in good condition.

The CSL pipeline has been determined to be in good condition with very slight corrosion present throughout the alignment and likely has significant life left. However, the segments of the exposed pipeline along the river are very critical and should be addressed as soon as possible.

7.0 RECOMMENDATIONS

Based on the findings of this Condition Assessment it is recommended that development of a rehabilitation and/or replacement program of portions of the River Trunk and Sutter Trunk pipeline facilities be included in the PDR. This should include an evaluation of rehabilitation methods best suited for the recommended pipe segments and manholes. Additionally, a cleaning schedule for the CSL to provide additional capacity that is currently lost due to settled solids should also be included. The following are recommendations based on the findings of this condition assessment.

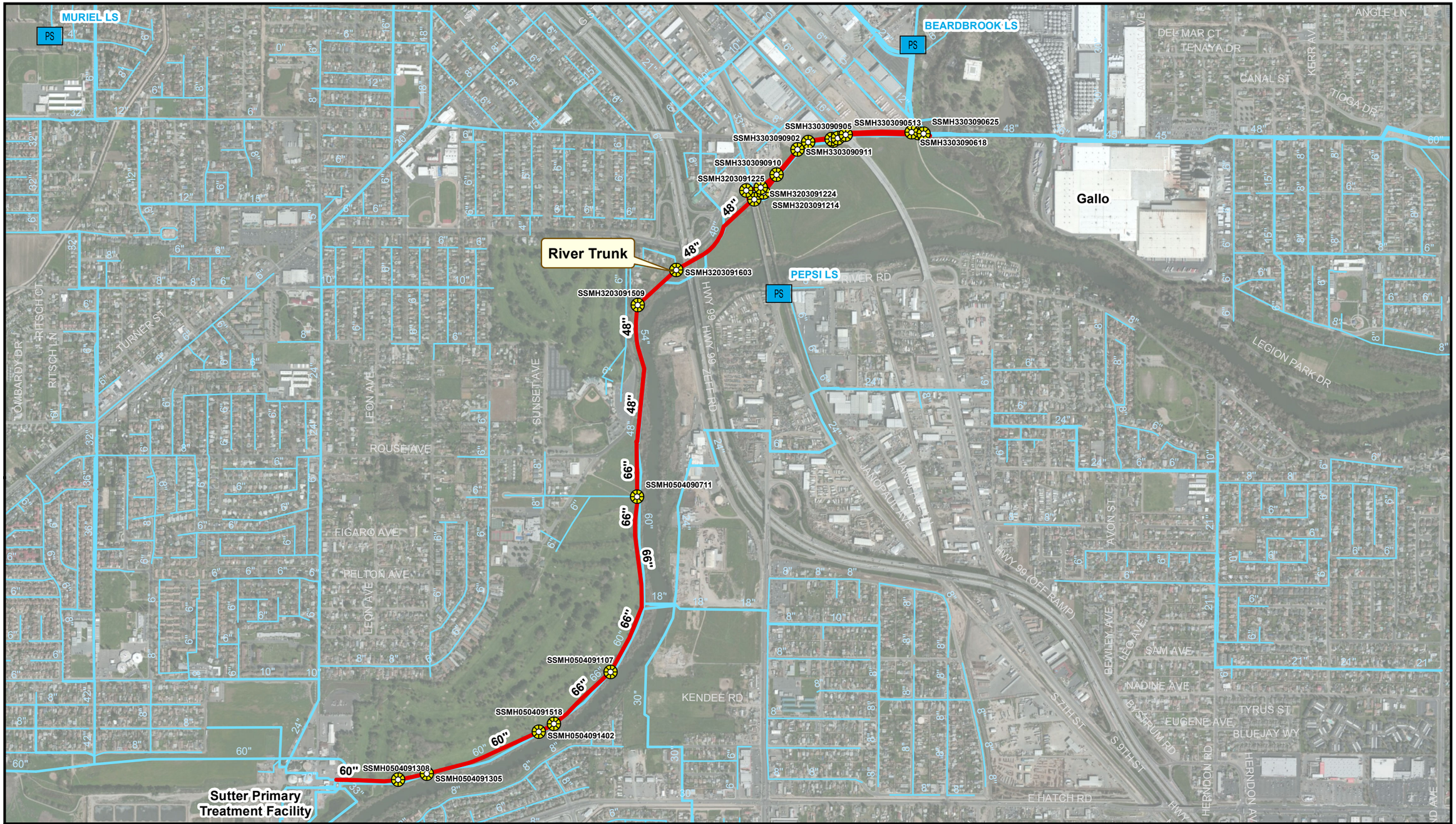
7.1.1 River Trunk

The River Trunk is in fair condition and on the verge of becoming a Grade 4. This pipeline has a likelihood of failure within the next 5 to 10 years if the sewer becomes Grade 4 in the near future. There is one segment with a Grade 5 structural defect, and due to the extreme consequence of pipeline failure, and high flows (averaging 12 mgd with peaks up to 50 mgd during sever storm events) this segment should be targeted for immediate repair. In addition, a segment of the River Trunk just upstream of the pipeline within the scope of this study recently failed creating a sinkhole on private property. The recent failure suggests that portions of the pipe are in dire need of rehabilitation or replacement. Currently, the City is in the process of completing the preliminary design of a new trunk sewer and pump station project that would allow the City to abandon this reach of high risk and vulnerable trunk sewer. The findings from this study and the recent failures provide further justification for the need to complete construction of the replacement facilities.

The recommendations for rehabilitation and/or repair for the River Trunk facilities are summarized in Table 2 and presented in Figure 19.

7.1.2 Sutter Trunk

The upper reach of the Sutter Trunk is in good condition and there are no recommendations for repair or rehabilitation, however, the brick manholes should be lined with an epoxy coating. The lower unlined stretch (from Garden to SAPTF) shows signs of heavy corrosion with limited pipeline life remaining. The recommended pipe segments and manholes that require rehabilitation are summarized in Table 3 and presented on Figure 20.



Legend

PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"

Rehabilitation/ Replacement Recommendations

- Immediate Concern (0-5 years)
- Re-inspect (5-10 years)
- Manhole Defciency Recommendations

Feet

0 1,000 2,000

RIVER TRUNK RECOMMEDATIONS

FIGURE 19

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

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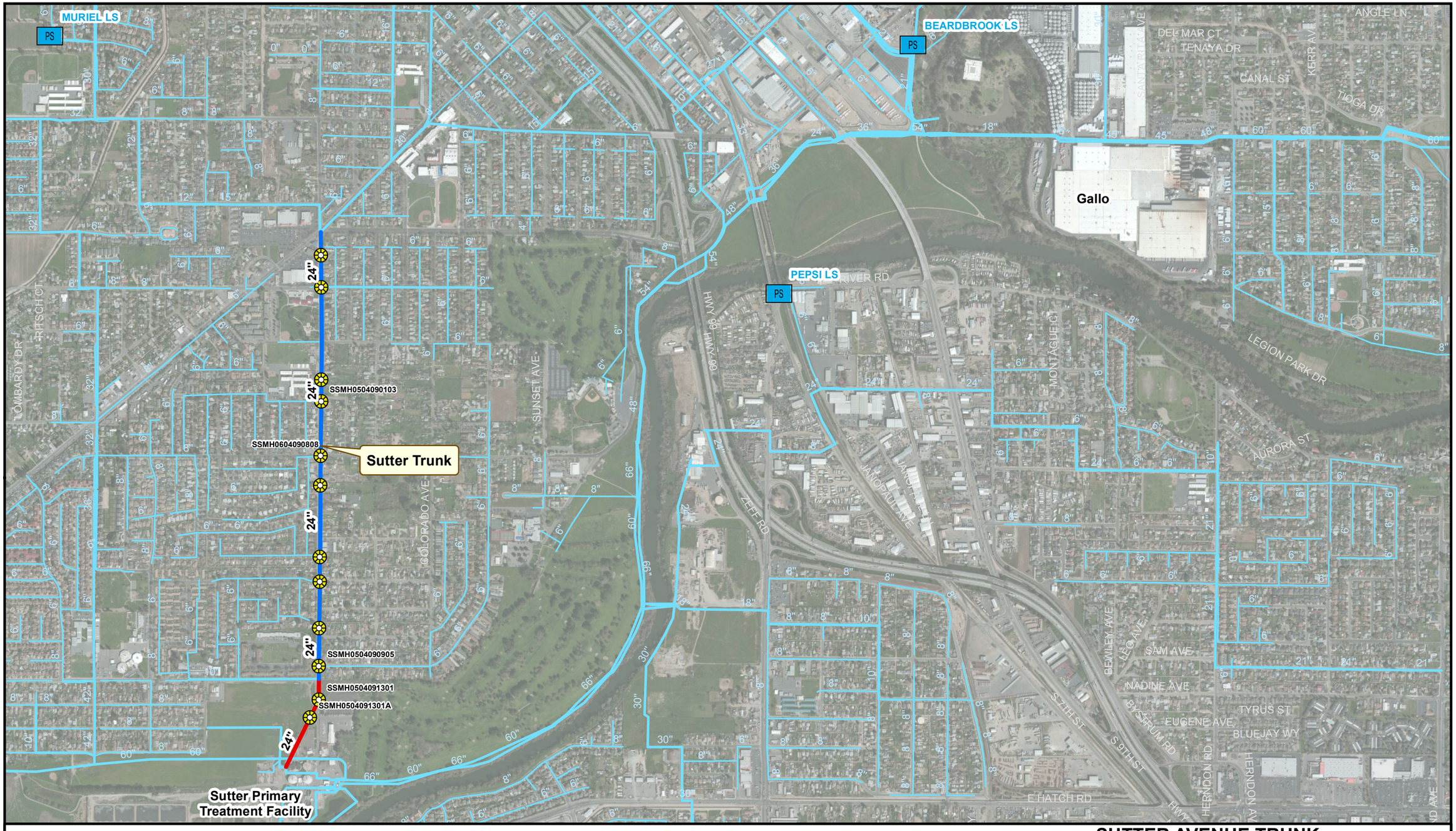

Legend

PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"

Rehabilitation/Replacement Recommendations

- Immediate Concern (0-5 years)
- Re-inspect (5-10 years)
- Manhole Defciency Recommendations

N

0 1,000 2,000 Feet

SUTTER AVENUE TRUNK RECOMMENDATIONS

FIGURE 20

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

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Table 2 River Trunk Condition Assessment Summary		
Pipe Segment/ Manhole	**Structural/Maintenance Defects**	**Recommendation**
SSMH333090619 to SSMH054091308	The majority of the pipeline shows heavy corrosion and is in Grade 3 condition	Rehabilitate or replace the entire alignment of pipe
SSMH333090908 to SSMH333090909	Broken Pipeline at joint Deposits attached due to the broken pipe.	Perform immediate spot repair to fix broken pipe.
SSMH333090619 to SSMH054091308	High water levels prevented thorough inspection of the alignment	None
SSMH333090625	Surcharged to 7.2 ft above crown	None
SSMH333090619, SSMH333090618, SSMH333090536, SSMH333090908, SSMH333090904, SSMH333090513, SSMH333090902, SSMH333090911,	Cover Missing Bolts	Install Bolts on Covers
SSMH333090902	Partial Bench/ Channel eroded away	Form new bench for manhole
SSMH333090910, SSMH323091224, SSMH323091225, SSMH323091219, SSMH323091214, SSMH232091217, SSMH323091603,	Cover Stuck and could not access pipe	Heavy equipment may be required to remove manhole covers then inspect manholes
SSMH323091509	Could not access due to overgrowth	Clear overgrowth and inspect manhole
SSMH054090711	Extra deep grade rings would not allow camera to pass	Reconstruct the cone of the manhole to allow future inspections.
SSMH054090711	Manhole not found	Perform potholing to see if manhole is buried.
SSMH054091402	Crown of pipe never cut to access pipe	Cut crown of pipe to allow camera and cleaning access
SSMH054091305	Cut out in crown not large enough for CCTV equipment	Enlarge the cut-out to allow access of CCTV equipment

Table 3 Sutter Trunk Condition Assessment Summary		
Pipe Segment/ Manhole	**Structural/Maintenance Defects**	**Recommendation**
SSMH054091301 to SSMH064091603	Surface aggregate projecting Grade 3 sewers. A short segment with corroded reinforcement and missing aggregate	Rehabilitate this portion of pipeline using a CIPP liner or like rehabilitation method
SSMH064090103 to SSMH064090811	Sag in Pipe causing water level rise and an increase in settled deposits.	Perform cleaning and re-inspect on a more frequent basis
SSMH313091611, SSMH064090811, SSMH054090905, SSMH054091301	Old brick manholes	Perform manhole rehabilitation using an epoxy coating
SSMH054090103, SSMH064090808	Deteriorating Concrete	Perform manhole rehabilitation using an epoxy coating
SSMH054090905, SSMH054091301A, SSMH054091301	Cracked or broken frame	Perform repair to manhole frame.

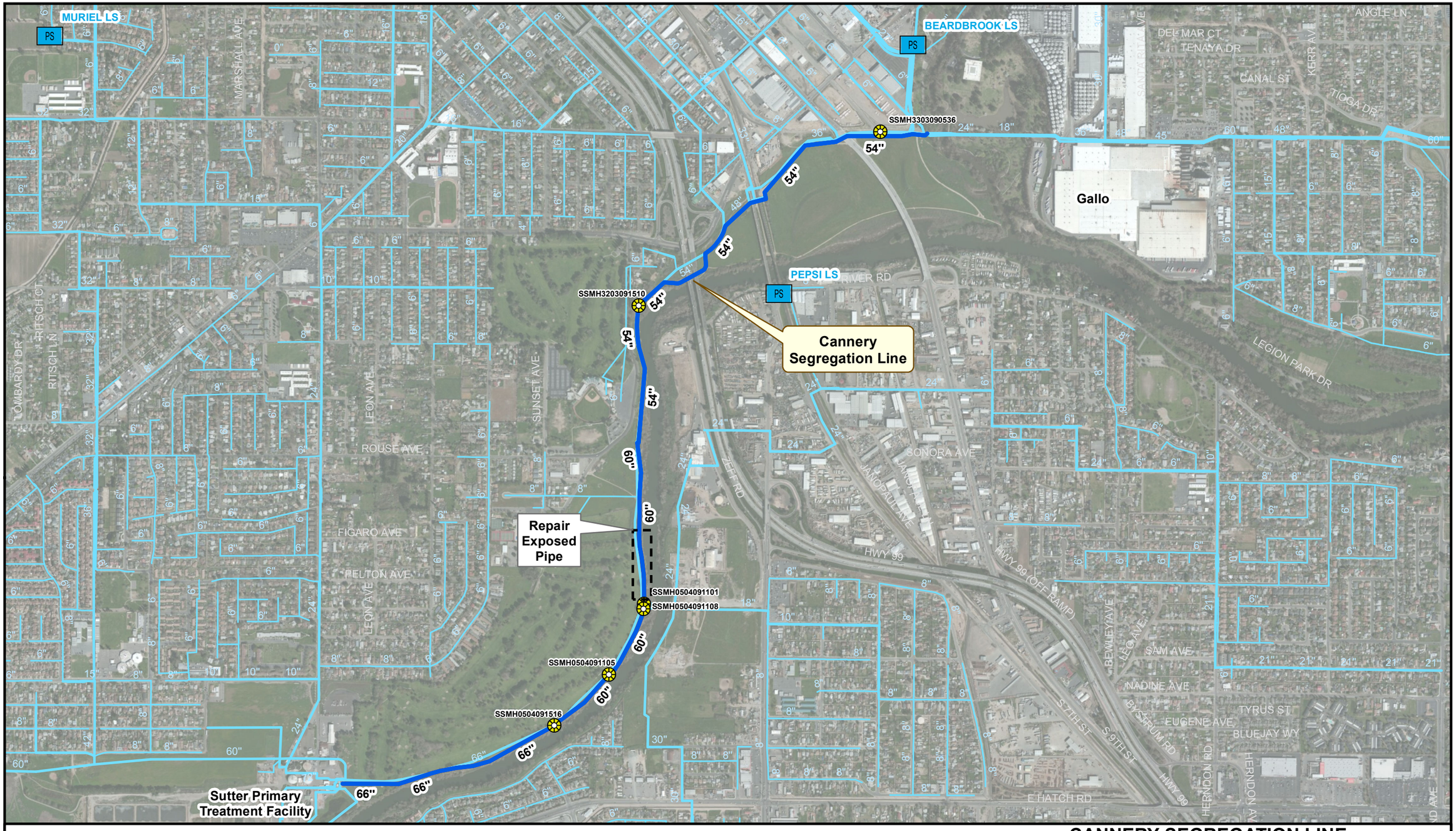
7.1.3 CSL Pipeline

There are signs of slight corrosion throughout the CSL alignment; however, this case is not severe enough to require immediate rehabilitation of the pipeline. The pipeline does have heavy sediment throughout the alignment and it is recommended that the pipeline be cleaned or flushed to prevent further buildup of sediment in the invert of the pipe. In addition to the structural and maintenance defects, there are segments of pipeline that have lost all cover and pipe support due to erosion. A subsequent inspection is recommended to inspect the pipe support throughout the alignment to understand the cause of these failures and help determine a suitable solution (bank armoring, etc). The segments that are already exposed should be repaired using gabion baskets or other erosion control devices at the City's earliest convenience. The segments that parallel the river have an extremely high consequence of failure and therefore it is recommended to re-inspect these pipelines every 5 years in order to track the rate of deterioration and detect potential failures before they become catastrophic.

The following manholes are recommended for repair or rehabilitation:

- SSMH 054091105.
- SSMH 323091510.

Table 4 and Figure 21 shows the recommendations for the CSL pipeline.



Legend

PS Lift Station

Other Pipelines

- 8" and Smaller
- Greater than 8"

Rehabilitation/Replacement Recommendations

- Immediate Concern (0-5 years)
- Re-inspect (5-10 years)
- Manhole Defciency Recommendations

N

0 1,000 2,000 Feet

CANNERY SEGREGATION LINE RECOMMENDATIONS

FIGURE 21

CITY OF MODESTO

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

C:\Users\kchristensen\Desktop\Modesto Figure\Renamed Figures\Figure 24 - Cannery Segregation Recommendations.mxd

Table 4 CSL Trunk Condition Assessment Summary		
Pipe Segment/ Manhole	**Structural/Maintenance Defects**	**Recommendation**
SSMH3303091003 to SSMH0504091401	Grade 2 sewer with surface aggregate visible. Alignment filled with sediment throughout causing up to 20% flow blockages	No immediate rehabilitation required, however the City should develop a plan for future inspection and cleaning to monitor the corrosion of the pipeline and prevent further sediment buildup
SSMH0504091401 to SSMH0504091304	High water level could not survey	None
SSMH0504091304	Manhole Buried and unable to inspect	Uncover manhole and finish inspection
SSMH323091510	Frame Corroded	Install new frame and cover
SSMH054091516, SSMH054091101, SSMH054091108	Evidence of surcharging	None
SSMH054091101	Missing cover bolts	Install new cover bolts
SSMH054091105	Channel filled with concrete	Remove concrete from manhole channel

APPENDIX A – CCTV INSPECTION DATA DVD FORMAT

APPENDIX B – CSL MACP MANHOLE CONDITION SUMMARY

Appendix B River Trunk MACP Manhole Condition Summary					
Manhole Number	**Depth (ft)**	**Manhole Material**	**Manhole Lined or Unlined**	**MACP Condition**	**Major (Significant) Defects**
333090625	16.2	Precast Concrete	Plastic	1	Surcharged 7.2 ft
333090619	11.4	Precast Concrete	Plastic	2	Cover missing bolts
333090618	14.5	Precast Concrete	Plastic	2	Cover missing bolts
333091006	12.8	Precast Concrete	Unlined	1	None
333090617	12.9	Brick	Cementitious	1	None
333090536	14.3	Precast Concrete	Plastic	2	Cover missing bolts
333090514	13.1	Precast Concrete	Unlined	1	None
333090909	11.8	Precast Concrete	Plastic	1	None
333090908	9.6	Precast Concrete	Plastic	2	Cover missing bolts
333090904	9.8	Precast Concrete	Plastic	2	Cover missing bolts
333090905	-	-	-	4	Cover Broken abandoned inspection
333090513	15.0	Precast Concrete	Plastic	2	Cover missing bolts
333090539	17.3	Precast Concrete	Plastic	1	None
333090902	17.5	Precast Concrete	Unlined	4	Cover missing bolts Partial Bench/Channel eroded away
333090912	19.0	Precast Concrete	Plastic	1	None
333090911	13.4	Precast Concrete	Plastic	2	Cover missing bolts
333090901	13.1	Precast Concrete	Unlined	1	None
054091519	10.1	Precast Concrete	Plastic	1	None
323091215	10.7	Brick	Cementitious	1	None
323091219	10.4	Brick	Cementitious	1	None
333090910	-	-	-	-	Cover stuck could not access
323091224	-	-	-	-	Cover stuck could not access
323091225	-	-	-	-	Cover stuck could not access
323091219	-	-	-	-	Cover stuck could not access

Appendix B River Trunk MACP Manhole Condition Summary					
Manhole Number	**Depth (ft)**	**Manhole Material**	**Manhole Lined or Unlined**	**MACP Condition**	**Major (Significant) Defects**
323091214	-	-	-	-	Cover stuck could not access
323091217	-	-	-	-	Cover stuck could not access
323091222	12.1	Precast Concrete	Unlined	1	None
323091603	-	-	-	-	Cover stuck could not access
323091509	-	-	-	-	Could not access MH due to overgrowth
323091512	14.8	Precast Concrete	Unlined	1	None
054090307	14.5	Precast Concrete	Plastic	1	None
054090309	15.5	Precast Concrete	Plastic	1	None
054090310	14.6	Precast Concrete	Unlined	1	None
054090711	13.9	Precast Concrete	Unlined	1	Extra deep grade rings would not allow camera access
054090706	13.3	Precast Concrete	Unlined	1	None
054090707	11.2	Precast Concrete	Unlined	1	None
054091102	13.7	Precast Concrete	Unlined	1	None
054091107	-	-	-	-	Manhole not found
054091518	10.6	Precast Concrete	Unlined	2	Cover missing bolts
054091402	6.0	Precast Concrete	Unlined	1	Crown was never cut in order to access sewer pipe
054091305	13.2	Precast Concrete	Unlined	1	Cut out in crown of pipe not large enough to allow for sewer inspection
054091308	17.3	Precast Concrete	Plastic	2	Cover missing bolts

Appendix B Sutter Trunk MACP Manhole Condition Summary					
Manhole Number	**Depth (ft)**	**Manhole Material**	**Manhole Lined or Unlined**	**MACP Condition**	**Major (Significant) Defects**
313091611	19.4	Brick	Unlined	1	None
313091610	19.0	Precast Concrete	Unlined	1	None
054090101	19.3	Precast Concrete	Unlined	1	None
054090103	19.6	Precast Concrete	Unlined	3	Deteriorating concrete
064090808	19.9	Precast Concrete	Unlined	3	Deteriorating concrete
054090102	20.4	Precast Concrete	Unlined	1	None
064090810	20.2	Precast Concrete	Unlined	1	None
064090811	11.3	Brick	Unlined	1	None
054090902	10.1	Precast Concrete	Unlined	1	None
054090904	13.0	Brick	Unlined	1	None
054090905	14.8	Precast Concrete	Unlined	3	Broken frame
054091301	6.5	Brick	Unlined	2	Cracked frame
054091301A	5.7	Precast Concrete	Unlined	2	Cracked frame

Appendix B CSL MACP Manhole Condition Summary					
Manhole Number	**Depth (ft)**	**Manhole Material**	**Manhole Lined or Unlined**	**MACP Condition**	**Major (Significant) Defects**
333091001	13.4	Precast Concrete	Unlined	1	None
333090607	12.1	Precast Concrete	Plastic	1	None
333091003	15.6	Precast Concrete	Cementitious	1	None
333090907	16.6	Precast Concrete	Unlined	1	None
333090906	9.8	Precast Concrete	Unlined	1	None
333090903	12.3	Precast Concrete	Unlined	1	None
323091213	13.4	Precast Concrete	Unlined	1	None

Appendix B CSL MACP Manhole Condition Summary					
Manhole Number	**Depth (ft)**	**Manhole Material**	**Manhole Lined or Unlined**	**MACP Condition**	**Major (Significant) Defects**
323091216	13.1	Precast Concrete	Unlined	1	None
323091220	20.3	Precast Concrete	Unlined	1	None
323091221	12.0	Precast Concrete	Unlined	1	None
323091606	10.3	Precast Concrete	Unlined	1	None
323091605	10.4	Precast Concrete	Unlined	1	None
323091604	10.1	Precast Concrete	Unlined	1	None
323091607	10.4	Precast Concrete	Unlined	1	None
323091511	9.7	Precast Concrete	Unlined	1	None
054090304	9.9	Precast Concrete	Unlined	1	None
054090306	13.1	Precast Concrete	Unlined	1	None
054090705	15.3	Precast Concrete	Unlined	1	None
323091510	10.2	Precast Concrete	Unlined	2	Frame corroded
054091517	11.2	Precast Concrete	Plastic	1	None
054091516	12.2	Precast Concrete	Plastic	1	Evidence of surcharging
054091101	12.7	Precast Concrete	Unlined	2	Evidence of surcharging Cover missing bolts
054091108	12.5	Precast Concrete	Unlined	1	Evidence of surcharging
054091105	8.2	Precast Concrete	Unlined	3	Channel filled with concrete
054091401	11.4	Precast Concrete	Unlined	1	None
054091304	16.9	Precast Concrete	Unlined	1	None

APPENDIX C – SUTTER TRUNK MACP MANHOLE CONDITION SUMMARY

APPENDIX D – RIVER TRUNK PIPELINE CONDITION RATINGS SUMMARY

Appendix D River Trunk Pipeline Condition Ratings Summary

Upstream Manhole (SSMH)	Downstream Manhole (SSMH)	Diameter (in)	Inspected Length (LF)	PACP Structural Condition Score	PACP Maintenance Condition Score	Notes
333090619	333090618	36	82	**0**	0	None
333090618	333090536	36	365	**0**	0	None
333090536	333090539	36	353.4	**0**	0	None
333090539	333090513	36	54.4	**0**	0	None
333090513	333090905	42	101.4	**0**	0	None
333090905	333090904	42	65.7	**0**	0	None
333090904	333090908	42	2.8	**0**	0	Survey abandoned at 2.8 ft, camera unable to pass elbow.
333090619	333091006	36	93	**3**	1	Surface aggregate projecting Deposits settled
333091006	333090617	36	25	**3**	0	Surface aggregate projecting
333090617	333090514	36	329.5	**3**	0	Surface aggregate projecting
333090514	333090513	36	404.8	**3**		Surface aggregate projecting Surface Reinforcement Projecting
333090908	333090902	36	100	**3**	0	Surface aggregate projecting Survey abandoned at 100.00 ft
333090908	333090909	24	23	**5**	3	Broken pipeline at joint Deposits attached, concrete

Appendix D River Trunk Pipeline Condition Ratings Summary

Upstream Manhole (SSMH)	Downstream Manhole (SSMH)	Diameter (in)	Inspected Length (LF)	PACP Structural Condition Score	PACP Maintenance Condition Score	Notes
333090909	333090912	24	75	**0**	0	Survey abandoned at 75.0 ft, zoom limit
333090912	333090911	24	75	**0**	0	Survey abandoned at 75.0 ft, zoom limit
333090902	333090901	36	100	**3**	0	Surface aggregate projecting Survey abandoned at 100.0 ft, zoom limit
333090901	323091214	36	100	**3**	0	Surface aggregate projecting Survey abandoned at 100.0 ft, zoom limit
333090912	333090911	24	75	0	0	Survey abandoned at 75.0 ft, zoom limit
333090911	333090910	24	75	0	0	Survey abandoned at 75.0 ft, zoom limit
323091214	323091215	36	57	3	0	Surface aggregate projecting
323091215	323091217	36	125	3	0	Surface aggregate projecting
323091217	323091219	36	25	3	0	Surface aggregate projecting Cloth/canvas hanging from manhole
323091219	323091226	36	51	3	0	Surface aggregate projecting
323091226	323091222	48	75	3	0	Surface aggregate projecting Survey abandoned at 75.0 ft, zoom limit
323091222	323091603	48	8	3	0	Surface aggregate projecting Plugged pipe outlet Underside of manhole flat top Survey abandoned at 8.0 ft, zoom limit
323091509	323091512	48	75	**0**	**0**	Curve in pipeline Survey abandoned at 75.0 ft, zoom limit

Appendix D River Trunk Pipeline Condition Ratings Summary

Upstream Manhole (SSMH)	Downstream Manhole (SSMH)	Diameter (in)	Inspected Length (LF)	PACP Structural Condition Score	PACP Maintenance Condition Score	Notes
323091512	054090307	48	75	**3**	0	48" pipe to the east is plugged Surface reinforcement projecting Surface aggregate visible Survey abandoned at 75.0 ft, zoom limit
054090307	054090309	48	9	**0**	0	None
054090309	054090310	54	16	**3**	**0**	Surface aggregate visible
054090310	054090711	66	75	**3**	**0**	Surface aggregate visible Surface spalling Survey abandoned at 75.0 ft, zoom limit
054090711	0545090706	66	38	**0**	**0**	Surface spalling
0545090706	0545090707	66	75	**0**	**0**	Surface spalling Survey abandoned at 75.0 ft, zoom limit
0545090707	054091102	66	75	**0**	**0**	Surface spalling Vermin visible, cockroaches Survey abandoned at 75.0 ft, zoom limit
054091102	054091107	66	75	**0**	**0**	Surface spalling Survey abandoned at 75.0 ft, zoom limit
054091107	054091518	66	75	**3**	**0**	Surface aggregate visible Survey abandoned at 75.0 ft, zoom limit
054091518	054091519	66	33	0	0	None
054091519	054091402	60	75	3	2	Surface aggregate visible Deposit visible, attached rag Survey abandoned at 75.0 ft, zoom limit
054091306	054091308	60	75	3	0	Surface aggregate projecting Survey abandoned at 75.0 ft, zoom limit

Appendix D River Trunk Pipeline Condition Ratings Summary						
Upstream Manhole (SSMH)	**Downstream Manhole (SSMH)**	**Diameter (in)**	**Inspected Length (LF)**	**PACP Structural Condition Score**	**PACP Maintenance Condition Score**	**Notes**
054091308	Dryden Box	60	75	**3**	**0**	Surface aggregate projecting Survey abandoned at 75.0 ft, zoom limit
Total			**3687**	**---**	**---**	

APPENDIX E – SUTTER TRUNK PIPELINE CONDITION RATINGS SUMMARY

Appendix E Sutter Trunk Pipeline Condition Ratings Summary						
Upstream Manhole (SSMH)	**Downstream Manhole (SSMH)**	**Diameter (in)**	**Inspected Length (LF)**	**PACP Structural Condition Score (SPRI)**	**PACP Maintenance Condition Score (MPRI)**	**Notes**
313091609	313091610	24	274.3	0	2	Intruding seal ring Plugged pipe in manhole
313091610	313091611	24	378.9	0	0	Surface spalling
313091611	054090101	24	661	0	0	No deficiencies detected
054090101	054090102	18	434.8	0	0	No deficiencies detected
054090102	054090103	18	256.5	0	0	No deficiencies detected
054090103	064090808	18	647.8	2	3	Surface Spalling Deposit settled, 15% of cross sectional area.
064090808	064090810	18	351	2	2	Lining failure Obstacle in joint Water level sag, 20% of cross sectional area
064090810	064090811	18	849.5	0	3	Deposit settled, 15% of cross sectional area.
064090811	054090902	18	291.3	0	0	No deficiencies detected
054090902	054090904	18	553.2	0	0	No deficiencies detected
054090904	054090905	18	450.3	0	2	Deposits attached , grease (DAG)

Appendix E Sutter Trunk Pipeline Condition Ratings Summary						
Upstream Manhole (SSMH)	**Downstream Manhole (SSMH)**	**Diameter (in)**	**Inspected Length (LF)**	**PACP Structural Condition Score (SPRI)**	**PACP Maintenance Condition Score (MPRI)**	**Notes**
054090905	054090906	18	154.7	0	0	No deficiencies detected
054090906	054091301	18	241.3	0	0	No deficiencies detected
054091301	054091301A	24	411	3	0	Surface aggregate projecting reinforcement corroded, surface aggregate missing.
054091301A	064091603	24	483.8	3	3	Surface aggregate projecting Deposit settled, 20% of cross sectional area.
Total			**6,439**	**---**	**---**	

APPENDIX F – CSL PIPELINE CONDITION RATINGS SUMMARY

Appendix F CSL Pipeline Condition Ratings Summary

Upstream Manhole (SSMH)	Downstream Manhole (SSMH)	Diameter (in)	Inspected Length (LF)	PACP Structural Condition Score (SPRI)	MACP Maintenance Condition Score (MPRI)	Notes
3303091003	3303091002	48	144.90	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible
3303091002	3303091001	48	119.4	2	2	Deposits settled compacted, 5% of cross sectional area. Surface aggregate visible
3303091001	330309007	54	649.20	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible Root intrusion occurring along pipeline.
3303090907	3303090906	54	144.90	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible
3303090903	3203091213	54	722.50	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible
3303090906	3303090903	54	344.80	2	2	Deposit settled compacted, 10% of cross sectional area. Surface aggregate visible
3203091213	3203091216	54	73.90	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible
3203091216	3203091220	54	189.20	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible
3203091220	3203091221	54	394.30	2	2	Deposit settled, 10% of cross sectional area. Surface aggregate visible
3203091221	3203091607	54	410.60	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible
3203091607	3203091606	54	123.50	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible
3203091606	3203091605	54	411.00	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible

Appendix F CSL Pipeline Condition Ratings Summary						
Upstream Manhole (SSMH)	**Downstream Manhole (SSMH)**	**Diameter (in)**	**Inspected Length (LF)**	**PACP Structural Condition Score (SPRI)**	**MACP Maintenance Condition Score (MPRI)**	**Notes**
						Root intrusion occurring along pipeline.
3203091605	3203091604	54	186.70	2	2	Root intrusion occurring along pipeline. Surface aggregate visible
3203091604	3203091510	54	399.50	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible
3203091510	3203091511	54	492.80	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible Root intrusion occurring along pipeline.
3203091511	0504090304	54	38.50	2	2	Deposit settled, 10% of cross sectional area. Surface aggregate visible. Survey abandoned at 38.5 ft due to heavy debris.
0504090304	0504090305	54	870.20	2	2	Deposit settled compacted, 10% of cross sectional area. Surface aggregate visible
0504090305	0504090306	54	15.00	2	2	Deposit settled compacted, 10% of cross sectional area. Surface aggregate visible
0504090306	0504090705	60	1.00	2	2	Deposit settled, 15% of cross sectional area. Surface aggregate visible. Survey abandoned at 1.00 ft due to large debris.
0504090306	0504090705	60	595.80	2	2	Deposit settled, 5% of cross sectional area. Surface aggregate visible. Survey abandoned at 595.80 ft due to debris.

Appendix F CSL Pipeline Condition Ratings Summary						
Upstream Manhole (SSMH)	**Downstream Manhole (SSMH)**	**Diameter (in)**	**Inspected Length (LF)**	**PACP Structural Condition Score (SPRI)**	**MACP Maintenance Condition Score (MPRI)**	**Notes**
0504090705	0504091101	60	1,256.90	2	2	Deposit settled,10% of cross sectional area. Surface aggregate visible.
0504091101	Unmarked MH3	60	57.50	2	2	Deposit settled, 10% of cross sectional area. Surface aggregate visible.
Unmarked MH3	Unmarked MH4	60	251.20	2	3	Deposit settled, 20% of cross sectional area. Surface aggregate visible. Survey abandoned at 251.20 ft due to debris.
Unmarked MH4	Unmarked MH5	60	890.10	2	2	Deposit settled, 15% of cross sectional area. Surface aggregate visible. Root intrusion occurring along pipeline. Survey abandoned at 890.10 ft due to debris.
Unmarked MH6	0504091401	66	227.00	2	2	Deposit settled, 15% of cross sectional area. Surface aggregate visible. Survey abandoned at 227.00 ft due to debris.
0504091401	0504091304	66	0.00	-	-	Survey abandoned due to water level.
0504091304	Treatment Plant	66	0.00	-	-	Manhole buried, unable to locate.
Total			**9,010**	**---**	**---**	

APPENDIX D – ALTERNATIVES EVALUATION (TM1)



CITY OF MODESTO
WASTEWATER COLLECTION SYSTEM
IMPROVEMENTS

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION LINE

ALTERNATIVES EVALUATION TECHNICAL MEMORANDUM

DRAFT

September 2014

2700 YGNACIO VALLEY ROAD, SUITE 300 • WALNUT CREEK, CALIFORNIA 94598 • P. 925.932.1710 • F. 925.930.0208

CITY OF MODESTO
WASTEWATER COLLECTION SYSTEM IMPROVEMENTS

RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

TECHNICAL MEMORANDUM

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RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION LINE PROJECT

1.0 INTRODUCTION

The objective of this technical memorandum (TM) is to document the development and evaluation of alternatives that address capacity deficiencies in the Sutter Trunk and the River Trunk systems, as well as capacity and operation and maintenance issues with the Beard Brook Siphon. An evaluation of the condition of the existing Sutter and River Trunks will be provided in a separate TM.

The City of Modesto (City) is located in Stanislaus County, in the Northern section of the San Joaquin Valley, approximately 90 miles north of the City of Fresno. Modesto is the 18th largest city in California, and is home to approximately 201,000 residents. Figure 1 shows Modesto's location and the surrounding area.

The City operates its own wastewater collection system, providing service to properties located within the City limits as well as some properties located in unincorporated Stanislaus County. The City's wastewater collection system is illustrated on Figure 2. The wastewater collection system consists of 39 sewage lift stations and an estimated 641 miles of sewer pipelines. Domestic and commercial wastewater is flows to the City's primary treatment facility at Sutter Avenue via five major trunk lines:

- West Trunk
- Emerald Trunk
- Sutter Trunk
- River Trunk
- South Trunk

Effluent from the Sutter Avenue Primary Treatment Facility (SAPTF) flows to the City's secondary treatment facility located about seven miles southwest, on Jennings Road. In addition to domestic and commercial sewers, the wastewater collection system includes the Cannery Segregation Line (CSL), constructed in 1999. The CSL consists of 12 miles of gravity sewer that conveys cannery process water from the Beard Industrial Park directly to the Jennings Road treatment facility, where it is blended with secondary effluent and used for irrigation of the City's ranch land. Cannery process water is treated separately to prevent impacts of high biochemical oxygen demand (BOD) loadings on the City's wastewater treatment processes.



REGIONAL LOCATION MAP

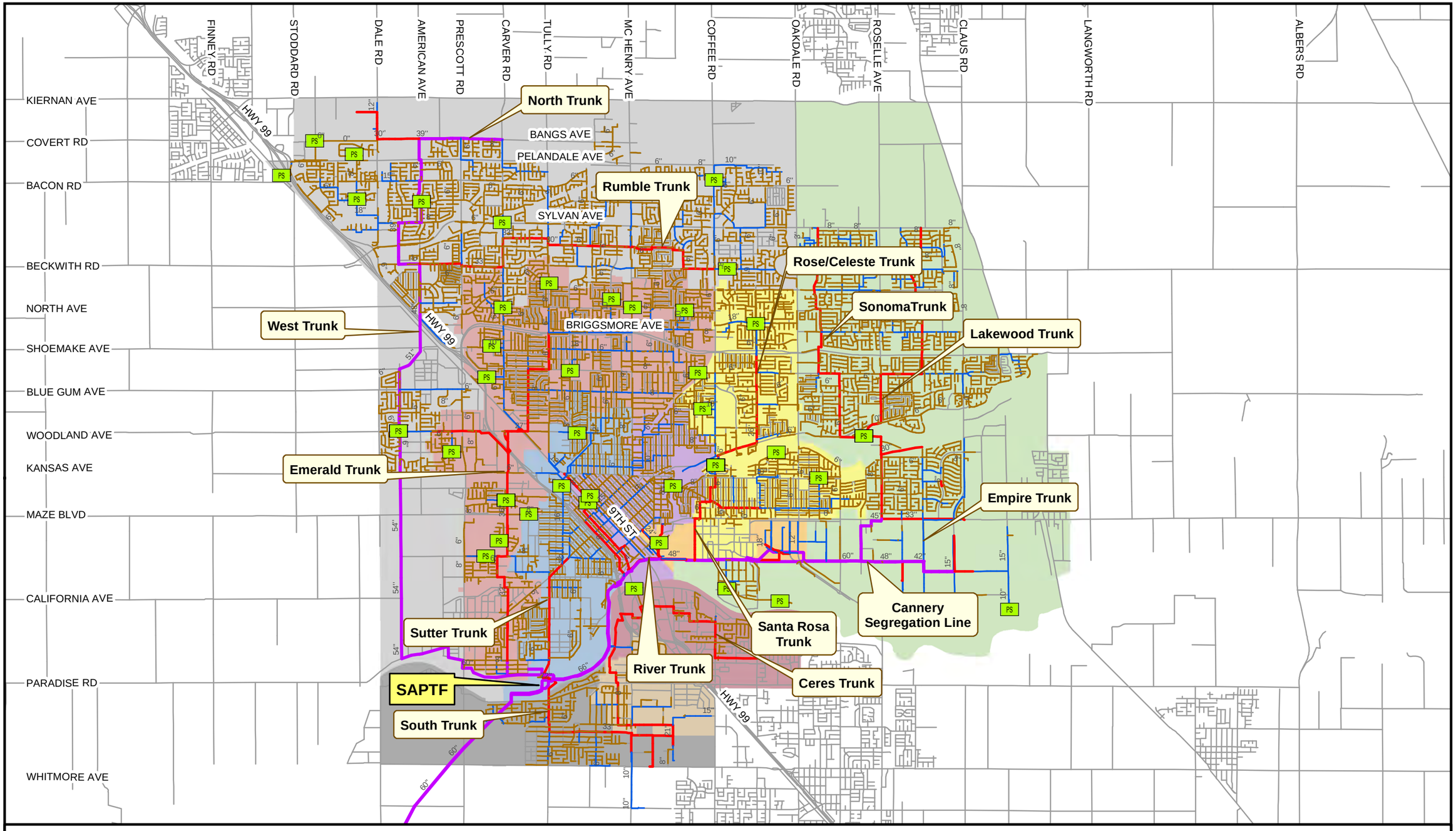
FIGURE 1

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

MODESTO CALIFORNIA

M:\Modesto_FNO\9551A.00\GIS\Figures\Alternatives Eval TM\Figure 01 - Regional Location Map.mxd



EXISTING WASTEWATER COLLECTION SYSTEM

FIGURE 2

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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MODESTO CALIFORNIA

M:\Modesto_FNO\9551A.00\GIS\Figures\Alternatives Eval TM\Figure 02 - Existing Wastewater Collection System.mxd

Carollo Engineers Inc (Carollo) was contracted by the City in 2003 to complete a wastewater collection system master plan (Master Plan). The Master Plan was finalized in 2007. The Master Plan identified several areas of the collection system where peak flows exceeded the existing collection system's capacity.

The Master plan recommended mitigation projects for the River Trunk, Sutter Trunk, and CSL that would provide the City with conveyance capacity to meet the requirements of the evaluation criteria documented in the Master Plan. The Master Plan also identified potentially significant deterioration of the Sutter Trunk and the River Trunk pipelines.

1.1 Project Need and Key Components

Since the inception of the improvements for the Sutter Trunk and River Trunk pipelines as outlined in the Master Plan, additional challenges have been identified that will require re-evaluation. The portion of the River Trunk adjacent to the Tuolumne River was exposed by erosion during high river flows in 2007. This event underscored the fact that this critical sewer is vulnerable to erosion and potential failure during high river flows. The riverbank erosion threat could be mitigated by realigning the River Trunk segment to a route inland from the Tuolumne River. Another challenge is that replacement of the existing Sutter Trunk in its current alignment would require difficult and costly construction, because there are numerous potentially conflicting utilities and the pipeline is over 20 feet deep. A new route for the Sutter Trunk pipeline would mitigate these concerns.

Two other projects identified in the Master Plan for the River Trunk are the Beard Brook Siphon and the CSL Diversion Structures. The Beard Brook siphon is deficient in hydraulic capacity, and it has operational and condition issues. In January 2012, West Yost Associates (West Yost) prepared the Cannery Segregation Line and River Trunk Diversion Plan Study, which identified a conceptual contingency plan to divert flows from the River Trunk to the CSL or from the CSL to the River Trunk, in the event of a failure of either trunk line. Subsequently, West Yost expanded on this analysis as part of the Draft 2014 Vulnerability Assessment Report. Because these projects would be impacted by a realignment of the River Trunk, they were included in the alternatives analysis for this TM.

In summary, the following four key project components were identified to meet the challenges associated with the River Trunk and Sutter Trunk projects:

- River Trunk Realignment
- Sutter Trunk Realignment
- Beard Brook Siphon Replacement
- CSL/River Trunk Diversion Structures

2.0 ALTERNATIVE SELECTION SUMMARY

The identification, evaluation, and final selection of the preferred alternative involved a multi step process that engaged City staff in the engineering, and public works departments. The following project goals were developed:

- Address deterioration of the Sutter and River Trunks
- Address peak flow limitations in the Sutter and River Trunks
- Address Beard Brook Siphon flow bottleneck and lack of redundancy
- Address CSL peak flow limitations
- Avoid treatment plant impacts from comingling of CSL and domestic flows
- Provide River Trunk O&M access and mitigate vulnerability from river bank washout
- Provide CSL O&M access and mitigate vulnerability from river bank washout of the line

Six initial alternatives to meet these goals were presented to the City's collection system Operations and Maintenance (O&M) staff at the O&M Coordination Meeting. The development of the initial alternatives was based on a review of existing information, and the peak flow requirements extracted from the hydraulic model. Nine alternatives were selected by the team for further evaluation:

- Alternative No. 1 - Master Plan Recommendations
- Alternative No. 2 - Pump Station on River Trunk
- Alternative No. 3 - Gravity Line to Replace River Trunk
- Alternative No. 4 - Beard Brook Industrial Park Alignment
    - Alternative No. 4A - Beard Brook Industrial Park Alignment (Pumped Option)
    - Alternative No. 4B - Beard Brook Industrial Park Alignment (Gravity Option)
- Alternative No. 5 - Dual Pump Station and Force Main
- Alternative No. 6 - Combined Option 2 & 5
- Alternative No. 7 - Modified Combination of Option 4 & 5
- Alternative No. 8 - Slip line River Trunk and CSL with Force Main
- Alternative No. 9 - Gravity Under Beard Brook
    - Alternative No. 9A - Gravity Under Beard Brook –Existing Alignment
    - Alternative No. 9B - Gravity Under Beard Brook –Southern Alignment

Following the O&M Workshop, Carollo conducted a Brainstorming Workshop with City staff to evaluate the nine alternatives. Four alternatives were selected for additional consideration:

- Alternative 4A – Beard Brook Industrial Park Alignment – Pumped Option
- Alternative 7 – Modified Combination of Option 4 & 5
- Alternative 9A – Gravity Under Beard Brook – Existing Alignment
- Alternative 9B - Gravity Under Beard Brook –Southern Alignment

The final step in the process was to evaluate the final four alternatives during an Alternative Evaluation Workshop. Screening-level cost estimates for the alternatives are summarized in Table 1. Alternative 9A has the lowest cost at $72.9 million.

Table 1 Alternative Cost Comparison

Alternative	Estimated Construction Cost ($ M)
Alternative 4A	$76.7
Alternative 7	$100.1
Alternative 9A	$72.9
Alternative 9B	$74.0

In addition to cost considerations, the workshop team evaluated advantages, disadvantages, and technical challenges. Consensus was reached that a modified version of Alternative 9A was the preferred project that should be carried forward for preliminary design. The preferred alternative is illustrated on Figure 3.

Refined costs for the preferred alternative are provided in Table 2. The cost is estimated to range from $71.8 million and $72.6 million, depending on the final alignment for the southern most sections of the new 60-inch diameter Sutter Trunk where it enters the SAPTF.

Table 2 Alternative 9A - Construction Cost Estimate						
					9A.1	9A.2
Item	Description	Quantity	Unit	Unit Cost	Total	Total
1	24” Rehabilitation (Sutter)	4,140	LF	$342	$1,416,000	$1,416,000
2	21” SS (Tuolumne)	1,330	LF	$599	$797,000	$797,000
3	48” SS (Tuolumne)	2,310	LF	$1,203	$2,779,000	$2,779,000
4	54” SS (Colorado)	3,860	LF	$1,323	$5,106,000	$5,106,000
5A	60” SS (Colorado to SAPTF)	3,820	LF	$1,604	$6,128,000	
5B	Alternate 60” SS (Colorado to SAPTF)	3,190	LF	$1,650		$5,263,000
6	Shackelford PS (4.2 mgd)	1	LS		$1,633,000	$1,633,000
7	Shackelford 14” FM & 18” Gravity Sewer	3,060	LF	$473	$1,446,000	$1,446,000
8	48” SS (BB Northern Alignment)	1,543	LF	$3,883	$5,991,000	$5,991,000
9	36” & 48” SS (B St to RTPS)	3,400	LF	$1,416	$4,816,000	$4,816,000
10	Dual 24” & 36” Force Mains (Tuolumne)	4,100	LF	$1,401	$5,746,000	$5,746,000
11	River Trunk PS (53 mgd)	1	LS		$24,721,000	$24,721,000
12	CSL Diversion Structures	1	LS		$466,000	$466,000
13	RT Rehabilitation	9,000	LF	$855	$7,696,000	$7,696,000
14	Riverbank Armament	1	LS		$3,887,000	$3,887,000
	TOTAL				**$72,626,000**	**$71,761,000**

Reverse River Trunk

Replace Beard Brook Siphon with Gravity

Sutter Trunk Gravity

River Trunk Pump Station

River Trunk Converts to CSL for Additional Capacity

Rehab Sutter Trunk

River Trunk/Sutter Trunk Gravity

Shackelford Pump Station

Alternative Route

Sutter Primary Treatment Facility

MURIEL LS

CALIFORNIA LS

BEARDBROOK LS

PEPSI LS

BENSON LS

Gallo

MARSHALL AVE

PICARDY DR

RITSCH CT

LOMBARDY DR

BEVERLY DR

VERNON AVE

MANOR DR

LEON AVE

COLORADO AVE

SUNSET AVE

ROUSE AVE

PELTON AVE

W HATCH RD

ZEFF RD

RIVER RD

FLORES AVE

SONORA AVE

JANOPAUL AVE

OLIVERO RD

HWY 99

TENAYA DR

CANAL ST

KERR AVE

ANGLE LN

TIOGA DR

LEGION PARK DR

MAGIC LN

STONUM RD

PHIL WY

THOMPSON RD

BYSTRUM RD

LEO AVE

SAM AVE

NADINE AVE

EUGENE AVE

TYRUS ST

JOYCE AVE

S 7TH ST

S 9TH ST

HERNDON AVE

MUNCHKIN DR

WIZARD LN

SAUSALITO WY

YELLOW BRICK RD

PISMO PL

RICHLAND AVE

E HATCH RD

ATLANTIC DR

DOVER AVE

WATSON AVE

PARKLAWN AVE

MIDWAY AVE

MORGAN RD

HWY 99 (ON RAMP)

GIDDINGS ST

GRAND VIEW AVE

DARBY LN

Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- PS Proposed Lift Station
- PS Other Lift Stations
- Proposed CSL Control Structure
- Proposed Junction Box

N

0 1,000 2,000 Feet

RECOMMENDED ALTERNATIVE

FIGURE 3

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

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M:\Modesto_FNO\9551A.00\GIS\Figures\Alternatives Eval TM\Updated Figures\Figure 03 - Recommended Alternative 9.mxd

3.0 PROJECT BACKGROUND

This section provides a description of the existing Sutter Trunk, River Trunk, Beard Brook Siphon, and the CSL facilities. In addition, this section describes the capacity constraints, and project goals used to evaluate and the preferred alternative.

3.1 Capacity Constraints and Challenges

3.1.1 River Trunk

The River Trunk (Figure 2) is approximately five miles long, and conveys flows from six major tributaries of the City's collection system. The River Trunk begins near the intersection of Beard Avenue and Nathan Avenue and flows west along Nathan Avenue and Oregon Drive to Beard Brook Park. Pipeline sizes range from 45 to 60 inches in diameter. At Beard Brook Park, the River Trunk crosses Dry Creek through a single 48-inch diameter inverted siphon. Between Beard Brook Park and the Union Pacific Railroad (UPRR) crossing, the River Trunk alternates as single and parallel segments with segments varying between 24-inches and 48-inches in diameter. West of the UPRR crossing, a 48-inch diameter pipeline runs west along the Tuolumne River and increases to a 60-inch diameter pipeline in the lower reaches near the SAPTF.

Currently, the River Trunk conveys an Average Dry Weather Flow (ADWF) of approximately 12.3 million gallons per day (mgd). Projected flows are approximately 18.0 mgd at buildout. During existing Peak Wet Weather Flow (PWWF) conditions, the flows in the River Trunk are approximately 53 mgd. At buildout with direct storm drain connections removed, the PWWF is estimated to be 42 mgd.

The Master Plan identified hydraulic capacity deficiencies in several portions of the River Trunk west of Beard Brook Park (see Figure 4). The capacity-deficient portions of this reach of the River Trunk are primarily in the single and parallel 24-inch through 48-inch diameter reaches. In some cases, the hydraulic model indicates that the maximum full flow capacity of the River Trunk is 25.3 mgd compared to a required capacity of 52 mgd.

The major project challenges associated with the River Trunk include:

- **Deterioration:** The River Trunk was originally constructed in the 1940's. Only a portion of the line has been inspected internally. Digital photo inspection at select locations has revealed significant deterioration. A condition assessment of this facility west of Beard Brook Park will be performed as part of this project to determine if the deterioration is consistent for the full length of the pipeline. Results of the condition assessment will be presented in a separate TM. However, it is very likely that River Trunk will require full-length rehabilitation.

MURIEL LS
PS
CALIFORNIA LS
PS
BEARDBROOK LS
PS
Detail A
Beard Brook Siphon
Gallo
River Trunk
PEPSI LS
PS
Cannery Segregation Line
BENSON LS
PS
Sutter Trunk
Shackelford Siphon
Detail A
Triple Barrel Cannery Segregation Line Siphon
Single Barrel River Trunk Siphon
Sutter Primary Treatment Facility
Source: Esri, DigitalBodGeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
RIVER RD
SUNSET AVE
ZEFF RD
MEECE DR
SONORA AVE
JANOPAUL AVE
BYSTRUM RD
LEGION PARK DR
STONUM RD
THOMPSON RD
PICARDY DR
LOMBARDY DR
BEVERLY DR
VERNON AVE
MANOR DR
W HATCH RD
OLIVER
PARKLAWN AVE
RISSO CT
DEL MAR CT
TENAYA DR
CANAL ST
KERR AVE
ANGLE LN
SAN MATEO WYYELLOW BRICK RD

Legend

Capacity Deficient Trunklines
- River Trunk
- Cannery Segregation Line
- Sutter

Other Pipelines
- 8" and Smaller
- Greater than 8"
- PS Lift Station

0 1,000 2,000 Feet

carollo

C:\Users\jramirez\Desktop\Modesto figures\Figure 4 - Capacity Deficiencies.mxd

CAPACITY DEFICIENT TRUNKLINES

FIGURE 4

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

MODESTO CALIFORNIA

- **Vulnerability to River Bank Washout:** In 2007, California experienced a wet winter that created record flows in the Tuolumne River. High river flows eroded the bank of the river and exposed a portion of the CSL. Because of this, the City needed to implement emergency armoring of the CSL pipeline. However, the risk associated with the failure of the River Trunk and the CSL in this area is still considered extreme. For this reason, the selected alternative must address the vulnerability of the both the River Trunk and CSL.

- **Deep Sewer Pipelines:** The River Trunk and CSL are adjacent to the Tuolumne River, which is one of the lowest elevation areas within the City. Relocating the River Trunk out of the riverbed will require construction of deep pipelines requiring costly trenchless construction methods.

- **Operations and Maintenance (O&M) Issues:** The alignment of the River Trunk poses additional challenges beyond risk of potential wash out due to high river flows. The day-to-day operation and maintenance procedures typically required of wastewater collection systems is hampered by the location along the river. During rain events, it is not possible to drive on the Dryden Golf Course, eliminating the possibility to conduct maintenance or cleaning activities. Access to the pipeline parallel to the Tuolumne River edge is also extremely challenging, as there is environmentally protected vegetation along the riverbanks. Therefore, should the River Trunk be relocated out of the riverbed, it will be beneficial from both an accessibility as well as vulnerability standpoint.

3.1.2 Sutter Trunk

The Sutter Trunk (Figure 2) begins near the intersection of Jefferson and 8th Street and runs south of Jefferson Street, Paradise Avenue, and Sutter Avenue down to the SAPTF. The Sutter Trunk is approximately 13,000 linear feet long and ranges in size from 16 to 24-inches in diameter.

Currently, the Sutter Trunk conveys approximately 1.1 mgd of wastewater flow on an ADWF basis. At buildout, the flow is projected to increase to 1.3 mgd. According to the hydraulic model, the Sutter Trunk PWWF is approximately 5.3 mgd. At buildout, with direct storm drain connections removed, the PWWF is approximately 3.9 mgd. According to the hydraulic model, the maximum full flow capacity of the Sutter Trunk is approximately 3.6 mgd.

The Master Plan identified capacity deficiencies in the Sutter Trunk in the 6,700 linear foot reach of 24-inch diameter pipeline on Sutter Avenue from Tuolumne Boulevard to the SAPTF. The location of the capacity deficient reach of the Sutter Trunk is shown on Figure 3.

The major project challenges associated with the Sutter Trunk include:

- **Deterioration:** The Sutter Trunk was constructed is a major trunk line carrying domestic wastewater from the downtown area. As with the River Trunk, the full condition of this pipeline is currently unknown. A condition assessment of this facility will be performed as part of this project and will be presented in a separate TM.

- **Utility Conflicts in Sutter Avenue:** The number of existing utilities and traffic conditions within the existing Sutter Avenue alignment from Tuolumne Boulevard to the SAPTF make it all but impossible to replace the existing pipeline. Therefore, it is preferable to reroute the Sutter Trunk capacity relief sewer to Colorado Avenue, which has fewer utility conflicts and traffic congestion.

3.1.3 Beard Brook Siphon

The Beard Brook Siphon consists of a single 48-inch diameter pipeline that runs underneath Dry Creek, and parallel to the existing triple barrel CSL siphon (see Figure 3). The Beard Brook Siphon is approximately 1,720 linear feet long. The single 48-inch siphon barrel is the only pipeline that conveys domestic wastewater for three (3) of the City's tributaries (Areas 5, 6, and 7).

Currently, the Beard Brook Siphon conveys an ADWF of approximately 8.5 mgd, and is projected to convey an ADWF of approximately 13.7 mgd at future buildout. During existing PWWF conditions, the flows in the siphon are approximately 38.3 mgd. At future buildout with direct storm drain connections removed, the PWWF is estimated to be roughly 31.8 mgd in the Beard Brook Siphon.

The major project challenges associated with the Beard Brook Siphon include:

- **Deterioration:** As with the River Trunk, the Beard Brook Siphon was originally constructed in the 1940's and is in poor condition.

- **Vulnerability:** The current configuration of the existing Beard Brook Siphon does not include any redundancy in the event of a failure of the single barrel siphon under Dry Creek.

- **O&M Issues:** The physical location of the Beard Brook Siphon is mainly within private property owned by the Gallo wine company. The City has received numerous odor complaints from Gallo related to the Beard Brook Siphon, which is a major challenge for the City's O&M staff. In addition, Fats, Oil, and Grease (FOG) buildup is a major challenge in the junction boxes on both sides of the siphon. These issues are magnified by the capacity issues of the siphon itself.

3.1.4 Cannery Segregation Line

The CSL (Figure 2) begins at the Sutter Avenue Plant as a 66-inch diameter pipe and parallel to the River Trunk and the Tuolumne River (Figure 3). The CSL crosses beneath Highway 99 and the Union Pacific Railroad (UPRR). The CSL crosses under Dry Creek in a

12-inch, 18-inch, and 24-inch diameter triple barrel inverted siphon, where it continues east in Oregon Drive. Between Dry Creek and Garner Road, the diameter ranges between 12-inches and 48-inches. The total length of this pipeline is approximately 12-miles.

As previously discussed, West Yost Associates recently completed a Vulnerability Study for the City that identifies existing and projected flows in the CSL for non-canning season wastewater flows, as well as for maximum day and peak hour flows during the canning season. During the non-canning season, Average Daily Flow (ADF) in the CSL pipeline ranges from approximately 2.2 mgd to 3.8 mgd. During the canning season, the ADF in the CSL is estimated to range from 16.5 mgd to 22.9 mgd, with a peak hourly flow of 31.8 mgd. At buildout, the Vulnerability Study predicts that the peak hourly flow during the canning season approaches 51.6 mgd.

Based on these updated flow projections, capacity limitations in the existing CSL were identified. Under existing peak hourly flow conditions, the Vulnerability Assessment identifies minor surcharging in the existing CSL at the siphon and near the river bend by the Modesto Municipal Golf Course. Under future peak hour flow conditions, the Vulnerability Assessment predicts pipeline surcharging in the existing CSL.

The major challenges associated with the CSL include:

- **Capacity Constraints:** The scope of this Project does not specifically include addressing the existing and future capacity constraints of the CSL that were identified in the Vulnerability Assessment. However, the capacity needs of the CSL need to be considered, because the selected River Trunk/Sutter Trunk project will affect the way in which the City will address the CSL capacity needs moving forward. Therefore, the impacts to the CSL of each alternative should be included in the selecting a preferred alternative.

- **Vulnerability:** As with the River Trunk, the CSL is vulnerable to washout during major rain events along the Tuolumne River, as occurred in 2007.

- **O&M Issues:** Because the River Trunk and CSL follow the same general alignment, similar O&M and access issues are present in the CSL as with the River Trunk.

4.0 PROJECT GOALS

- The overriding objective of this project is to provide adequate capacity during PWWF to mitigate the risk of SSO's in the Sutter Trunk, River Trunk, and the Beard Brook Siphon facilities. However, during the conceptual development of the project, additional project goals were identified. Based on meetings with City staff and review of existing information, the following list of project goals was developed. Address deterioration of the Sutter and River Trunks,

- Address peak flow limitations in the Sutter and River Trunks,

- Address Beard Brook Siphon flow bottleneck and lack of redundancy,
- Address CSL peak flow limitations,
- Avoid treatment plant impacts from comingling of CSL and domestic flows,
- Provide River Trunk O&M access and mitigate vulnerability of river washout, and
- Provide CSL O&M access and mitigate vulnerability of river washout.

The following sections of this TM describe the identified alternatives, and detail their ability to meet the stated project goals. Ultimately, the selected alternative was one that provided the most benefit to the City as it relates to these seven goals.

5.0 HYDRAULIC DESIGN CRITERIA

Hydraulic design criteria outlined in the City's 2001 Standard Specifications and 2007 Sewer Master Plan (SMP) were used to evaluate alternatives to increase hydraulic capacity. The planning criteria include pipe roughness, acceptable gravity sewer pipe slopes, velocity constraints, and maximum allowable depth of flow within a pipeline.

5.1 Manning Coefficient

The manning coefficient 'n' is a friction coefficient that depends on pipe material, size of pipe, depth of flow, smoothness of joints and the presence of root intrusion. For sewer pipes, the manning coefficient typically ranges between 0.011 and 0.017, with 0.013 being a representative value used for system planning purposes. For this study, a manning "n" factor of 0.013 was adopted for all proposed and improved sewer collection system pipelines in the hydraulic model, and then refined as necessary during model verification to accurately simulate field measured wastewater levels and velocities.

5.2 Flow Depth Criteria

Table 3 summarizes the flow depth criteria proposed for the evaluation of existing gravity sewers and for sizing new gravity pipelines. For existing pipelines, facilities with a flow depth greater than 85 percent (85 percent), or a diameter ratio (d/D) of 0.85, were considered deficient. Proposed new pipelines were sized to convey design flows at a maximum capacity of 70 percent (70 percent), or d/D ratio of 0.70.

Table 3 Maximum Flow Depth Criteria

Sewer	Maximum d/D Ratio (at PWWF)
Existing	0.85
Proposed	0.70

5.3 Design Velocities

To minimize the settlement of solids in the pipeline and avoid wear from erosion, it is standard practice in the design of gravity pipelines to specify minimum velocity constraints. It is standard practice to design gravity sewers with a minimum velocity of 2 feet per second (ft/s). Additionally, force mains are typically designed for a minimum velocity of 3 ft/s and maximum velocity of 8 ft/s.

Table 4 lists the recommended minimum slopes for gravity sewers when flowing at maximum depth. These slopes will enable peak flows to maintain a minimum velocity of 2 ft/s.

Table 4 Minimum Slope for New Gravity Pipes

Pipe Diameter (inches)	Recommended Minimum Slope
18	0.0010
21	0.0008
24	0.0007
27	0.0006
30	0.0005
36	0.0004
42	0.0003
48	0.0003
54	0.0003
60	0.0003
66	0.0003

6.0 PROJECT ALTERNATIVES

Nine project alternatives were initially developed and evaluated during a Brainstorming Workshop (July 10, 2014) with the City, Carollo team members, and other project team members. Below is a detailed description of the original alternatives.

6.1 Alternative 1 – Master Plan Recommendations

Alternative 1 is based on the recommendations documented in the 2007 Master Plan (Figure 5). This option includes the replacement of the Beard Brook Siphon with a 1,800 linear foot, triple barrel inverted siphon. The siphon would include two 42-inch barrels and a single 24-inch barrel.

Capacity deficiencies in the River Trunk would be mitigated by constructing a peak flow diversion structure that diverts to the CSL during wet weather events, the available



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Proposed Diversion Structure
- Proposed Lift Station (PS)
- Other Lift Stations (PS)

N

0 1,000 2,000 Feet

ALTERNATIVE 1 - MASTER PLAN RECOMMENDATION

FIGURE 5

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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C:\Users\jramirez\Desktop\Modesto figures\Figure 5 - Alternative 1.mxd

capacity in the CSL can be used to convey peak domestic wastewater flows. A second diversion structure would be constructed just upstream of the SAPTF to divert the flows back to the River Trunk for primary treatment. The CSL would be flushed after the diversions multiple times prior to returning to normal canning season operation. Capacity deficiencies in the Sutter Trunk would be mitigated by replacing the existing sewer with a new 24-inch diameter gravity sewer. This alternative also includes rehabilitation of the River trunk based on recommendations that will be developed as part of a separate technical memorandum. The components of Alternative 1 are included in Table 5.

Table 5 Alternative 1 - Major Facilities Summary

Description	Location	Proposed Size	Estimated Depth (ft)	Quantity
Sutter Trunk Gravity	Sutter Ave. from Tuolumne to SAPTF	24”	Same as Existing	5,740 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Siphon	1,800 LF
River Trunk – CSL Diversion	10th Street and Morton Boulevard	48”	10	1
CSL – River Trunk Diversion	Dryden Golf Course, east of the SAPTF	60”	10	1

Based on the project goals discussed above, Alternative 1 only meets the first three goals, as summarized in Table 6.

Table 6 Project Alternative Comparison to Project Goals - Alternative 1

		Alternatives								
	Project Goals	1	2	3	4	5	6	7	8	9
1	Deteriorating River Trunk and Sutter Trunk	X								
2	Peak flow limitations for River Trunk and Sutter Trunk	X								
3	Beard Brook Siphon: flow bottle neck and lack of redundancy	X								
4	CSL peak flow limitations									
5	Treatment plant impacts from comingled flows									
6	River Trunk O&M access & vulnerability									
7	CSL Trunk O&M access & vulnerability									

6.2 Alternative 2 – Pump Station on River Trunk

Alternative 2 reroutes the existing River Trunk away from the Tuolumne River riverbed through the construction of a new River Trunk Pump Station and forcemain (Figure 6). This alternative includes replacing the existing Beard Brook Siphon with a new 1,800 linear foot, triple barrel siphon (via HDD construction under Dry Creek). The outer diameters of the siphon pipelines include one 24-inch barrel and two 42-inch barrels. The capacity deficiencies and exposure to washout from high river flows for the River Trunk would be mitigated by construct a new 53 mgd pump station east of Highway 99 that will convey the flows via a new 1,300 LF dual 24-inch and 36-inch diameter force main routed down Tuolumne Boulevard. The force main will convey flow under Highway 99, where it will discharge to a new 48-inch gravity pipeline from the east edge of the municipal golf course to the intersection of Colorado Avenue. This gravity segment is approximately 2,300 lineal feet in length. At the intersection of Tuolumne Boulevard and Colorado Avenue, the River trunk would be combined with a new Sutter Trunk to convey flow from both facilities south in Colorado to the SAPTF. The flows from the Shackelford siphon will be conveyed across the Dryden Golf course in a new gravity sewer to connect with the new combined River/Sutter Trunk sewer in Colorado Avenue. In addition, both the Sutter Trunk and the existing River trunks would be rehabilitated based on the recommendations in a separate technical memorandum. The major components of Alternative 2 are included in Table 7.

Table 7 Alternative 2 - Major Facilities Summary

Description	Location	Proposed Size	Estimated Depth (ft)	Quantity
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Colorado	30”	19.9’ – 23.3’	1,330 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Siphon	1,800 LF
River Trunk PS	Tuolumne and 7th St. Parking Lot	53 mgd (firm capacity)	57’	1
River Trunk Force Main	Tuolumne from 7th St. to Neece	24” and 36” Dual	~5’ to 10’	1,200 LF
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	48”	9.5’ – 21.6’	2,310 LF
River Trunk/Sutter Trunk Gravity	Colorado Ave from Tuolumne to Pelton	54”	22.1’ – 33.0’	5,330 LF
River Trunk/Sutter Trunk to Sutter Plant Connector	Colorado to Sutter Plant	66”	11.0’ – 31.6’	3,170 LF
Shackelford Gravity	Existing siphon to Colorado	27”	5.4’ – 31.6’	4,210 LF



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Proposed Junction Structure
- PS Proposed Lift Station
- PS Other Lift Stations

N

0 1,000 2,000 Feet

ALTERNATIVE 2 - PUMP STATION ON RIVER TRUNK

FIGURE 6

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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C:\Users\jramirez\Desktop\Modesto figures\Figure 06 - Alternative 2.mxd

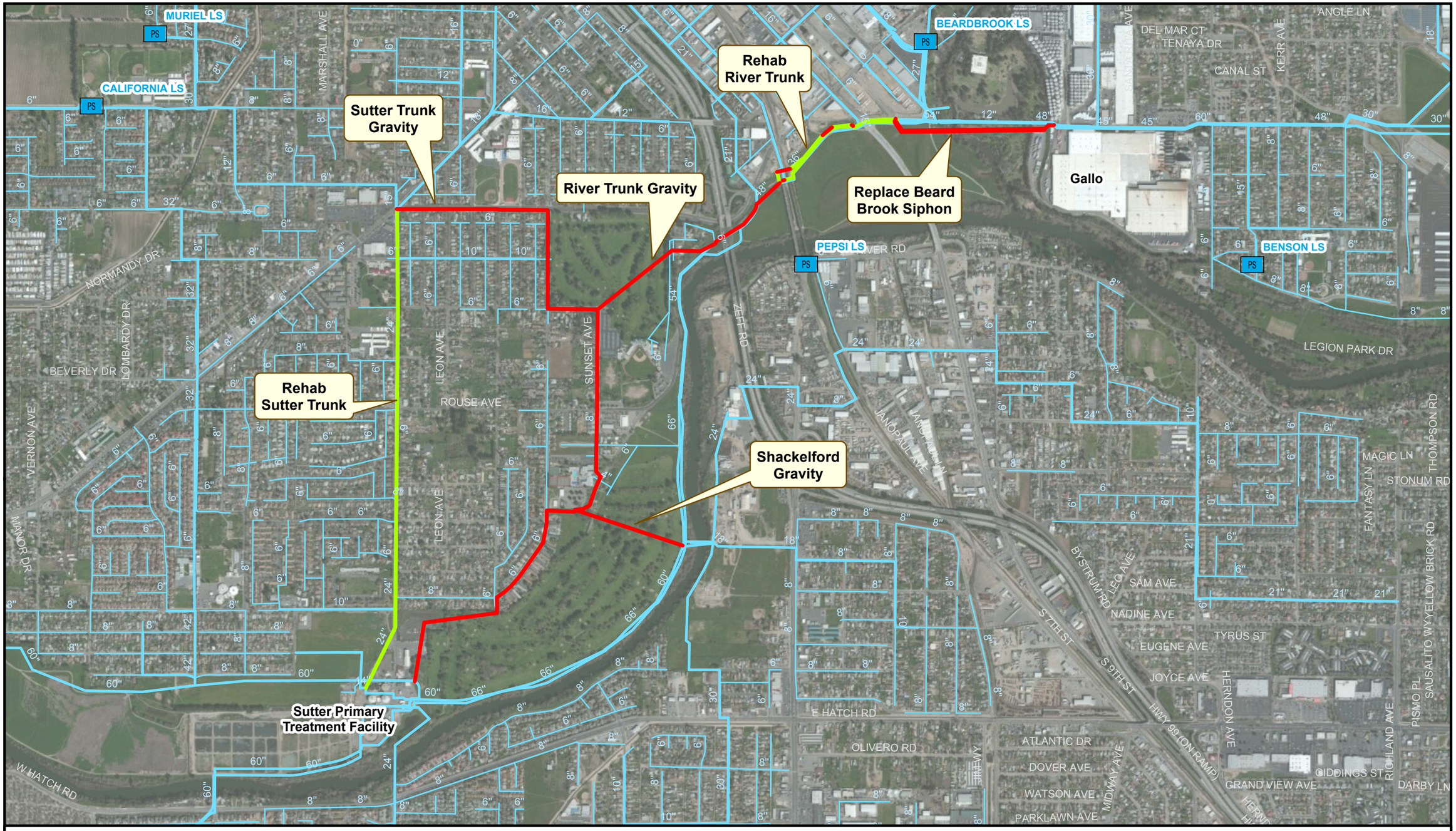
Based on the project goals discussed above, Alternative 2 meets goals one, two, three, five, and six as summarized in Table 8.

Table 8 Project Alternative Comparison to Project Goals – Alternative 2

		Alternatives								
	Project Goals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Deteriorating River Trunk and Sutter Trunk	X	X							
2	Peak flow limitations for River Trunk and Sutter Trunk	X	X							
3	Beard Brook Siphon: flow bottle neck and lack of redundancy	X	X							
4	CSL peak flow limitations									
5	Treatment plant impacts from comingled flows		X							
6	River Trunk O&M access & vulnerability		X							
7	CSL Trunk O&M access & vulnerability									

6.3 Alternative 3 – Gravity Line to Replace River Trunk

This alternative would consist of constructing a new gravity sewer for the River Trunk west of Highway 99 to the SAPTF (Figure 7). Similar to the first two alternatives, Alternative 3 includes replacing the existing Beard Brook Siphon with a new 1,800 linear foot, triple barrel siphon (via HDD construction under Dry Creek). The outer diameters of the siphon pipelines include one 24-inch barrel and two 42-inch barrels. The main difference between this alternative and Alternative 2 is the construction of roughly 9,200 linear feet of new 54-inch through 66-inch diameter gravity pipeline to convey flow from the existing River Trunk west across the existing Modesto Municipal Golf Course to Sunset Avenue and down to the SAPTF. The Sutter Trunk would be combined with the River Trunk by constructing 4,000 linear feet of new 30-inch diameter gravity pipeline from the intersection of Sutter Avenue and Tuolumne Boulevard down Tuolumne Boulevard to Roselawn Avenue, down Roselawn Avenue to South Avenue and then over to the connecting point with the River Trunk/Sutter Trunk pipeline at Sunset Avenue. The flows from the Shackelford siphon will be conveyed across the Dryden Golf course in a new gravity sewer to connect with the new combined River/Sutter Trunk sewer in Colorado Avenue. In addition, both the Sutter Trunk and the existing River trunks would be rehabilitated based on the recommendations in a separate technical memorandum. The major components of Alternative 3 are included in Table 9.



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Proposed Junction Structure
- Proposed Lift Station
- Other Lift Stations

0 1,000 2,000 Feet

ALTERNATIVE 3 - GRAVITY LINE TO REPLACE RIVER TRUNK

FIGURE 7

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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C:\Users\jramirez\Desktop\Modesto figures\Figure 07 - Alternative 3.mxd

Table 9 Alternative 3 - Major Facilities Summary				
Description	**Location**	**Proposed Size**	**Estimated Depth (ft)**	**Quantity**
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Sunset	30”	20’ to 25’	4,000 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Siphon	1,800 LF
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	54” and 66”	30’ – 40’	9,200 LF
Shackelford Gravity	Existing siphon to Colorado	27”	5.4’ – 31.6’	4,210 LF

Alternative 3, meets all the project goals except goal number four (Table 10). Goal four is not satisfied by this alternative, because there would be CSL flow capacity limitations between Beard Brook Park and Highway 99, where the new gravity sewer would connect.

Table 10 Project Alternative Comparison to Project Goals – Alternative 3										
		Alternatives								
	Project Goals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Deteriorating River Trunk and Sutter Trunk	X	X	X						
2	Peak flow limitations for River Trunk and Sutter Trunk	X	X	X						
3	Beard Brook Siphon: flow bottle neck and lack of redundancy	X	X	X						
4	CSL peak flow limitations									
5	Treatment plant impacts from comingled flows		X	X						
6	River Trunk O&M access & vulnerability		X	X						
7	CSL Trunk O&M access & vulnerability			X						

6.4 Alternative 4 – Beard Industrial Park Alignment

Alternative 4 is divided into two sub-alternatives (4A and 4B). Alternative 4A and 4B build off Alternatives 2 and 3 by constructing a new gravity sewer from the Beard Brook Park to 7th Street. This new sewer mitigates capacity deficiencies in the River Trunk in that reach as well as provides additional capacity for the CSL. The additional segment would allow the existing River Trunk between Beard Brook Park and 7th Street to be dedicated to the CSL for additional capacity at 7th Street.

The major facilities for Alternative 4A are illustrated in Figure 8 and summarized in Table 11.

Table 11 Alternative 4A - Major Facilities Summary

Description	Location	Proposed Size	Estimated Depth (ft)	Quantity
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Colorado	30”	19.9’ – 23.3’	1,330 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Microtunnel	1,800 LF
Replace River Trunk	B St/10th St. from River Trunk to new Pump Station	48”	18.0’ – 49.7’	3,070 LF
River Trunk PS	Tuolumne and 7th St. Parking Lot	53 mgd (firm capacity)	57’	1
River Trunk Force Main	Tuolumne from 7th St. to Neece	24” and 36” Dual	~5’ to 10’	1,200 LF
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	48”	9.5’ – 21.6’	2,310 LF
River Trunk/Sutter Trunk Gravity	Colorado Ave from Tuolumne to Pelton	54”	22.1’ – 33.0’	5,330 LF
River Trunk/Sutter Trunk to Sutter Plant Connector	Colorado to Sutter Plant	66”	11.0’ – 31.6’	3,170 LF
Shackelford Gravity	Existing siphon to Colorado	27”	5.4’ – 31.6’	4,210 LF
CSL Diversion Structure	Near Sutter Plant	n/a	--	1

Alternative 4B is similar to Alternative 3, but with the addition of a new pipeline that would be installed along Tuolumne to convey the River Trunk flows by gravity to the SAPTF (Figure 9). components of the alternative are summarized in Table 12.



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Proposed Junction Structure
- Proposed Lift Station (PS)
- Other Lift Stations (PS)

N

0 1,000 2,000 Feet

ALTERNATIVE 4A - BEARD BROOK INDUSTRIAL PARK ALIGNMENT, PUMPED

FIGURE 8

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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C:\Users\jramirez\Desktop\Modesto figures\Figure 08 - Alternative 4A.mxd

Replace River Trunk

Sutter Trunk Gravity

River Trunk Gravity

Replace Beard Brook Siphon

River Trunk/Sutter Trunk Gravity

Rehab Sutter Trunk

Shackelford Gravity

Sutter Primary Treatment Facility

MURIEL LS

CALIFORNIA LS

BEARDBROOK LS

PEPSI LS

BENSON LS

Gallo

NORMANDY DR

BEVERLY DR

LOMBARDY DR

RITSCH LN

LEON AVE

VERNON AVE

MANOR DR

PELTON AVE

W HATCH RD

ZEFF RD

SONORA AVE

DEL MAR CT

TENAYA DR

CANAL ST

KERR AVE

ANGLE LN

LEGION PARK DR

AURORA ST

THOMPSON RD

STONUM RD

PHIL WY

OLIVERO RD

E HATCH RD

ATLANTIC DR

DOVER AVE

WATSON AVE

PARKLAWN AVE

MIDWAY AVE

MORGAN RD

HWY 99 (ON RAMP)

BYSTRUM RD

LEO AVE

SAM AVE

NADINE AVE

EUGENE AVE

JOYCE AVE

TYRUS ST

S 7TH ST

S 9TH ST

HERNDON AVE

GIDDINGS ST

GRAND VIEW AVE

RICHLAND AVE

PISMO PL

SAUSALITO WY

YELLOW BRICK RD

DARBY LN

Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Proposed Junction Structure
- Proposed Lift Station
- Other Lift Stations

N

0 1,000 2,000 Feet

ALTERNATIVE 4B - BEARD BROOK INDUSTRIAL PARK ALIGNMENT, GRAVITY

FIGURE 9

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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C:\Users\jramirez\Desktop\Modesto figures\Figure 09 - Alternative 4B.mxd

Table 12 Alternative 4B - Major Facilities Summary				
Description	**Location**	**Proposed Size**	**Estimated Depth (ft)**	**Quantity**
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
River Trunk Gravity	Beard Brook Park to 7th Street	48”	40+’	3,000
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Sunset	30”	20’ to 25’	4,000 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Siphon	1,800 LF
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	54” and 66”	30’ – 40’	9,200 LF
Shackelford Gravity	Existing siphon to Colorado	27”	5.4’ – 31.6’	4,210 LF

Alternative 4A and 4B both meet all seven of the project goals as summarized in Table 13.

Table 13 Project Alternative Comparison to Project Goals – Alternative 4										
		Alternatives								
	Project Goals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Deteriorating River Trunk and Sutter Trunk	X	X	X	X					
2	Peak flow limitations for River Trunk and Sutter Trunk	X	X	X	X					
3	Beard Brook Siphon: flow bottle neck and lack of redundancy	X	X	X	X					
4	CSL peak flow limitations				X					
5	Treatment plant impacts from comingled flows		X	X	X					
6	River Trunk O&M access & vulnerability		X	X	X					
7	CSL Trunk O&M access & vulnerability				X					

6.5 Alternative 5 – Dual Pump Station and Force Main

Alternative 5 includes a dual pump station configuration that would convey both River Trunk and the CSL flows in separate force mains (Figure 10). This alternative includes replacing the existing Beard Brook Siphon with a new 1,800 linear foot, triple barrel siphon (via HDD construction under Dry Creek). The outer diameters of the pipelines are one 24-inch barrel and two 42-inch barrels. It also includes the construction of a new 3,000 linear foot reach of



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Proposed Junction Structure
- Proposed Lift Station
- Other Lift Stations

N

0 1,000 2,000 Feet

ALTERNATIVE 5 - DUAL PUMP STATION AND FORCE MAIN

FIGURE 10

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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C:\Users\jramirez\Desktop\Modesto figures\Figure 10 - Alternative 5.mxd

48-inch diameter gravity pipeline from Beard Brook Park, up 10th Street to B Street and then westerly down B Street to 7th Street. The main difference between this alternative and Alternative 4A is the construction of a new combined River Trunk/CSL pump station. The new pump station would consist of two separate pump stations at a single site. The first pump station is dedicated to the River Trunk flows and sized to handle 53 mgd. The second pump station is sized for a CSL peak flow of 51.6 mgd. Each pump station includes dual force mains to convey flow from the pump station south across the river, down Zeff Road, and then back across the river to the existing River Trunk near the Shackelford Siphon. The dual CSL force mains continue on to the SAPTF, whereas the River Trunk force mains discharge into the existing River Trunk pipeline. The River Trunk force mains are 30-inches and 36-inches in diameter and would have a total length of approximately 5,900 linear feet. The CSL force mains are 18-inches and 42-inches in diameter and would have a total length of approximately 10,500 linear feet.

For the Sutter Trunk, a new 8,600 linear foot 30-inch diameter gravity pipeline would be constructed along Tuolumne Boulevard to Colorado Avenue and then continue down Colorado Avenue to the SAPTF. The major facilities for Alternatives 5 are summarized in Table 14.

Table 14 Alternative 5 - Major Facilities Summary

Description	Location	Proposed Size	Estimated Depth (ft)	Quantity
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
River Trunk Gravity	Beard Brook Park to 7th Street	48”	40+’	3,000
Sutter Trunk Gravity	Tuolumne to Colorado to SAPTF	30”	20’ to 30’	8,600 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Siphon	1,800 LF
River Trunk/CSL Combined Pump Station	Tuolumne and 7th St. Parking Lot	53 mgd (River Trunk), and 51 mgd (CSL)	50’	1
River Trunk Dual Forcemain	Tuolumne and 7th St. Parking Lot to SAPTF	30” and 36”	5’ to 10’	5,900
CSL Forcemain	Tuolumne and 7th St. Parking Lot to Can Seg Pump Station	18” and 42”	5’ to 10’	10,500
Shackelford Gravity	Existing siphon to Colorado	27”	5.4’ – 31.6’	4,210 LF

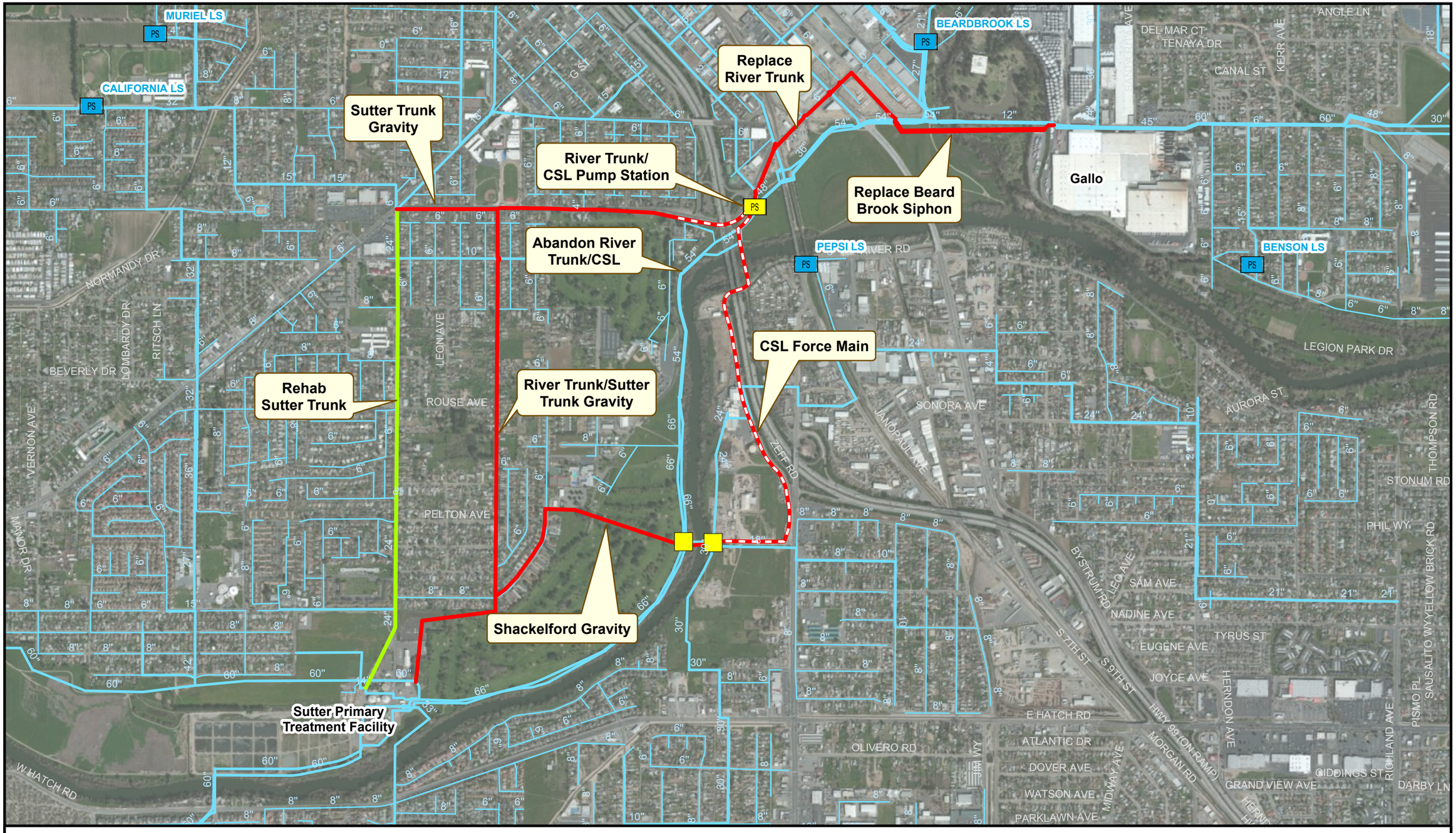
Alternative 5 meets all seven of the project goals, as summarized in Table 15.

Table 15 Project Alternative Comparison to Project Goals – Alternative 5

		Alternatives								
	Project Goals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Deteriorating River Trunk and Sutter Trunk	X	X	X	X	X				
2	Peak flow limitations for River Trunk and Sutter Trunk	X	X	X	X	X				
3	Beard Brook Siphon: flow bottle neck and lack of redundancy	X	X	X	X	X				
4	CSL peak flow limitations				X	X				
5	Treatment plant impacts from comingled flows		X	X	X	X				
6	River Trunk O&M access & vulnerability		X	X	X	X				
7	CSL Trunk O&M access & vulnerability				X	X				

6.6 Alternative 6 – Combined Alternatives 2 & 5

Alternative 6 was developed to combine Alternatives 2 and 5 (Figure 11). This alternative utilizes the dual pump station concept, but instead of pumping the River Trunk flows across the river east of Highway 99, the River Trunk force main and gravity pipelines would be identical to Alternative 2. The major facilities for Alternative 6 are included in Table 16.



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Proposed Junction Structure
- Proposed Lift Station
- Other Lift Stations

0 1,000 2,000 Feet

ALTERNATIVE 6 - COMBINED ALTERNATIVES 2 AND 5

FIGURE 11

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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C:\Users\jramirez\Desktop\Modesto figures\Figure 11 - Alternative 6.mxd

Table 16	Alternative 6 - Major Facilities Summary			
Description	**Location**	**Proposed Size**	**Estimated Depth (ft)**	**Quantity**
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Colorado	30”	19.9’ – 23.3’	1,330 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Siphon	1,800 LF
River Trunk/CSL Combined Pump Station	Tuolumne and 7th St. Parking Lot	53 mgd (River Trunk), and 51 mgd (CSL)	50’	1
River Trunk Force Main	Tuolumne from 7th St. to Neece	24” and 36” Dual	~5’ to 10’	1,200 LF
CSL Forcemain	Tuolumne and 7th St. Parking Lot to Can Seg Pump Station	18” and 42”	5’ to 10’	10,500
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	48”	9.5’ – 21.6’	2,310 LF
River Trunk/Sutter Trunk Gravity	Colorado Ave from Tuolumne to Pelton	54”	22.1’ – 33.0’	5,330 LF
River Trunk/Sutter Trunk to Sutter Plant Connector	Colorado to Sutter Plant	66”	11.0’ – 31.6’	3,170 LF
Shackelford Gravity	Existing siphon to Colorado	27”	5.4’ – 31.6’	4,210 LF

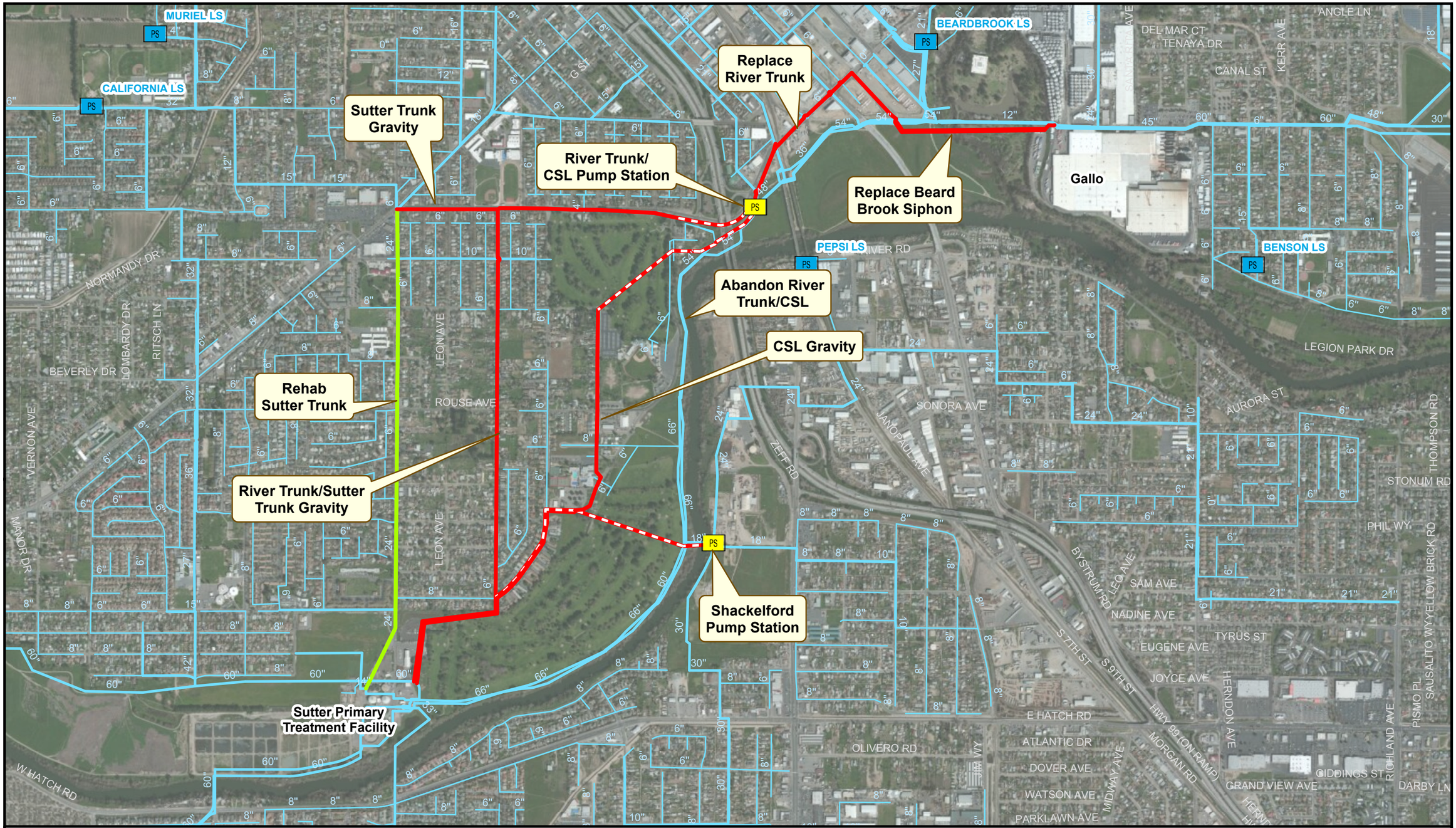
Alternative 6 meets all seven of the project goals, as summarized in Table 17.

Table 17 Project Alternative Comparison to Project Goals – Alternative 6

		Alternatives								
	Project Goals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Deteriorating River Trunk and Sutter Trunk	X	X	X	X	X	X			
2	Peak flow limitations for River Trunk and Sutter Trunk	X	X	X	X	X	X			
3	Beard Brook Siphon: flow bottle neck and lack of redundancy	X	X	X	X	X	X			
4	CSL peak flow limitations				X	X	X			
5	Treatment plant impacts from comingled flows		X	X	X	X	X			
6	River Trunk O&M access & vulnerability		X	X	X	X	X			
7	CSL Trunk O&M access & vulnerability				X	X	X			

6.7 Alternative 7 – Modified Combination of Option 4 & 5

This option was developed to utilize the dual pump station option, but still combine the Sutter Trunk project with the River Trunk Project (Figure 12). The River Trunk facilities are identical to Option 4A. For the CSL, the force main will convey flow under 99 and then into a new gravity pipeline. Another difference with this alternative is that the Shackleford flows would be conveyed to the River Trunk gravity sewer with a new pump station located on the east side of the river. This alternative includes the major facilities summarized in Table 18.



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Proposed Junction Structure
- PS Proposed Lift Station
- PS Other Lift Stations

N

0 1,000 2,000 Feet

ALTERNATIVE 7 - MODIFIED COMBINATION OF ALTERNATIVE 4A AND 5

FIGURE 12

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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C:\Users\jramirez\Desktop\Modesto figures\Figure 12 - Alternative 7.mxd

Table 18	Alternative 7 - Major Facilities Summary			
Description	**Location**	**Proposed Size**	**Estimated Depth (ft)**	**Quantity**
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Colorado	30”	19.9’ – 23.3’	1,330 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Siphon	1,800 LF
Replace River Trunk	B St/10th St. from River Trunk to new Pump Station	48”	18.0’ – 49.7’	3,070 LF
River Trunk PS	Tuolumne and 7th St. Parking Lot	53 mgd (firm capacity)	57’	1
River Trunk Force Main	Tuolumne from 7th St. to Neece	24” and 36” Dual	~5’ to 10’	1,200 LF
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	48”	9.5’ – 21.6’	2,310 LF
River Trunk/Sutter Trunk Gravity	Colorado Ave from Tuolumne to Pelton	54”	22.1’ – 33.0’	5,330 LF
River Trunk/Sutter Trunk to Sutter Plant Connector	Colorado to Sutter Plant	66”	11.0’ – 31.6’	3,170 LF
Shackelford PS	At existing Siphon location, east of River	4.2 mgd (firm capacity)	~20’	1
Shackelford Force Main	Sliplined in existing siphon and open cut through the golf course	14”	~5’-10’	2,000 LF
Shackelford Gravity	Roselawn to Colorado	18”	9.8’ – 14’	860 LF
CSL PS	Tuolumne and 7th St. Parking Lot	51 mgd (firm capacity)	20’	1
CSL Force Main	Pump station site to Roselawn	18” and 42” Dual	~5’-10’	5,000 LF
Existing River Trunk and CSL	Decommission	--	--	--

Alternative 7 meets all seven of the project goals, as summarized in Table 19.

Table 19 Project Alternative Comparison to Project Goals – Alternative 7

		Alternatives								
	Project Goals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Deteriorating River Trunk and Sutter Trunk	X	X	X	X	X	X	X		
2	Peak flow limitations for River Trunk and Sutter Trunk	X	X	X	X	X	X	X		
3	Beard Brook Siphon: flow bottle neck and lack of redundancy	X	X	X	X	X	X	X		
4	CSL peak flow limitations				X	X	X	X		
5	Treatment plant impacts from comingled flows		X	X	X	X	X	X		
6	River Trunk O&M access & vulnerability		X	X	X	X	X	X		
7	CSL Trunk O&M access & vulnerability				X	X	X	X		

6.8 Alternative 8 – Dual Pump Station with Slip lining of River Trunk and CSL with Force Main

Alternative 8 includes construction of the dual pump station configuration and then constructing separate force mains for the River Trunk and CSL by slip lining the existing River Trunk and CSL pipelines that run along the river to the SAPTF (Figure 13). The major facilities of Alternative 8 are summarized in Table 20.



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation

Other Pipelines

- 8" and Smaller
- Greater than 8"

- Proposed Junction Structure
- PS Proposed Lift Station
- PS Other Lift Stations

N

0 1,000 2,000 Feet

ALTERNATIVE 8 - SLIPLINE EXISTING RIVER TRUNK AND CSL

FIGURE 13

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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C:\Users\jramirez\Desktop\Modesto figures\Figure 13 - Alternative 8.mxd

Table 20 Alternative 8 - Major Facilities Summary				
Description	**Location**	**Proposed Size**	**Estimated Depth (ft)**	**Quantity**
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne to Colorado to SAPTF	30”	20’ to 30’	8,600 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Siphon	1,800 LF
Replace River Trunk	B St/10th St. from River Trunk to new Pump Station	48”	18.0’ – 49.7’	3,070 LF
River Trunk PS	Tuolumne and 7th St. Parking Lot	53 mgd (firm capacity)	57’	1
River Trunk Force Main	Slipline Existing River Trunk	Sized to fit in existing RT	Inside Existing RT’	~10,000 LF
Shackelford Gravity	Existing siphon to Colorado	27”	5.4’ – 31.6’	4,210 LF
CSL PS	Tuolumne and 7th St. Parking Lot	51 mgd (firm capacity)	20’	1
CSL Force Main	Pump station site to Roselawn	18” and 42” Dual	~5’-10’	5,000 LF

Alternative 8 meets all the project goals except goals 6, and 7, because the River Trunk and the CSL would still be located in the river bed and along the Dryden golf Course. The goals for Alternative 8 are summarized in Table 21.

Table 21 Project Alternative Comparison to Project Goals – Alternative 8										
		Alternatives								
	Project Goals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Deteriorating River Trunk and Sutter Trunk	X	X	X	X	X	X	X	X	
2	Peak flow limitations for River Trunk and Sutter Trunk	X	X	X	X	X	X	X	X	
3	Beard Brook Siphon: flow bottle neck and lack of redundancy	X	X	X	X	X	X	X	X	
4	CSL peak flow limitations				X	X	X	X	X	
5	Treatment plant impacts from comingled flows		X	X	X	X	X	X	X	
6	River Trunk O&M access & vulnerability		X	X	X	X	X	X		
7	CSL Trunk O&M access & vulnerability				X	X	X	X		

6.9 Alternative 9 – Gravity under Beard Brook

Alternative 9 is similar to Alternative 2 but the River Trunk pump station will be moved to a location just west of Beard Brook Park and a new gravity sewer would be constructed beneath Dry Creek that will eliminate the need for an inverted siphon (Figure 14). Two sub-alternatives were developed for Alternative 9. The sub-alternatives (9A and 9B) offer two separate alignments for the sewer in Beard Brook Park. The major facilities for Alternative 9 are included in Table 22.

Table 22 Alternative 9A/9B - Major Facilities Summary

Description	Location	Proposed Size	Estimated Depth (ft)	Quantity
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Colorado	30”	19.9’ – 23.3’	1,330 LF
Replace Beard Brook Siphon with a Gravity Sewer	Under Dry Creek	36”/48”	Microtunnel	Alt. 9A: 1,490 LF of 48”, 55 LF of 36” Alt 9B: 1,625 LF of 48”, 530 LF of 36”
Reroute River Trunk	B St/10th St. from River Trunk to new Pump Station	36”/48”	13.4 – 29.5	740 LF of 36” 2,690 LF of 48”
River Trunk PS	Near Morton Blvd. and 11th St.	53 mgd (firm capacity)	52’	1
River Trunk Force Main	From Morton to Neece	24” and 36” Dual	~5’ to 10’	4,100 LF
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	48”	9.5’ – 21.6’	2,310 LF
River Trunk/Sutter Trunk Gravity	Colorado Ave from Tuolumne to Pelton	54”	22.1’ – 33.0’	5,330 LF
River Trunk/Sutter Trunk to Sutter Plant Connector	Colorado to Sutter Plant	66”	11.0’ – 31.6’	3,170 LF
Shackelford Gravity	Existing siphon to Colorado	27”	5.4’ – 31.6’	4,210 LF
CSL Diversion Structure	Near Sutter Plant	n/a	--	1



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation

Other Pipelines

- 8" and Smaller
- Greater than 8"

- Proposed Junction Structure
- PS Proposed Lift Station
- PS Other Lift Stations

N

0 1,000 2,000 Feet

ALTERNATIVE 9 - GRAVITY UNDER BEARD BROOK

FIGURE 14

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

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C:\Users\jramirez\Desktop\Modesto figures\Figure 14 - Alternative 9.mxd

Alternative 9 meets all seven of the project goals, as summarized in Table 23.

Table 23 Project Alternative Comparison to Project Goals – Alternative 9

		Alternatives								
	Project Goals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Deteriorating River Trunk and Sutter Trunk	X	X	X	X	X	X	X	X	X
2	Peak flow limitations for River Trunk and Sutter Trunk	X	X	X	X	X	X	X	X	X
3	Beard Brook Siphon: flow bottle neck and lack of redundancy	X	X	X	X	X	X	X	X	X
4	CSL peak flow limitations				X	X	X	X	X	X
5	Treatment plant impacts from comingled flows		X	X	X	X	X	X	X	X
6	River Trunk O&M access & vulnerability		X	X	X	X	X	X		X
7	CSL Trunk O&M access & vulnerability				X	X	X	X		X

6.10 Project Alternative Summary

Nine project alternatives were developed as part of the initial alternatives development process. Table 24 provides a comparison of each alternative with respect to its adequacy in meeting the established goals of the Project. As shown, five of the nine initial project alternatives (Alternatives 4, 5, 6, 7, and 9) meet all of the seven Project Goals, while three other initial project alternatives (Alternatives 2, 3, and 8) only satisfy five of the goals. Alternative 1 only meets three goals, and was therefore eliminated from further consideration.

Table 24 Project Alternative Comparison to Project Goals

		Alternatives								
	Project Goals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Deteriorating River Trunk and Sutter Trunk	X	X	X	X	X	X	X	X	X
2	Peak flow limitations for River Trunk and Sutter Trunk	X	X	X	X	X	X	X	X	X
3	Beard Brook Siphon: flow bottle neck and lack of redundancy	X	X	X	X	X	X	X	X	X
4	CSL peak flow limitations				X	X	X	X	X	X
5	Treatment plant impacts from comingled flows		X	X	X	X	X	X	X	X
6	River Trunk O&M access & vulnerability		X	X	X	X	X	X		X
7	CSL Trunk O&M access & vulnerability				X	X	X	X		X

7.0 NON-MONETARY EVALUATION CRITERIA AND WEIGHTING

7.1 Non-Monetary Evaluation Criteria

Each initial alternative was evaluated based on non-monetary criteria. This section describes the criteria used to evaluate the initial alternatives for non-monetary factors.

7.1.1 Hydraulic Capacity (15 percent)

All alternatives must provide adequate hydraulic capacity to prevent exceeding design benchmarks and risk of sanitary sewer overflows. Evaluation of options requires an assessment of downstream hydraulics as well.

7.1.2 Constructability (15 percent)

Constructability refers to the difficulty of construction methods required, issues, and risks associated with installing pipeline segments and facilities. Special construction methods include trenchless construction, such as microtunneling, pipe-jacking, horizontal directional drilling, or pipe bursting. These construction methods usually require specialty subcontractors to perform the work.

Difficult construction conditions will include deep trenches, high groundwater, high traffic areas, limited access routes, or proximity to environmentally sensitive areas. Alternatives with alignments that are within public ROW or that require temporary construction easements receive higher scores than those with alignments through private property that will require acquisition of temporary and permanent easements.

7.1.3 Permitting (5 percent)

Permitting considers the effect of necessary permits from both government and private agencies. Issues that arise during the permitting process may delay progress and increase associated costs. Alternatives that require a greater number of permits will receive a lower score.

7.1.4 Operations & Maintenance (20 percent)

O&M considerations include the degree to which the operations staff can access the pipelines and facilities (manholes and pump stations) for maintenance and/or repair work. Projects that increase O&M costs or system complexity will receive a lower score under this category. Also, multiple pump stations will score low due to increase maintenance and increased skill level required of maintenance staff.

7.1.5 Utilities (5 percent)

Alignment routes with excessive utilities near or buried will score lower as theses issues have the potential to create project delays and increase cost. An unexpected utility can

force gravity sewer alignments to deviate and alter a segments slope, reducing its hydraulic capacity.

7.1.6 Community Disruption (10 percent)

Community disruption relates to impacts or disruption to the community (e.g., traffic, neighborhoods, and parks) during construction or operation of the completed facilities.

7.1.7 Reliability/Redundancy (20 percent)

Reliability refers to the relative risk of failure of a particular facility. Newer facilities are generally more reliable than older facilities, and thus would receive a higher reliability score. Fully or partially redundant facilities would lesson the impact to the City and the general public in the event of a failure of any of the proposed facilities. Options that include fully or partially redundant facilities are viewed more favorably and would receive a higher score relative to options that do not have redundancy.

7.1.8 CSL Flexibility (10 percent)

While the intent of this project is not to solve the CSL capacity challenges, there is a side benefit to the City to give higher scores to options that will provide flexibility to the City with regards to the future operation of the CSL. Options that allow for more flexibility in addressing the CSL capacity deficiencies in the future would therefore receive a higher score.

8.0 SCREENING OF VIABLE ALTERNATIVES

8.1 Initial Evaluation of Alternatives

An alternative Brainstorming Workshop was conducted on June 10th, 2014 as a means to accomplish several tasks:

- Brainstorm other alternatives that may present viable options that meet project goals,
- Evaluate the options relative to one another via the non monetary evaluation criteria as described above, and
- Determine the top three viable options to move forward to the fifteen percent (15 percent) level of design for more detailed evaluation.

As part of the Brainstorming Workshop, an Alternative Evaluation Scoring Matrix was developed based on the non-monetary evaluation criteria. Each Alternative was given a score between one and five relative to the other options. The options performance score was then multiplied by the evaluation criteria weight and given a weighted score. The weighted scores were totaled and then compared for all nine identified alternatives. The evaluation matrix is presented as Table 25.

Table 25 Initial Alternative Evaluation
River Trunk, Beard Brook Siphon, and CSL Project
City of Modesto

Criteria	Ranking Weight	Option 1 Master Plan Recommendation	Unweighted Score	Weighted Score	Option 2 Pump Station on River Trunk	Unweighted Score	Weighted score	Option 3 Gravity Line to Replace River Trunk	Unweighted Score	Weighted Score	Option 4.2 Beard Brook Industrial Park Alignment, Pumped	Unweighted Score	Weighted Score	Option 4.3 Beard Brook Industrial Park Alignment, Gravity	Unweighted Score	Weighted Score
Hydraulic Capacity	15%	**Advantages:** **Disadvantages:** ● Use of CSL for River Trunk flows in the winter likely not feasible ● Existing River Trunk not available for CSL	3	0.45	**Advantages:** ● Meets hydraulic requirements **Disadvantages:** ● Existing River Trunk still in use between Beard Brook and 7th St (not available for CSL)	4	0.6	**Advantages:** ● Meets hydraulic requirements **Disadvantages:** ● Existing River Trunk still in use between Beard Brook and 7th St (not available for CSL)	4	0.6	**Advantages:** ● Meets hydraulic requirements ● Existing River Trunk freed up for CSL past Beard Brook **Disadvantages:**	5	0.75	**Advantages:** ● Meets hydraulic requirements ● Existing River Trunk freed up for CSL past Beard Brook **Disadvantages:**	5	0.75
Constructability	15%	**Advantages:** ● Open cut ● Shortest length of new facilities ● No pump stations **Disadvantages:**	5	0.75	**Advantages:** ● Open cut **Disadvantages:** ● Pump Station ● Shackelford gravity sewer in golf course requires easement	4	0.6	**Advantages:** ● No pump stations **Disadvantages:** ● Microtunneling required for River Trunk gravity sewer ● Shackelford gravity sewer in golf course requires easement	2	0.3	**Advantages:** ● Mostly open cut ● River Trunk between 7th St and Beard Brook Park in Public ROW **Disadvantages:** ● Deep sewer between 7th St and Beard Brook Park in Public ROW ● Jack and Bore under CSL near Beard Brook Park	3	0.45	**Advantages:** ● Mostly open cut ● River Trunk between 7th St and Beard Brook Park in Public ROW ● No pump stations **Disadvantages:** ● Microtunneling required for River Trunk gravity sewer ● Shackelford gravity sewer in golf course requires easement ● Jack and Bore under CSL near Beard Brook Park	2.5	0.375
Permitting	5%	**Advantages:** ● No major permitting issues expected **Disadvantages:**	5	0.25	**Advantages:** **Disadvantages:** ● Caltrans/Highway 99	4	0.2	**Advantages:** **Disadvantages:** ● Caltrans/Highway 99	4	0.2	**Advantages:** **Disadvantages:** ● Caltrans/Highway 99	4	0.2	**Advantages:** **Disadvantages:** ● Caltrans/Highway 99	4	0.2
Operations & Maintenance (O&M)	20%	**Advantages:** ● No pump stations **Disadvantages:** ● Siphon	1	0.2	**Advantages:** **Disadvantages:** ● Siphon ● Pump station ● Gravity sewer in golf course	3	0.6	**Advantages:** ● No pump stations **Disadvantages:** ● Siphon ● Two gravity sewers in golf courses	2	0.4	**Advantages:** **Disadvantages:** ● Siphon ● Pump station ● Gravity sewer in golf course	3	0.6	**Advantages:** ● No pump stations **Disadvantages:** ● Siphon ● Two gravity sewers in golf courses	2	0.4
Utilities	5%	**Advantages:** ● Relatively minor utility impact **Disadvantages:** ● Sutter Ave alignment difficult	4	0.2	**Advantages:** **Disadvantages:** ● Small diameter sewers need to be reconnected	3	0.15	**Advantages:** ● Fewer small diameter sewers need to be reconnected **Disadvantages:**	4	0.2	**Advantages:** **Disadvantages:** ● Small diameter sewers need to be reconnected	3	0.15	**Advantages:** ● Fewer small diameter sewers need to be reconnected **Disadvantages:**	4	0.2
Community Disruption	10%	**Advantages:** **Disadvantages:** ● Sutter Ave	4	0.4	**Advantages:** **Disadvantages:** ● Golf Course	4	0.4	**Advantages:** **Disadvantages:** ● Golf Course (2)	2.5	0.25	**Advantages:** **Disadvantages:** ● Golf Course	4	0.4	**Advantages:** **Disadvantages:** ● Golf Course (2)	2.5	0.25
Reliability/Redundancy	20%	**Advantages:** **Disadvantages:** ● Option does not provide redundancy to River Trunk or CSL ● Siphon	1	0.2	**Advantages:** ● Some reliability for River Trunk **Disadvantages:** ● No redundancy for CSL ● No redudant sewers upstream of pump station ● Pump station	2.5	0.5	**Advantages:** ● Some reliability for River Trunk **Disadvantages:** ● No redundancy for CSL ● No redudant sewers east of Highway 99 ● Siphon	3	0.6	**Advantages:** ● Existing River Trunk downstream of Beard Brook can be converted to CSL for redundancy **Disadvantages:** ● Pump station ● Siphon	3.5	0.7	**Advantages:** ● Existing River Trunk downstream of Beard Brook can be converted to CSL for redundancy **Disadvantages:** ● Siphon	4	0.8
CSL/Phasing Flexibility	10%	**Advantages:** **Disadvantages:** ● No phasing flexibility or benefits to the CSL	1	0.1	**Advantages:** **Disadvantages:** ● No phasing flexibility or benefits to the CSL	1	0.1	**Advantages:** **Disadvantages:** ● No phasing flexibility or benefits to the CSL	1	0.1	**Advantages:** ● Project can be phased ● Frees up existing River Trunk for CSL capacity **Disadvantages:**	3	0.3	**Advantages:** ● Project can be phased ● Frees up existing River Trunk for CSL capacity **Disadvantages:**	3	0.3
Total Score	**100%**			**2.55**			**3.15**			**2.65**			**3.55**			**3.275**

Table 25 Initial Alternative Evaluation
River Trunk, Beard Brook Siphon, and CSL Project
City of Modesto

Criteria	Option 5 Dual Pump Station and Force Main	Unweighted Score	Weighted Score	Option 6 Combined Option 2 & 5	Unweighted Score	Weighted Score	Option 7 Modified Combination of Option 4 & 5	Unweighted Score	Weighted Score	Option 8 Slipline River Trunk and CSL with Force Main	Unweighted Score	Weighted Score	Option 9 Gravity Under Beard Brook	Unweighted Score	Weighted Score
Hydraulic Capacity	**Advantages:** ● Meets hydraulic requirements ● Existing River Trunk freed up for CSL past Beard Brook **Disadvantages:**	5	0.75	**Advantages:** ● Meets hydraulic requirements ● Existing River Trunk freed up for CSL past Beard Brook **Disadvantages:**	5	0.75	**Advantages:** ● Meets hydraulic requirements ● Existing River Trunk freed up for CSL past Beard Brook **Disadvantages:**	5	0.75	**Advantages:** ● Meets hydraulic requirements ● Existing River Trunk freed up for CSL past Beard Brook **Disadvantages:**	5	0.75	**Advantages:** ● Meets hydraulic requirements ● Existing River Trunk freed up for CSL past Beard Brook **Disadvantages:**	5	0.75
Constructability	**Advantages:** ● River Trunk between 7th St and Beard Brook Park in Public ROW **Disadvantages:** ● Pump station ● Two river crossings ● Force main adjacent to River/golf course ● Deep sewer between 7th St and Beard Brook Park in Public ROW ● Jack and Bore under CSL near Beard Brook Park	2	0.3	**Advantages:** ● River Trunk between 7th St and Beard Brook Park in Public ROW **Disadvantages:** ● Pump station ● Two Highway 99 crossings ● Two river crossings ● Shackelford gravity sewer in golf course requires easement ● Deep sewer between 7th St and Beard Brook Park in Public ROW ● Jack and Bore under CSL near Beard Brook Park	1	0.15	**Advantages:** ● River Trunk between 7th St and Beard Brook Park in Public ROW **Disadvantages:** ● Two pump stations ● Two force mains in golf course ● Deep sewer between 7th St and Beard Brook Park in Public ROW ● Jack and Bore under CSL near Beard Brook Park	3	0.45	**Advantages:** ● River Trunk between 7th St and Beard Brook Park in Public ROW **Disadvantages:** ● Pump station ● Construction Phasing difficult ● Deep sewer between 7th St and Beard Brook Park in Public ROW ● Jack and Bore under CSL near Beard Brook Park ● Shackelford gravity sewer in golf course requires easement	2	0.3	**Advantages:** ● Eliminates Beard Brook Siphon **Disadvantages:** ● Pump station ● Deep gravity under Beard Brook ● Shackelford gravity sewer in golf course requires easement	2.5	0.375
Permitting	**Advantages:** **Disadvantages:** ● Caltrans/Highway 99 ● Two River Crossings ● Force main alignment along river	1	0.05	**Advantages:** **Disadvantages:** ● Caltrans/Highway 99 ● Two River Crossings	2	0.1	**Advantages:** **Disadvantages:** ● Caltrans/Highway 99 ● One River Crossing	3	0.15	**Advantages:** **Disadvantages:** ● One River Crossing	4	0.2	**Advantages:** **Disadvantages:** ● Caltrans/Highway 99 ● One River Crossing	3	0.15
Operations & Maintenance (O&M)	**Advantages:** **Disadvantages:** ● Siphon ● Combined River Trunk/CSL pump station ● Force main alignment along river	3.5	0.7	**Advantages:** **Disadvantages:** ● Siphon ● Combined River Trunk/CSL pump station ● Gravity sewer in golf course	3	0.6	**Advantages:** **Disadvantages:** ● Siphon ● Combined River Trunk/CSL pump station ● Shackelford Pump station ● Two force mains thorugh golf courses	3	0.6	**Advantages:** **Disadvantages:** ● Siphon ● Combined River Trunk/CSL pump station ● Gravity sewer in golf course ● Long reaches of force mains along the river	2	0.4	**Advantages:** ● Eliminates Beard Brook siphon **Disadvantages:** ● Pump station ● Gravity sewer in golf course	4	0.8
Utilities	**Advantages:** **Disadvantages:** ● Small diameter sewers need to be reconnected	2	0.1	**Advantages:** **Disadvantages:** ● Small diameter sewers need to be reconnected	1	0.05	**Advantages:** **Disadvantages:** ● Small diameter sewers need to be reconnected	2.5	0.125	**Advantages:** **Disadvantages:** ● Small diameter sewers need to be reconnected	4	0.2	**Advantages:** **Disadvantages:** ● Small diameter sewers need to be reconnected	4	0.2
Community Disruption	**Advantages:** **Disadvantages:** ● Lower Golf Course	3.5	0.35	**Advantages:** **Disadvantages:** ● Golf Course	3	0.3	**Advantages:** **Disadvantages:** ● Golf Course (2) ● Additional alignments for CSL	2	0.2	**Advantages:** **Disadvantages:** ● Golf Course	4	0.4	**Advantages:** **Disadvantages:** ● Golf Course	4	0.4
Reliability/Redundancy	**Advantages:** ● Existing River Trunk downstream of Beard Brook can be converted to CSL for redundancy **Disadvantages:** ● Pump station ● Siphon	3.5	0.7	**Advantages:** ● Existing River Trunk downstream of Beard Brook can be converted to CSL for redundancy ● CSL flows are pumped around the River Bend **Disadvantages:** ● Pump station ● Siphon	4.5	0.9	**Advantages:** ● Existing River Trunk downstream of Beard Brook can be converted to CSL for redundancy **Disadvantages:** ● Pump station ● Siphon	4	0.8	**Advantages:** **Disadvantages:** ● No reducndancy for CSL ● Pump station ● Siphon	2	0.4	**Advantages:** ● Existing River Trunk downstream of Beard Brook can be converted to CSL for redundancy ● Beard Brook Siphon eliminated **Disadvantages:** ● Pump station	4.5	0.9
CSL Phasing Flexibility	**Advantages:** ● Project can be phased ● Fully adresses CSL capacity issues **Disadvantages:**	5	0.5	**Advantages:** ● Project can be phased ● Fully adresses CSL capacity issues **Disadvantages:**	5	0.5	**Advantages:** ● Project can be phased ● Fully adresses CSL capacity issues **Disadvantages:**	5	0.5	**Advantages:** **Disadvantages:** ● No phasing flexibility or benefits to the CSL	1	0.1	**Advantages:** ● Project can be phased ● Frees up existing River Trunk for CSL capacity **Disadvantages:**	3	0.3
Total Score			**3.45**			**3.35**			**3.575**			**2.75**			**3.875**

Table 26 provides a summary of the initial alternatives evaluation. As shown in Table 4, the initial alternatives were assigned a weighted score that ranged between 2.55 and 3.875. The three alternatives that scored the highest weighted score were Alternative 4A (3.55), Alternative 7 (3.575), and Alternative 9 (3.875).

Table 26	**Initial Alternatives Evaluation Scoring**	
Alternative	**Description**	**Weighted Score**
1	Master Plan Recommendation	2.550
2	Pump Station on River Trunk	3.150
3	Gravity Line to Replace River Trunk	2.650
4A	**Beard Industrial District Alignment, Pumped**	**3.550**
4B	Beard Industrial District Alignment, Gravity	3.275
5	Dual Pump Station and Force Main	3.450
6	Combined Option 2 & 5	3.350
7	**Modified Combination of Option 4 & 5**	**3.575**
8	Slipline River Trunk and CSL with Force Main	2.750
9	**Gravity Under Beard Brook**	**3.875**

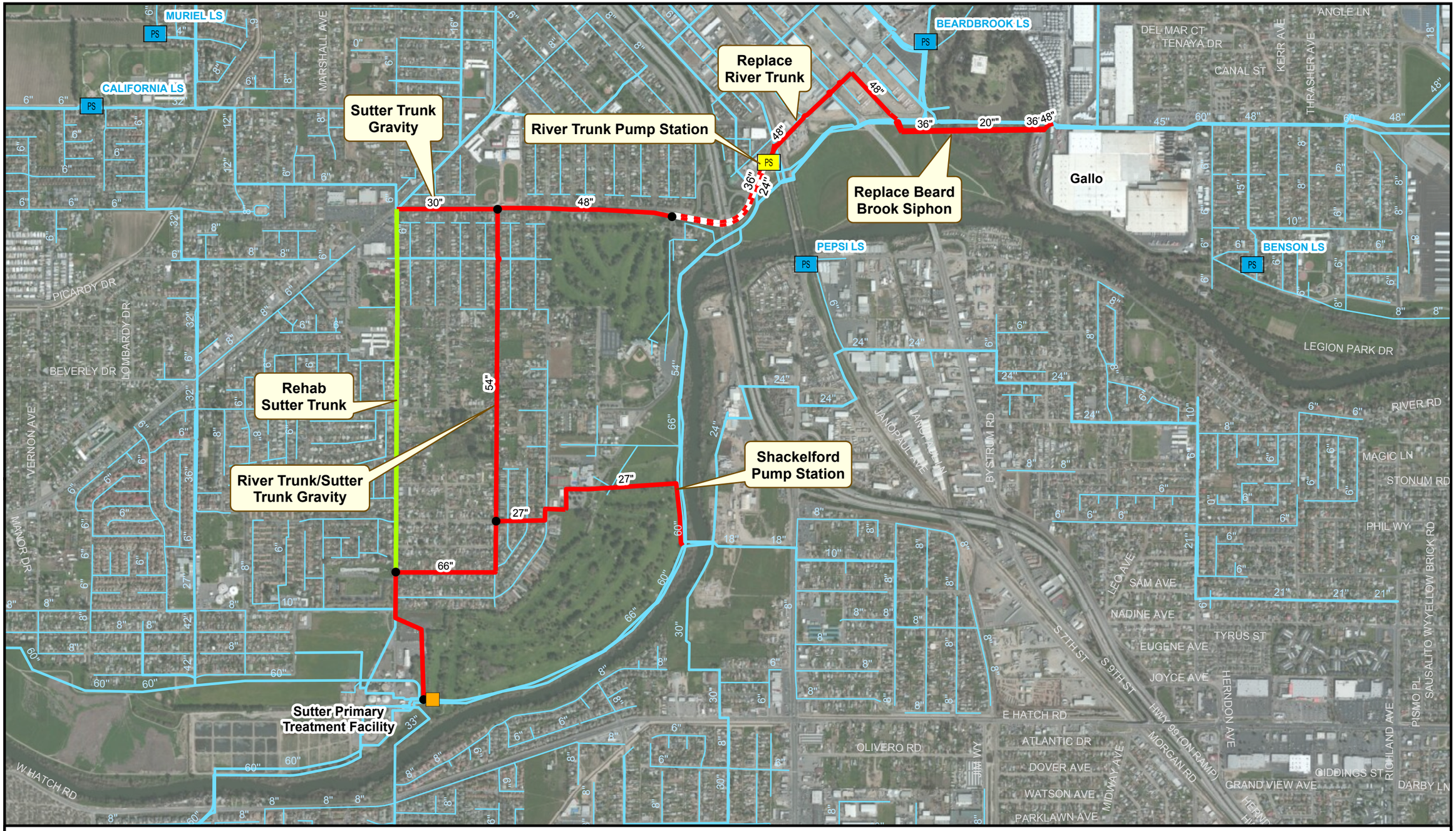
The top three alternatives carried forward for further analysis, and Alternative 9B was added to include an alternative alignment for the Beard Brook deep gravity sewer. The four alternatives are:

- Alternative 4A
- Alternative 7
- Alternative 9A
- Alternative 9B

The alternatives were analyzed in greater detail at the 15-percent design level of detail. As part of the 15-percent design, each alternative was refined in response to City comments received during the Brainstorming Workshop. Preliminary cost estimates were also prepared for each alternative.

8.1.1 Alternative 4A

Alternative 4A was refined to include modifications to the alignment of the River Trunk/Sutter Trunk Gravity sewer near the SAPT. Additionally, a new alignment for the Shackelford Gravity sewer that would cross the Dryden Park Golf Course between the driving range and the greens was also included. These two changes were made based on City staff input to lessen the impact to and the amount of sewer within the golf course (to the extent possible). Alternative 4A is shown on Figure 15, and includes the following key features:



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Proposed Lift Station
- Other Lift Stations
- Proposed CSL Control Structure
- Proposed Junction Box

N

0 1,000 2,000 Feet

SCREENED ALTERNATIVE 4A

FIGURE 15

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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MODESTO CALIFORNIA

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- Rehabilitation of the existing Sutter Trunk,
- Replacement of the existing River Trunk with a new pump station, force main, and gravity trunk,
- Replacement of the existing Beard Brook Siphon with a brand new siphon beneath Dry Creek (the existing River Trunk siphon would then be converted for use by the CSL), and
- Utilization of the existing River Trunk facilities for future CSL capacity needs.

8.1.1.1 Permitting Requirements

The permitting requirements for Alternative 4A, are included in Table 27.

Table 27 Alternative 4A – Required Permits

Agency	Permit Title
Stanislaus County Department of Public Works	Encroachment/Construction Permit
Union Pacific Railroad	Nonintrusive Civil Engineering Survey Permit, Pipeline Crossing Agreement, Railroad Protective Liability Insurance
Caltrans District 10	Encroachment Permit
U.S. Army Core of Engineers	Nationwide Permit No. 12
California Department of Fish and Wildlife	Lake or Streambed Alternation Permit
Central Valley Flood Protection Board	Encroachment Permit
San Joaquin Valley Air Pollution Control Board	Regulation VIII Fugitive PM10 Prohibitions Construction Notification Form
Central Valley Regional Water Quality Control Board	Section 401 Certification
U.S. Environmental Protection Agency	Consultation

Details specific to the requirements of these permits is included in Appendix G. It should be noted that the consultation with the U.S Environmental Protection Agency consultation is only required should the project be funded by federally earmarked funds or through the State Revolving Fund.

8.1.1.2 Easement Requirements

Based on the proposed alignment for Alternative 4A, two permanent easements would need to be established. The new siphon alignment through Beard Brook Park would require a new easement with Gallo for construction and operations of the new facility. The River Trunk Pump Station could be built on one of two City owned parcels in the proposed

location (APN's 102-016-022, and 102-016-003) or would require the purchase of property in APN 102-016-001, which is currently owned by a private party. An easement for the gravity pipeline across the Dryden Golf course would also be required, however the City of Modesto currently owns the golf course property so obtaining that easement would not require coordination with a private land owner.

8.1.1.3 Utility Research

A review of existing alternatives was conducted as part of the screening evaluation for each alternative. The City's utilities (water distribution system, wastewater collection system and the storm drain system) were discussed and included in the evaluation conducted at the Brainstorming Workshop. Additional utility companies were contacted as part of the evaluation process including those listed in Table 28.

Table 28 Alternative 4A – Utilities

Organization/Company	Utility Type
AT&T	Telephone and Data
Charter	Cable Television and Data
PG&E	Gas lines
Modesto Irrigation District (MID)	Electricity and Raw Water
Turlock Irrigation District (TID)	Raw Water
Comcast	Cable Television and Data
Kinder Morgan	Gas
Sprint	Telephone
Stanislaus County	Utilities
Union Pacific Railroad (UPRR)	Railroad

Based on the initial responses to the requests for information TID, and Charter Cable responded that they do not have utilities within the alignment.

8.1.1.4 Alternative 4A Advantage and Disadvantages

Table 29 includes a summary of the major facilities associated with Alternative 4A. Detail maps associated with each major facility, and preliminary profiles of each gravity sewer are included in Appendix A for reference.

The key advantages and disadvantages of this alternative are described below:

- **Advantages**
  - Removes the existing River Trunk from domestic service,
  - Provides a new Beard Brook Siphon with up to date design standards,
  - Addresses the odor concerns of the existing Beard Brook Siphon,

- Provides the River Trunk and Sutter Trunk with adequate capacity to convey peak wet weather flows, and
- Converts the existing River Trunk and River Trunk siphon to the CSL, which will provide CSL with needed capacity.

- **Disadvantages**
  - A domestic siphon will remain at Beard Brook,
  - CSL siphons will remain,
  - The existing River Trunk and CSL will remain adjacent to the Tuolumne River riverbank, and will require slope side armament, and
  - One additional pump station will be required to be operated and maintained.

Table 29 Alternative 4A- Major Facilities

Description	Location	Proposed Size	Estimated Depth (ft)	Quantity
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Colorado	30”	19.9’ – 23.3’	1,330 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Microtunnel	1,800 LF
Replace River Trunk	B St/10th St. from River Trunk to new Pump Station	48”	18.0’ – 49.7’	3,070 LF
River Trunk PS	Tuolumne and 7th St. Parking Lot	53 mgd (firm capacity)	57’	1
River Trunk Force Main	Tuolumne from 7th St. to Neece	24” and 36” Dual	~5’ to 10’	1,200 LF
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	48”	9.5’ – 21.6’	2,310 LF
River Trunk/Sutter Trunk Gravity	Colorado Ave from Tuolumne to Pelton	54”	22.1’ – 33.0’	5,330 LF
River Trunk/Sutter Trunk to Sutter Plant Connector	Colorado to Sutter Plant	66”	11.0’ – 31.6’	3,170 LF
Shackelford Gravity	Existing siphon to Colorado	27”	5.4’ – 31.6’	4,210 LF
CSL Diversion Structure	Near Sutter Plant	n/a	--	1

8.1.2 Alternative 7

Alternative 7 was refined based on the major elements associated with Alternative 7, as described in Section 3.7 of this TM. Key differences between Alternative 7 and the initial

Alternative 7 are some modifications to the alignment of the River Trunk/Sutter Trunk Gravity sewer near the SAPTF, as a new alignment for the Shackelford force main that will directly cross the Dryden Park Golf Course between the driving range and the greens was considered. Additionally, the alignment of the CSL force mains and gravity sewer were adjusted to avoid crossing the Municipal Golf Course. As with Alternative 4A, these changes were made based on City staff input obtained at the Brainstorming Workshop. Alternative 7 is shown on Figure 16, and includes the following key features:

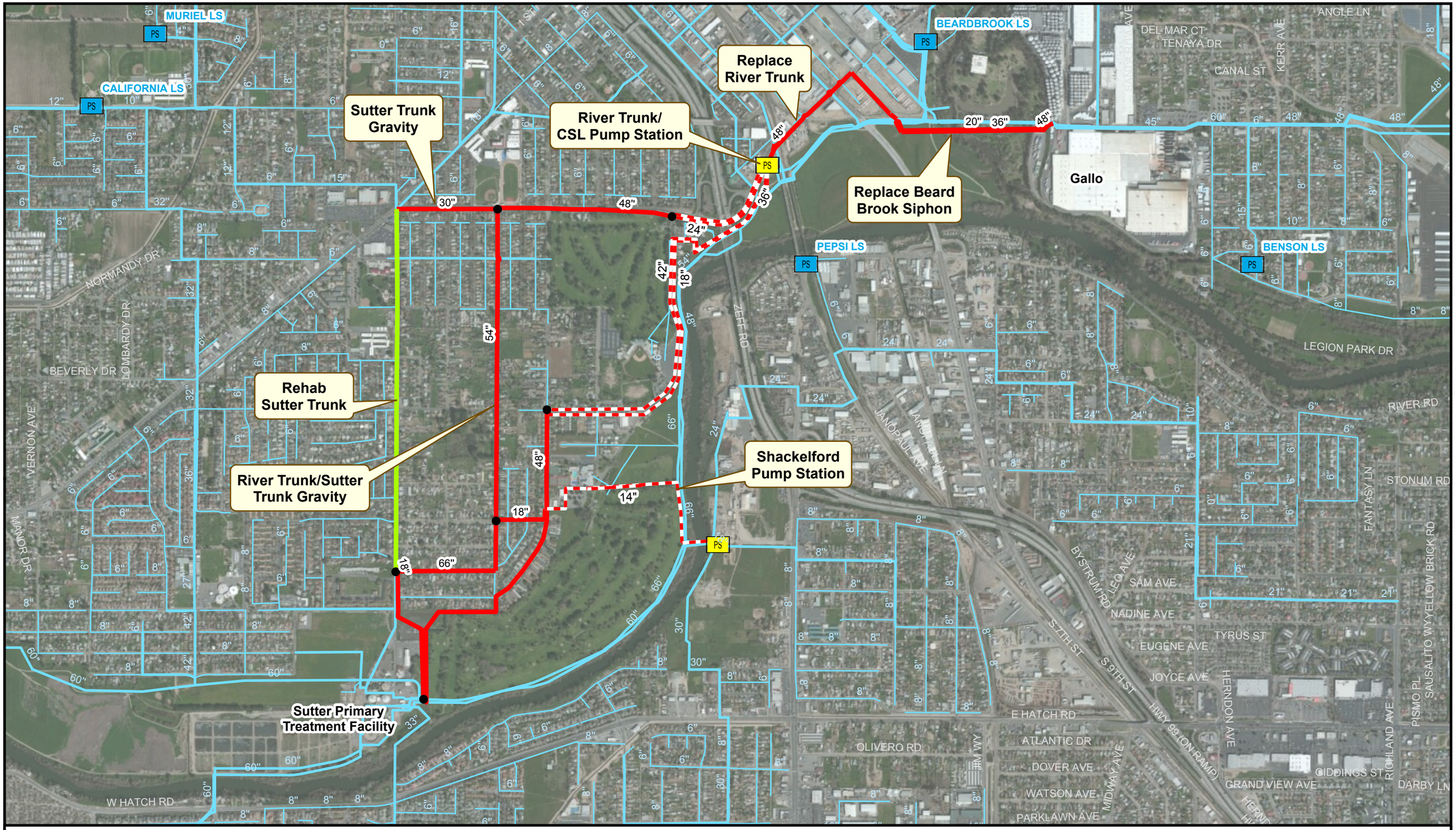
- Rehabilitation of the existing Sutter Trunk,
- Replacement of the existing River Trunk with a new pump station, force main, and gravity trunk,
- Replacement of the existing Beard Brook Siphon with a brand new siphon beneath Dry Creek,
- Replacement of the Shackelford siphon with a new pump station, force main, and gravity sewer to the River Trunk connection ,
- Replacement of the existing CSL with a new pump station, force main, and gravity sewer, and
- Decommission the existing River Trunk and CSL facilities.

8.1.2.1 Permitting Requirements

The permitting requirements for Alternative 7, are included in Table 30.

Table 30 Alternative 7 – Required Permits

Agency	Permit Title
Stanislaus County Department of Public Works	Encroachment/Construction Permit
California State Lands Commission	New Application of General Lease
Union Pacific Railroad	Nonintrusive Civil Engineering Survey Permit, Pipeline Crossing Agreement, Railroad Protective Liability Insurance
Caltrans District 10	Encroachment Permit
U.S. Army Core of Engineers	Nationwide Permit No. 12
California Department of Fish and Wildlife	Lake or Streambed Alternation Permit
Central Valley Flood Protection Board	Encroachment Permit
San Joaquin Valley Air Pollution Control Board	Regulation VIII Fugitive PM10 Prohibitions Construction Notification Form
Central Valley Regional Water Quality Control Board	Section 401 Certification
U.S. Environmental Protection Agency	Consultation



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- PS Proposed Lift Station
- PS Other Lift Stations
- Proposed CSL Control Structure
- Proposed Junction Box

N

0 1,000 2,000 Feet

SCREENED ALTERNATIVE 7

FIGURE 16

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

MODESTO CALIFORNIA

C:\Users\jramirez\Desktop\Modesto figures\Figure 16 - Screened Alternative 7.mxd

Details specific to the requirements of these permits is included in Appendix G. The main difference between the requirements for Alternative 4A and Alternative 7 is the inclusion of the State Lands Commission Lease Application. This requirement is only for Alternative 7 because of the additional crossing of the Tuolumne River for the Shackleford flows. It should be noted that the consultation with the U.S Environmental Protection Agency consultation is only required should the project be funded by Federally earmarked funds or through the State Revolving Fund.

8.1.2.2 Easement Requirements

Based on the proposed alignment for Alternative 7, multiple permanent easements would need to be established. The new siphon alignment through Beard Brook Park would require a new easement with Gallo for construction and operations of the new facility. The River Trunk Pump Station could be built on one of two City owned parcels in the proposed location (APN's 102-016-022, and 102-016-003) or would require the purchase of property in APN 102-016-001, which is currently owned by a private party. A new easement under Highway 99 would be required for the CSL forcemain running from the pump station to Cliff Drive just west of the Highway 99. An easement for the forcemain running across the Dryden Golf course would also be required for the flows from the proposed Shackleford Pump Station and for the new CSL reach down near the SAPTF. However, the City of Modesto currently owns the golf course property, so obtaining that easement would not require coordination with a private landowner.

8.1.2.3 Utility Research

A review of existing alternatives was conducted as part of the screening evaluation for each alternative. The City's utilities (water distribution system, wastewater collection system and the storm drain system) were discussed and included in the evaluation conducted at the Brainstorming Workshop. Additional utility companies were contacted as part of the evaluation process including those listed in Table 31.

Table 31 Alternative 7 – Utilities

Organization/Company	Utility Type
AT&T	Telephone and Data
Charter	Cable Television and Data
PG&E	Gas lines
Modesto Irrigation District (MID)	Electricity and Raw Water
Turlock Irrigation District (TID)	Raw Water
Comcast	Cable Television and Data
Kinder Morgan	Gas
Sprint	Telephone
Stanislaus County	Utilities
Union Pacific Railroad (UPRR)	Railroad

Based on the initial responses to the requests for information TID, and Charter Cable responded that they do not have utilities within the alignment.

8.1.2.4 Alternative 7 Advantage and Disadvantages

Table 32 includes a summary of the major facilities associated with Alternative 7. Detail maps associated with each major facility, and preliminary profiles of each gravity sewer are included in Appendix B for reference.

Table 32 Alternative 7 - Major Facilities

Description	Location	Proposed Size	Estimated Depth (ft)	Quantity
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Colorado	30”	19.9’ – 23.3’	1,330 LF
Replace Beard Brook Siphon	Under Dry Creek	1 x 24” and 2 x 42” (Outer Diameter)	Microtunnel	1,800 LF
Replace River Trunk	B St/10th St. from River Trunk to new Pump Station	48”	18.0’ – 49.7’	3,070 LF
River Trunk PS	Tuolumne and 7th St. Parking Lot	53 mgd (firm capacity)	57’	1
River Trunk Force Main	Tuolumne from 7th St. to Neece	24” and 36” Dual	~5’ to 10’	1,200 LF
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	48”	9.5’ – 21.6’	2,310 LF
River Trunk/Sutter Trunk Gravity	Colorado Ave from Tuolumne to Pelton	54”	22.1’ – 33.0’	5,330 LF
River Trunk/Sutter Trunk to Sutter Plant Connector	Colorado to Sutter Plant	66”	11.0’ – 31.6’	3,170 LF
Shackelford PS	*At existing Siphon location, east of River*	*4.2 mgd (firm capacity)*	*~20’*	*1*
Shackelford Force Main	*Sliplined in existing siphon and open cut through the golf course*	*14”*	*~5’-10’*	*2,000 LF*
Shackelford Gravity	*Roselawn to Colorado*	*18”*	*9.8’ – 14’*	*860 LF*
CSL PS	*Tuolumne and 7th St. Parking Lot*	*51 mgd (firm capacity)*	*~20’*	*1*
CSL Force Main	*Pump station site to Roselawn*	*18” and 42” Dual*	*~5’-10’*	*5,000 LF*
Existing River Trunk and CSL	*Decommission*	--	--	--

Note: Cells shown in italic font are unique to this alternative. Other cells share these features with one or more other options.

The key advantages and disadvantages of this alternative are described below:

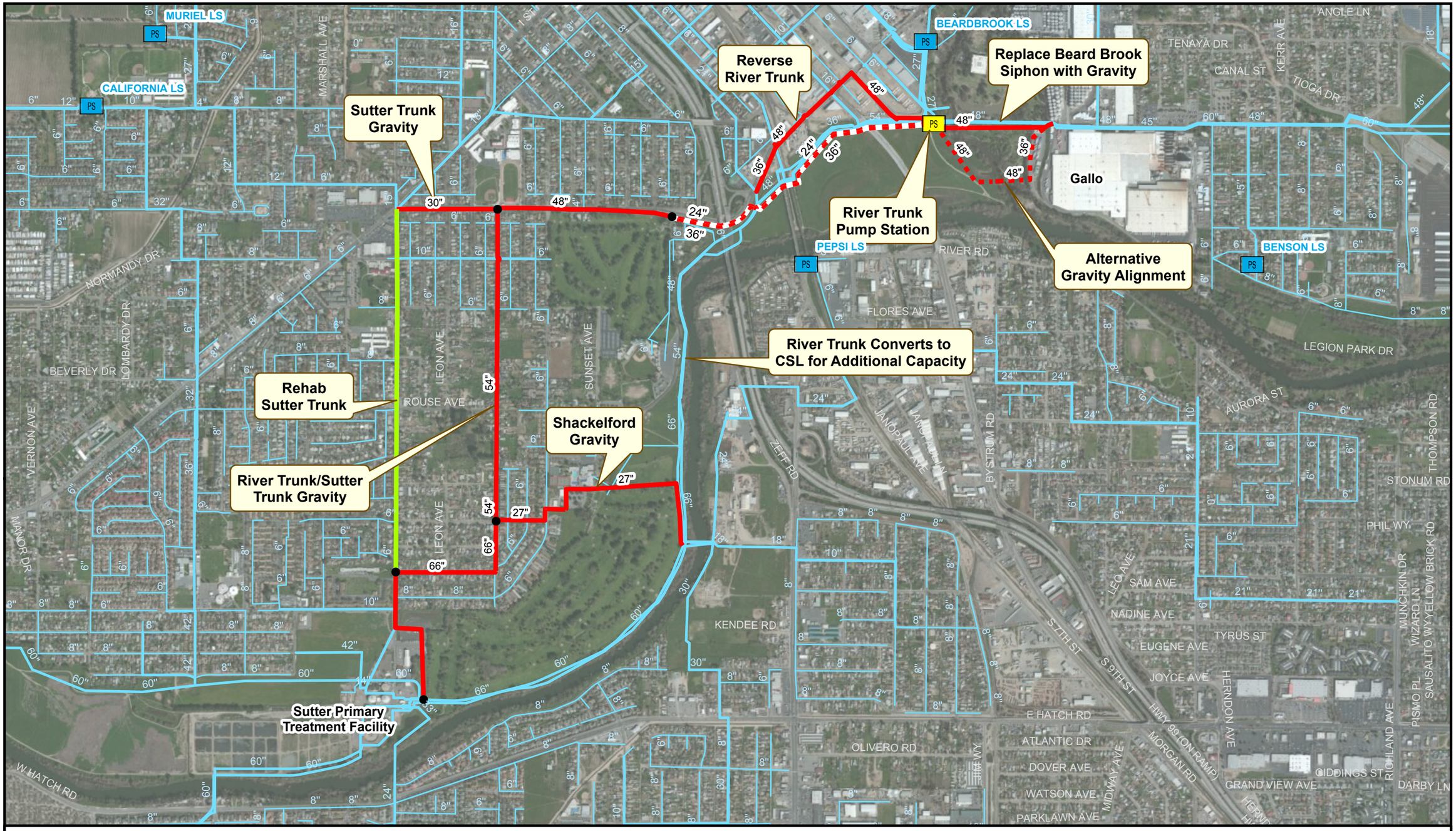
- **Advantages**
  - Provides a new Beard Brook siphon with up to date design standards,
  - Addresses the odor concerns of the existing Beard Brook siphon,
  - Provides the River Trunk and Sutter Trunk with adequate capacity to convey peak wet weather flows,
  - Converts the existing River Trunk siphon to the CSL, which would provide CSL with needed capacity, and
  - Removes the existing River Trunk and CSL from service adjacent to the riverbank.

- **Disadvantages**
  - A domestic siphon will remain at Bear Brook,
  - CSL siphons will remain,
  - Three additional pump stations will be required to be operated and maintained.

8.1.3 Alternative 9

Alternative 9 was refined based on the major elements associated with Alternative 9, as described in Section 3.9 of this TM. Key differences between the screened Alternative 9 and the initial Alternative 9 are modifications to the alignment of the River Trunk/Sutter Trunk Gravity sewer near the SAPTF, as a new alignment for the Shackelford force main that will directly cross the Dryden Park Golf Course between the driving range and the greens was considered. Additionally, the alignment of the gravity trunk required to reverse flow from the local trunks, in the Industrial Park, up to the new River Trunk pump station has been modified to follow the B Street/10th Street alignment used in Alternatives 4A and 7. This provides for the alignment to be within the public right-of-way. Alternative 9 is shown on Figure 17. It includes the following key features:

- Rehabilitation of the existing Sutter Trunk,
- Replacement of the existing River Trunk with a new pump station, force main, and gravity trunk,
- Replacement of the existing Beard Brook Siphon with a new gravity sewer beneath Dry Creek (two alternative alignments were considered),
  - Alternative 9A: northern alignment beneath Dry Creek,
  - Alternative 9B: southern alignment beneath Dry Creek,
- Reroute Shackelford siphon to the new River Trunk gravity sewer, and
- Utilization of the existing River Trunk facilities for future CSL capacity needs.



Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- Proposed Lift Station
- Other Lift Stations
- Proposed CSL Control Structure
- Proposed Junction Box

0 1,000 2,000 Feet

SCREENED ALTERNATIVE 9

FIGURE 17

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

carollo

MODESTO CALIFORNIA

C:\Users\jramirez\Desktop\Modesto figures\Figure 17 - Screened Alternative 9.mxd

8.1.3.1 Permitting Requirements

The permitting requirements for Alternative 9, are included in Table 33.

Table 33 Alternative 9 – Required Permits

Agency	Permit Title
Stanislaus County Department of Public Works	Encroachment/Construction Permit
Union Pacific Railroad	Nonintrusive Civil Engineering Survey Permit, Pipeline Crossing Agreement, Railroad Protective Liability Insurance
Caltrans District 10	Encroachment Permit
U.S. Army Core of Engineers	Nationwide Permit No. 12
California Department of Fish and Wildlife	Lake or Streambed Alternation Permit
Central Valley Flood Protection Board	Encroachment Permit
San Joaquin Valley Air Pollution Control Board	Regulation VIII Fugitive PM10 Prohibitions Construction Notification Form
Central Valley Regional Water Quality Control Board	Section 401 Certification
U.S. Environmental Protection Agency	Consultation

Details specific to the requirements of these permits is included in Appendix G. It should be noted that the consultation with the U.S Environmental Protection Agency consultation is only required should the project be funded by federally earmarked funds or through the State Revolving Fund.

8.1.3.2 Easement Requirements

Based on the proposed alignment for Alternative 9, two permanent easements would need to be established. The new gravity sewer alignment through Beard Brook Park would require a new easement with Gallo for construction and operations of the new facility. The River Trunk Pump Station would require the purchase of property in a parcel that has yet to be determined for the placement of the facility. New easements would be required for the dual forcemains running from the River Trunk Pump Station under the 7th Street Bridge and up to the Tuolumne Boulevard alignment.

An easement for the gravity pipeline across the Dryden Golf course would also be required; however, the City of Modesto currently owns the golf course property so obtaining that easement would not require coordination with a private land owner.

8.1.3.3 Utility Research

A review of existing alternatives was conducted as part of the screening evaluation for each alternative. The City's utilities (water distribution system, wastewater collection system and the storm drain system) were discussed and included in the evaluation conducted at the Brainstorming Workshop. Additional utility companies were contacted as part of the evaluation process including those listed in Table 34.

Table 34 Alternative 9– Utilities

Organization/Company	Utility Type
AT&T	Telephone and Data
Charter	Cable Television and Data
PG&E	Gas lines
Modesto Irrigation District (MID)	Electricity and Raw Water
Turlock Irrigation District (TID)	Raw Water
Comcast	Cable Television and Data
Kinder Morgan	Gas
Sprint	Telephone
Stanislaus County	Utilities
Union Pacific Railroad (UPRR)	Railroad

Based on the initial responses to the requests for information TID, and Charter Cable responded that they do not have utilities within the alignment.

8.1.3.4 Alternative 9 Advantage and Disadvantages

Table 35 includes a summary of the major facilities associated with Alternative 9. Detail maps associated with each major facility, and preliminary profiles of each gravity sewer are included in Appendix C for reference.

The key advantages and disadvantages of this alternative are described below:

- **Advantages**
  - Removes the existing River Trunk from domestic service,
  - Provides a new Beard Brook gravity sewer to eliminate siphon issues,
  - Addresses the odor concerns of the existing Beard Brook Siphon,
  - Provides the River Trunk and Sutter Trunk with adequate capacity to convey peak wet weather flows, and
  - Converts the existing River Trunk and River Trunk siphon to the CSL, which would provide CSL with needed capacity.

- **Disadvantages**
  - CSL siphons will remain,
  - The existing River Trunk and CSL will remain adjacent to the riverbank, and will require slope side armament, and
  - One (1) additional pump station will be required to be operated and maintained.

Table 35 Alternative 9A/9B - Major Facilities

Description	Location	Proposed Size	Estimated Depth (ft)	Quantity
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24"	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Colorado	30"	19.9' – 23.3'	1,330 LF
Replace Beard Brook Siphon with a Gravity Sewer	*Under Dry Creek*	*36"/48"*	*Microtunnel*	*Alt. 9A: 1,490 LF of 48", 55 LF of 36"* *Alt 9B: 1,625 LF of 48", 530 LF of 36"*
Reroute River Trunk	*B St/10th St. from River Trunk to new Pump Station*	*36"/48"*	*13.4 – 29.5*	*740 LF of 36"* *2,690 LF of 48"*
River Trunk PS	*Near Morton Blvd. and 11th St.*	*53 mgd (firm capacity)*	*52'*	*1*
River Trunk Force Main	*From Morton to Neece*	*24" and 36" Dual*	*~5' to 10'*	*4,100 LF*
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	48"	9.5' – 21.6'	2,310 LF
River Trunk/Sutter Trunk Gravity	Colorado Ave from Tuolumne to Pelton	54"	22.1' – 33.0'	5,330 LF
River Trunk/Sutter Trunk to Sutter Plant Connector	Colorado to Sutter Plant	66"	11.0' – 31.6'	3,170 LF
Shackelford Gravity	Existing siphon to Colorado	27"	5.4' – 31.6'	4,210 LF
CSL Diversion Structure	Near Sutter Plant	n/a	--	1

Note: Cells shown in italic font are unique to this alternative. Other cells share these features with one or more other options.

8.2 Cost Comparison of Viable Alternatives

Construction cost estimates were developed for the four viable alternatives to aid in the selection of the preferred alternative. Construction costs were developed based on the following assumptions:

- Construction cost estimates are considered “Class 4” level estimates, as defined by the Association for the Advancement of Cost Engineering (AACE),
- Class 4 level estimates have an expected range of accuracy of -30 percent to +50 percent,
- Costs consider construction costs only, with the following contingencies:
  - Construction contingency = 30 percent,
  - Contractor Overhead and Profit = 15 percent,
  - Sales Tax = 8 percent, applied to 50 percent of the Subtotal,
- Pumps stations are assumed to be submersible type,
- The entire reach of the Sutter Trunk is assumed to be in need of rehabilitation,
- Half (50 percent) of the River Trunk is assumed to be in need of rehabilitation, and
- Engineering, Administrative, and Legal costs are not considered.

Appendix D includes detailed cost estimates for each of the viable alternatives, which are summarized in Tables 36 through 39 by project element.

Table 40 provides an overall cost comparison of the four viable alternatives. As shown in Table 40, Alternative 9A is the least expensive alternative at $72.9 million, followed by Alternative 9B and Alternative 4A at $74.0 million and $76.7 million, respectively. Alternative 7 is significantly more expensive than the other three alternatives at an estimated construction cost of $100.1 million.

Table 36	Alternative 4A – Construction Cost Estimate				
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**
1	24” Rehabilitation (Sutter)	4,140	LF	$342	$1,414,000
2	30” SS (Tuolumne)	1,330	LF	$731	$972,000
3	48” SS (Tuolumne)	2,310	LF	$1,203	$2,779,000
4	54” SS (Colorado)	4,140	LF	$1,334	$5,523,000
5	66” SS (Colorado to SAPTF)	3,820	LF	$1,663	$6,353,000
6	27” SS (Shackelford to 66”)	3,610	LF	$712	$2,572,000
7	24” & (2) 42” Beard Brook Siphons	1,800	LF	$3,531	$6,355,000
8	48” SS (B St to RTPS)	2,830	LF	$4,145	$11,731,000
9	Dual 24” & 36” Force Mains (Tuolumne)	1,750	LF	$1,262	$2,209,000
10	River Trunk PS (53 mgd)		LS		$24,721,000
11	CSL Diversion Structures		LS		$466,000
12	48” RT Rehabilitation	9,000	LF	$855	$7,696,000
13	Riverbank Armament		LS		$3,887,000
	TOTAL				**$76,678,000**

Table 37	Alternative 7 – Construction Cost Estimate				
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**
1	24” Rehabilitation (Sutter)	4,140	LF	$342	$1,414,000
2	30” SS (Tuolumne)	1,330	LF	$731	$972,000
3	48” SS (Tuolumne)	2,310	LF	$1,203	$2,779,000
4	54” SS (Colorado)	4,140	LF	$1,334	$5,523,000
5	66“” SS (Colorado to SAPTF)	3,820	LF	$1,663	$6,353,000
6	Shackelford PS (4.2 mgd)		LS		$1,633,000
7	Shackelford 14” FM & 18” SS	4,555	LF	$405	$1,847,000
8	48” SS (B St to RTPS)	2,830	LF	$4,145	$11,731,000
9	Dual 24” & 36” Force Mains (Tuolumne)	1,750	LF	$1,262	$2,209,000
10	24” & (2) 42” Beard Brook Siphons	1,800	LF	$3,531	$6,355,000
11	RT PS (53 mgd) & CSL PS (51 mgd)		LS		$48,510,000
12	42” Force Main (Neece to Roselawn)	5,700	LF	$668	$3,806,000
13	18” Force Main (Neece to Roselawn)	5,700	LF	$340	$1,940,000
14	48” SS (Roselawn)	4,890	LF	$1,028	$5,028,000
	TOTAL				**$100,100,000**

Table 38 Alternative 9A – Construction Cost Estimate					
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**
1	24” Rehabilitation (Sutter)	4,140	LF	$342	$1,415,000
2	30” SS (Tuolumne)	1,330	LF	$731	$972,000
3	48” SS (Tuolumne)	2,310	LF	$1,203	$2,779,000
4	54” SS (Colorado)	4,140	LF	$1,334	$5,524,000
5	66” SS (Colorado to SAPTF)	3,820	LF	$1,663	$6,354,000
6	27” SS (Shackelford to 66”)	3,610	LF	$713	$2,573,000
7	Dual 24” & 36” Forcemains along Floodplain and Tuolumne	1,543	LF	$3,883	$5,992,000
8	36” & 48” SS (B St to RTPS)	3,400	LF	$1,417	$4,817,000
9	River Trunk PS (53 mgd)	4,100	LF	$1,401	$5,746,000
10	Option 9A – Beard Brook North Gravity Alignment	1	LS		$24,722,000
11	CSL Diversion Structures	1	LS		$468,000
12	48” RT Rehabilitation	9,000	LF	$855	$7,697,000
13	Riverbank Armorment	1	LS		$3,887,000
	TOTAL				**$72,900,000**

Table 39 Alternative 9B – Construction Cost Estimate					
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total**
1	24” Rehabilitation (Sutter)	4,140	LF	$342	$1,414,000
2	30” SS (Tuolumne)	1,330	LF	$731	$972,000
3	48” SS (Tuolumne)	2,310	LF	$1,203	$2,779,000
4	54” SS (Colorado)	4,140	LF	$1,334	$5,523,000
5	66” SS (Colorado to SAPTF)	3,820	LF	$1,663	$6,353,000
6	27” SS (Shackelford to 66”)	3,610	LF	$712	$2,572,000
7	Dual 24” & 36” Force Mains along Floodplain and Tuolumne	4,100	LF	$1,401	$5,746,000
8	36” & 48” SS (B St to RTPS)	3,400	LF	$1,416	$4,816,000
9	River Trunk PS (53 mgd)		LF		$24,721,000
10	Option 9B – Beard Brook South Gravity Alignment		LS		$7,076,000
11	CSL Diversion Structures		LS		$466,000
12	48” RT Rehabilitation	9,000	LF	$855	$7,696,000
13	Riverbank Armorment	1	LS		$3,887,000
	TOTAL				**$74,021,000**

Table 40 Alternative Cost Comparison	
Alternative	**Est. Construction Cost ($, M)**
Alternative 4A	$76.7
Alternative 7	$100.1
Alternative 9A	**$72.9**
Alternative 9B	$74.0

9.0 RECOMMENDED ALTERNATIVE

An alternative selection workshop was conducted on August 12, 2014. The purpose of the workshop was to:

- Review project goals
- Review the major elements of each screened alternative (both plan and profile view)
- Evaluate the options relative to one another for both monetary and non monetary considerations
- Determine the selected alternative to move forward to the 30 percent level of design
- Identify any potential refinements to the recommended alternative to be included in the thirty percent (30 percent) level of design

Table 41 provides a summary of non-financial ranking of each of the screened alternatives, as well as the construction cost estimates for each alternative. As shown in the table, Alternative 9A ranked highest in the scores and it represented the lowest cost approach. Therefore, Alternative 9A was selected as the preferred alternative.

Table 41 Alternative Selection		
Alternative	**Weighted Non-Financial Score**	**Est. Construction Cost of Screened Alternatives ($, M)**
Alternative 4A	3.550	$76.7
Alternative 7	3.575	$100.1
Alternative 9A	**3.875**	**$72.9**
Alternative 9B	3.875	$74.0

City staff incorporated further refinements to the preferred alternative. The resulting refinement is shown on Figure 18. The refinement includes the addition of the Shackelford Pump Station that was included in Alternative 7. This allows for the River Trunk/Sutter Trunk gravity sewer to be constructed at a shallower depth and a steeper slope, thereby reducing the required diameter to 60-inches and reducing the construction cost of this alternative. In addition, the Sutter Trunk to River Trunk connector was reduced to a 21-inch

diameter based on refinements to the operation of the overflow pipe from the Sutter Trunk in the hydraulic model.

Table 42 summarizes the major elements of the selected alternative, and Appendix E provides detail maps and profiles for each of the major elements associated with the selected alternative. Appendix F and Table 43 summarizes the revised construction cost estimated for the selected alternative. As shown in Table 15, the selected alternative cost has been reduced slightly to $72.6 million. This estimate can be further reduced by an addition $0.8 million to $71.8 million with the inclusion of an alternative alignment for the 60-inch River Trunk/Sutter Trunk from the intersection of Avalon Avenue and Colorado Avenue down to the SAPTF. This alternative alignment is shown as a dashed line on Figure 18.

Table 42 Selected Alternative - Major Facilities

Description	Location	Proposed Size	Estimated Depth (ft)	Quantity
Sutter Trunk Rehab	Sutter Ave. from Tuolumne to Avalon	24”	Same as Existing	4,780 LF
Sutter Trunk Gravity	Tuolumne Blvd. from Sutter to Colorado	21”	19.9’ – 23.3’	1,330 LF
Replace Beard Brook Siphon with a Gravity Sewer	Under Dry Creek	36”/48”	Microtunnel	1,490 LF of 48”, 55 LF of 36”
Reroute River Trunk	B St/10th St. from River Trunk to new Pump Station	36”/48”	13.4 – 29.5	740 LF of 36” 2,690 LF of 48”
River Trunk PS	Near Morton Blvd. and 11th St.	53 mgd (firm capacity)	52’	1
River Trunk Force Main	From Morton to Neece	24” and 36” Dual	~5’ to 10’	4,100 LF
River Trunk Gravity	Tuolumne Blvd. from Neece to Colorado	48”	9.5’ – 21.6’	2,310 LF
River Trunk/Sutter Trunk Gravity	Colorado Ave from Tuolumne to Pelton	54”	22.1’ – 33.0’	3,860 LF
River Trunk/Sutter Trunk to Sutter Plant Connector	Colorado to Sutter Plant	60”	11.0’ – 31.6’	3,820 LF
Shackelford PS	*At existing Siphon location, east of River*	*4.2 mgd (firm capacity)*	*~20’*	*1*
Shackelford Force Main	*Sliplined in existing siphon and open cut through the golf course*	*14”*	*~5’-10’*	*2,270 LF*
Shackelford Gravity	*Roselawn to Colorado*	*18”*	*9.8’ – 14’*	*890 LF*
CSL Diversion Structure	Near Sutter Plant	n/a	--	1

Table 43 Alternative 9 - Construction Cost Estimate						
					9A.1	9A.2
Item	Description	Quantity	Unit	Unit Cost	Total	Total
1	24” Rehabilitation (Sutter)	4,140	LF	$342	$1,416,000	$1,416,000
2	21” SS (Tuolumne)	1,330	LF	$599	$797,000	$797,000
3	48” SS (Tuolumne)	2,310	LF	$1,203	$2,779,000	$2,779,000
4	54” SS (Colorado)	3,860	LF	$1,323	$5,106,000	$5,106,000
5A	60” SS (Colorado to SAPTF)	3,820	LF	$1,604	$6,128,000	
5B	Alternate 60” SS (Colorado to SAPTF)	3,190	LF	$1,650		$5,263,000
6	Shackelford PS (4.2 mgd)	1	LS		$1,633,000	$1,633,000
7	Shackelford 14” FM & 18” Gravity Sewer	3,060	LF	$473	$1,446,000	$1,446,000
8	48” SS (BB Northern Alignment)	1,543	LF	$3,883	$5,991,000	$5,991,000
9	36” & 48” SS (B St to RTPS)	3,400	LF	$1,416	$4,816,000	$4,816,000
10	Dual 24” & 36” Force Mains (Tuolumne)	4,100	LF	$1,401	$5,746,000	$5,746,000
11	River Trunk PS (53 mgd)	1	LS		$24,721,000	$24,721,000
12	CSL Diversion Structures	1	LS		$466,000	$466,000
13	RT Rehabilitation	9,000	LF	$855	$7,696,000	$7,696,000
14	Riverbank Armament	1	LS		$3,887,000	$3,887,000
	TOTAL				**$72,626,000**	**$71,761,000**

Reverse River Trunk

Replace Beard Brook Siphon with Gravity

Sutter Trunk Gravity

River Trunk Pump Station

River Trunk Converts to CSL for Additional Capacity

Rehab Sutter Trunk

River Trunk/Sutter Trunk Gravity

Shackelford Pump Station

Alternative Route

Sutter Primary Treatment Facility

MURIEL LS

CALIFORNIA LS

BEARDBROOK LS

PEPSI LS

BENSON LS

Gallo

MARSHALL AVE

PICARDY DR

RITSCH CT

LOMBARDY DR

BEVERLY DR

VERNON AVE

MANOR DR

LEON AVE

COLORADO AVE

SUNSET AVE

ROUSE AVE

PELTON AVE

ZEFF RD

RIVER RD

FLORES AVE

SONORA AVE

JANOPAUL AVE

W HATCH RD

OLIVERO RD

E HATCH RD

ATLANTIC DR

DOVER AVE

WATSON AVE

PARKLAWN AVE

MIDWAY AVE

HWY 99 (ON RAMP)

MORGAN RD

BYSTRUM RD

LEO AVE

SAM AVE

NADINE AVE

EUGENE AVE

JOYCE AVE

S 7TH ST

S 9TH ST

HERNDON AVE

TYRUS ST

GIDDINGS ST

GRAND VIEW AVE

RICHLAND AVE

PISMO PL

SAUSALITO WY

YELLOW BRICK RD

MUNCHKIN DR

WIZARD LN

PHIL WY

MAGIC LN

STONUM RD

THOMPSON RD

DARBY LN

LEGION PARK DR

TENAYA DR

CANAL ST

KERR AVE

TIOGA DR

ANGLE LN

Legend

- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitation
- Other Pipelines
  - 8" and Smaller
  - Greater than 8"
- PS Proposed Lift Station
- PS Other Lift Stations
- Proposed CSL Control Structure
- Proposed Junction Box

0 1,000 2,000 Feet

RECOMMENDED ALTERNATIVE 9

FIGURE 18

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

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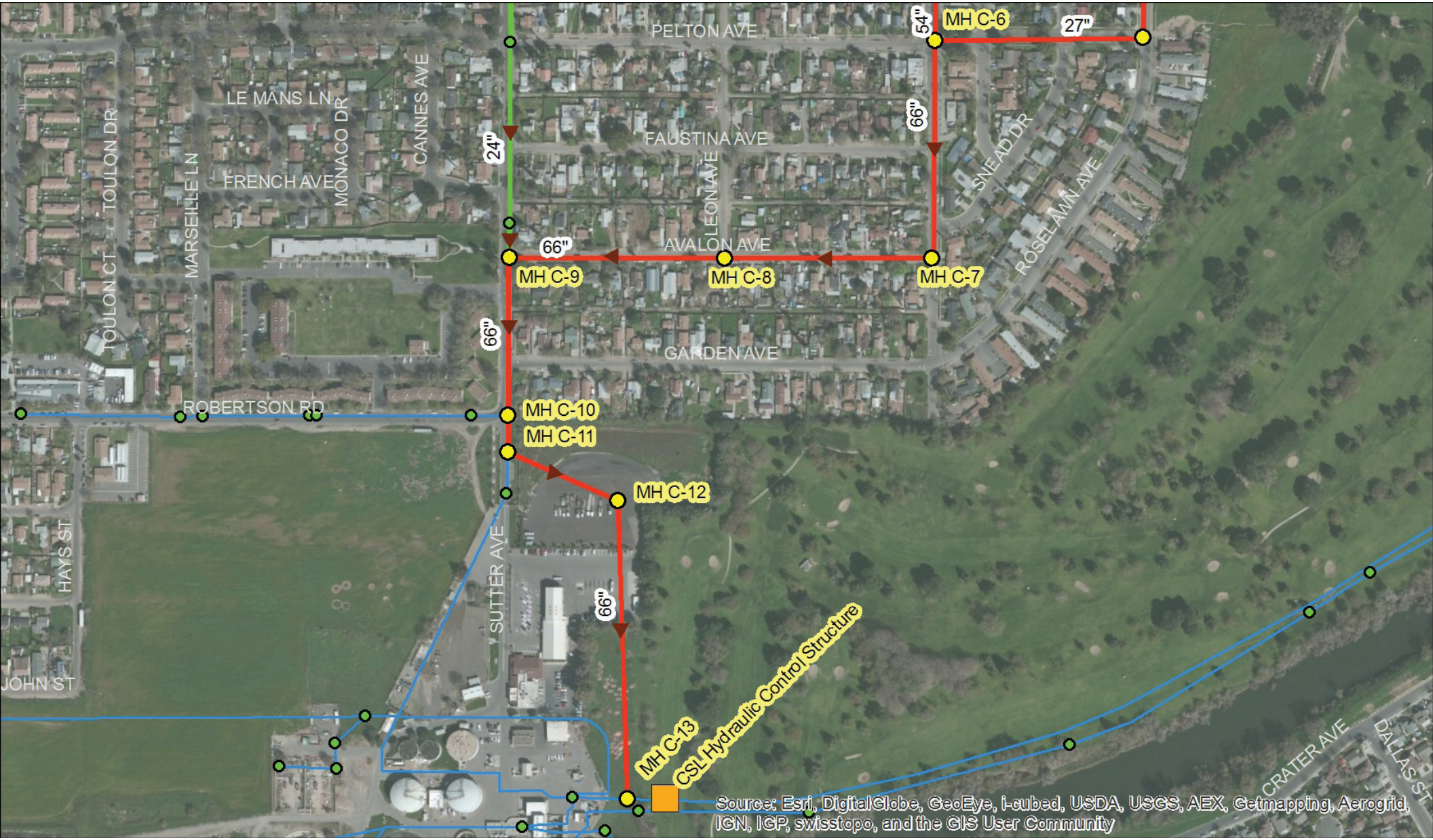
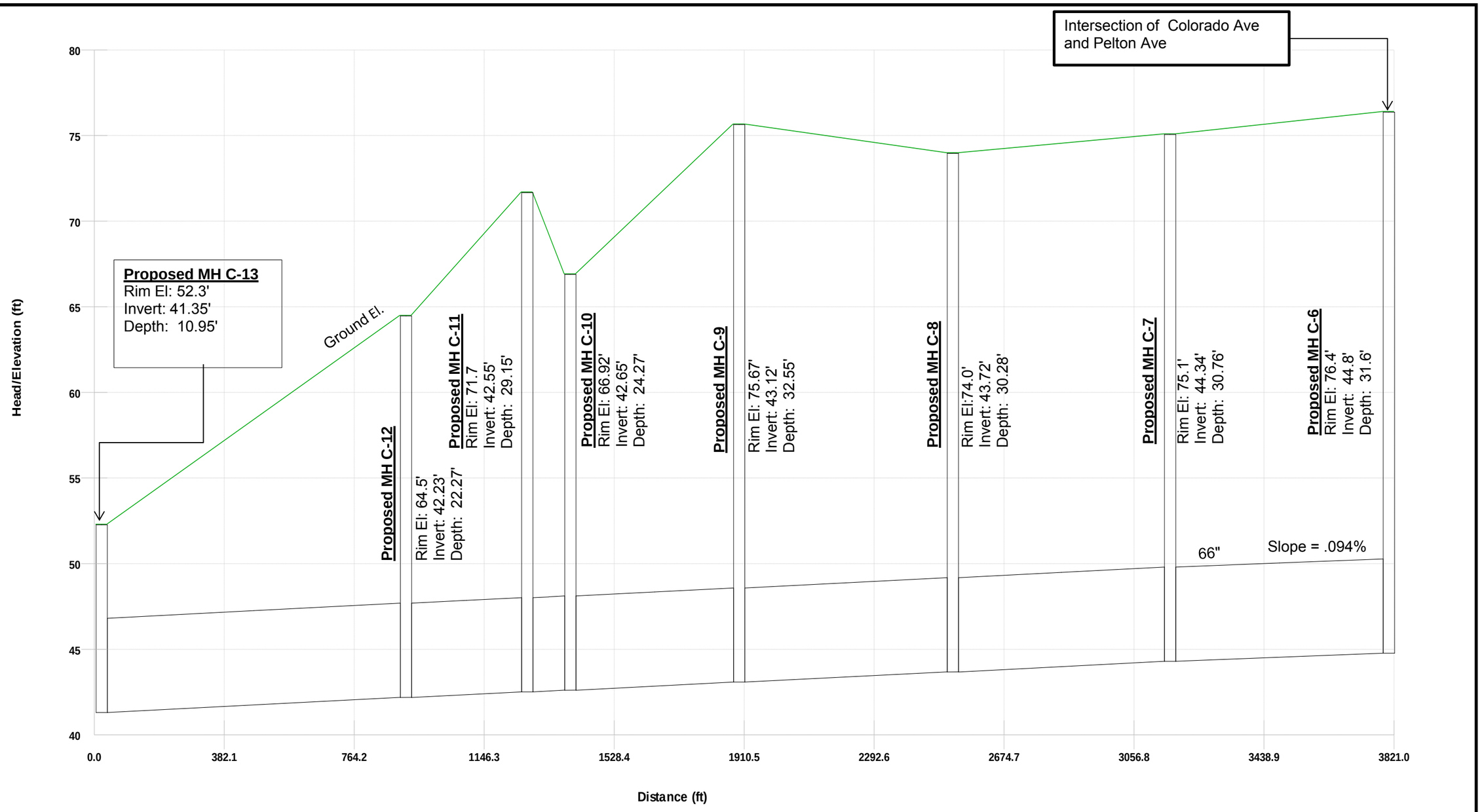
C:\Users\jramirez\Desktop\Modesto figures\Figure 18 - Recommended Alternative 9.mxd

APPENDIX A – SCREENED ALTERNATIVE 4.02 DETAIL MAPS AND PROFILES

All Options - Avalon/Sutter 66"





All Options - Avalon/Sutter 66"
River Trunk, Beard Brook, CSL Project
City of Modesto

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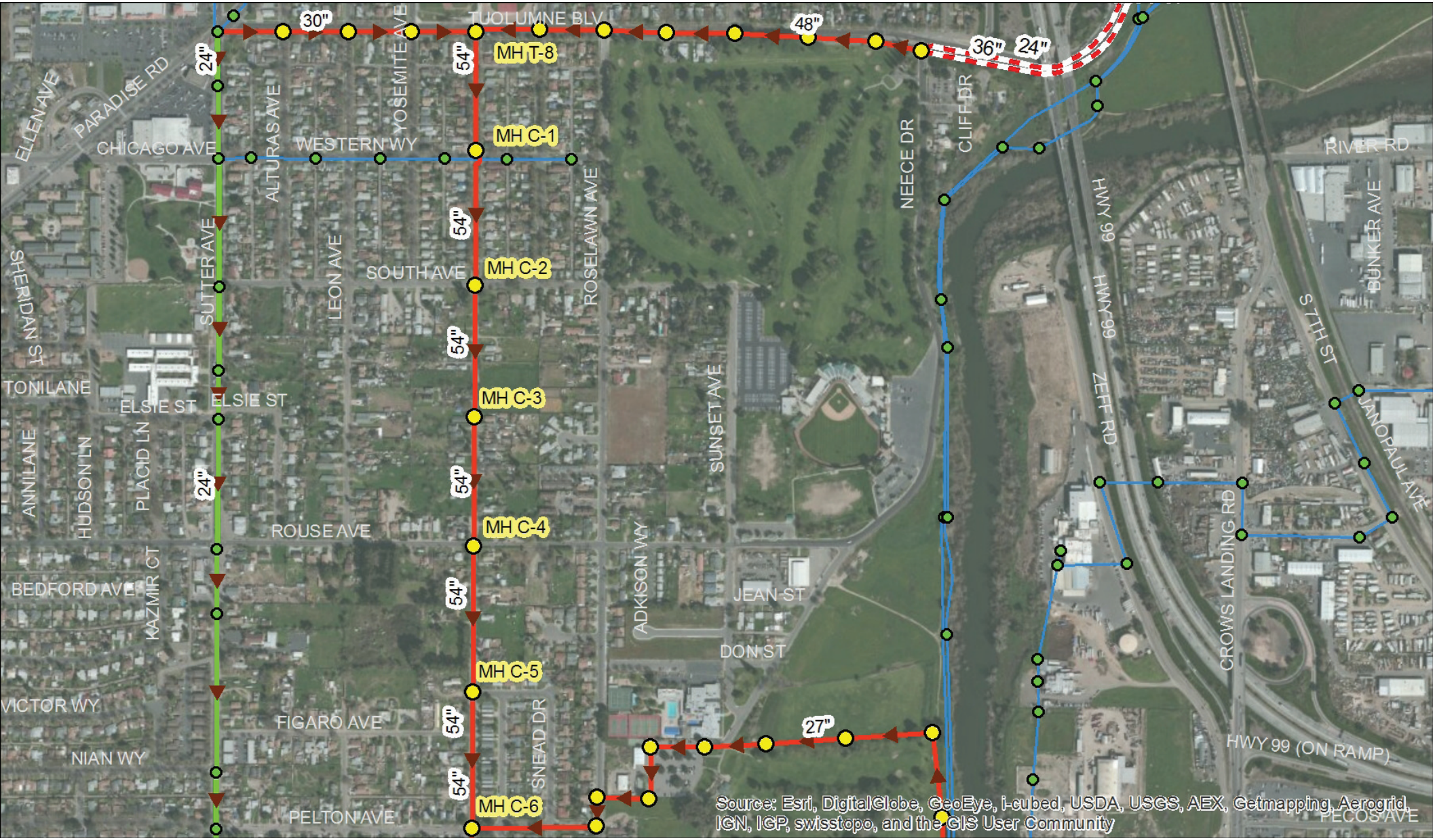
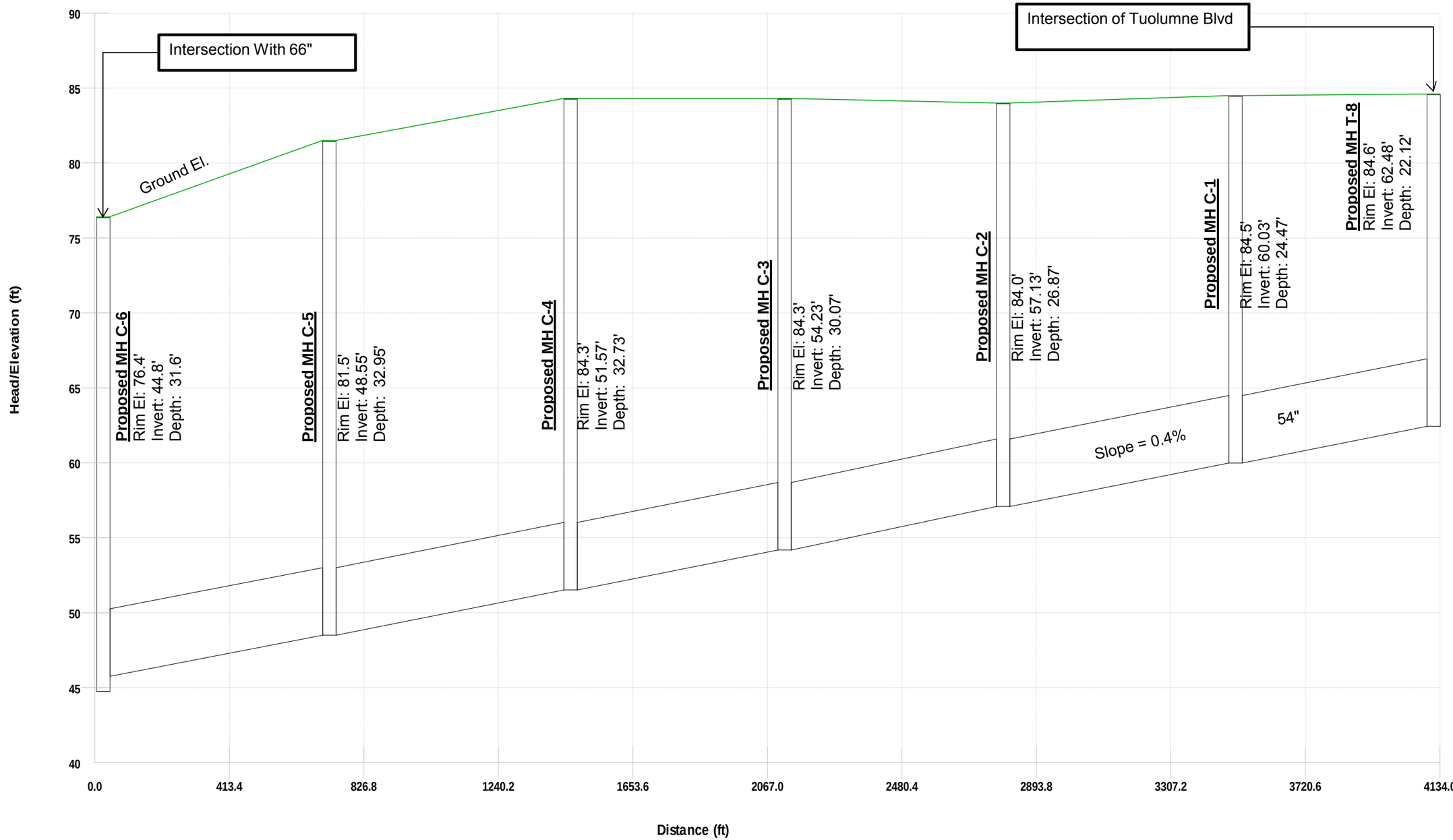
All Options - Colorado Ave. 54"





All Options - Colorado Ave. 54"
River Trunk, Beard Brook, CSL Project
City of Modesto

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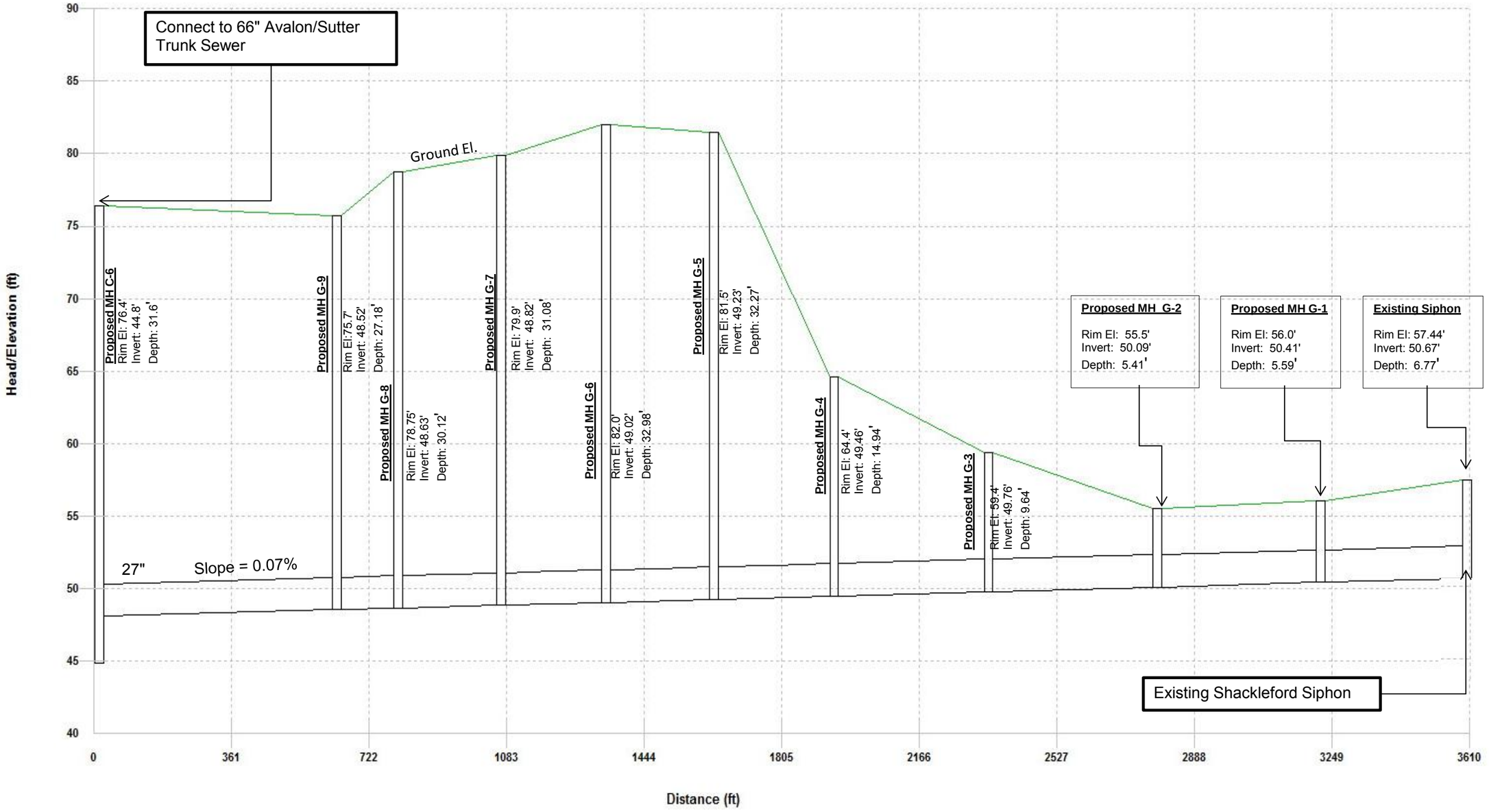
Option 4.02 and 9 - Shackleford Gravity





Option 4.02 and 9 - Shackleford Gravity
River Trunk, Beard Brook, CSL Project
City of Modesto

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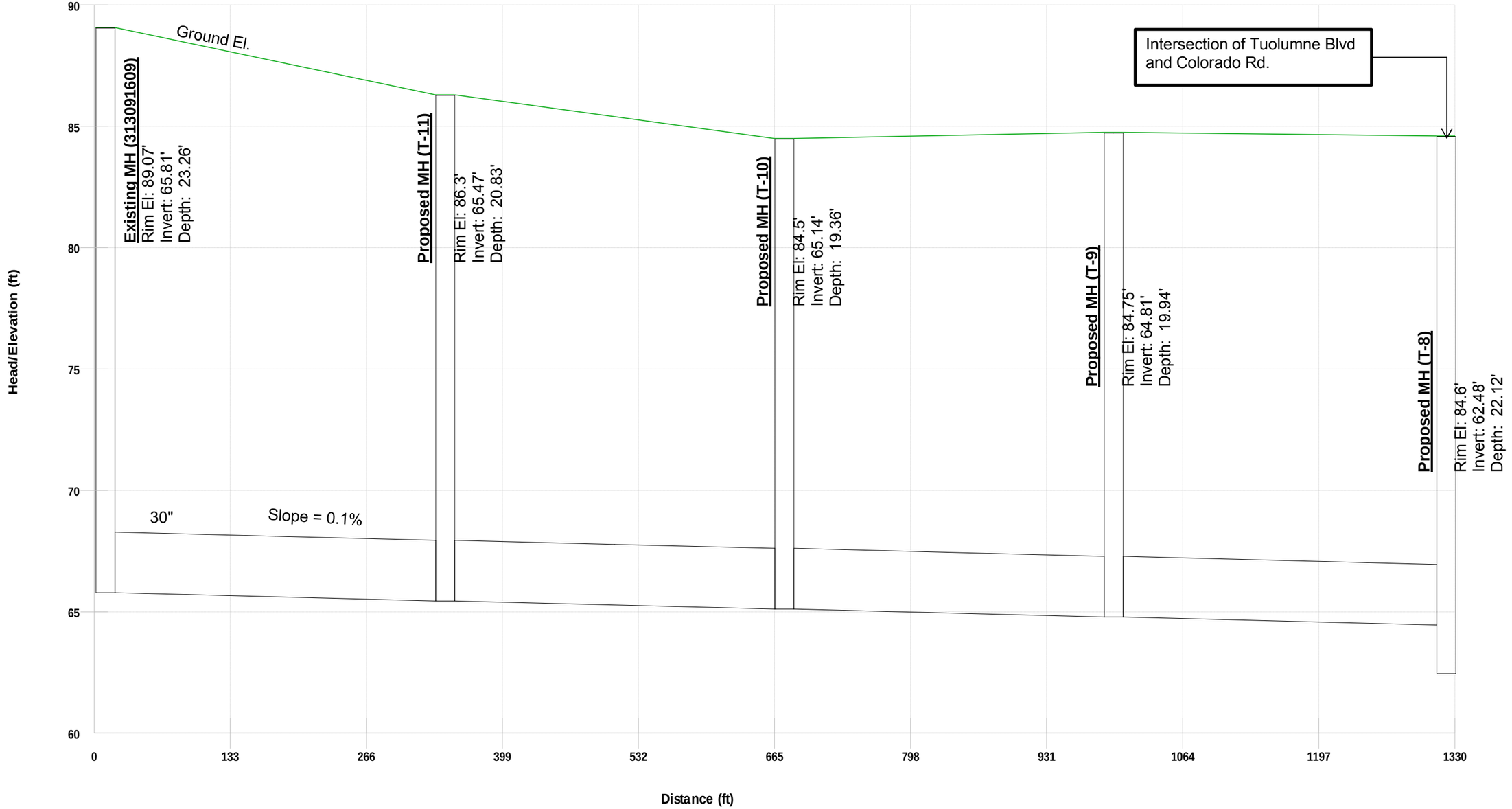
All Options - Tuolumne 30"





All Options - Tuolumne 30"
River Trunk, Beard Brook, CSL Project
City of Modesto

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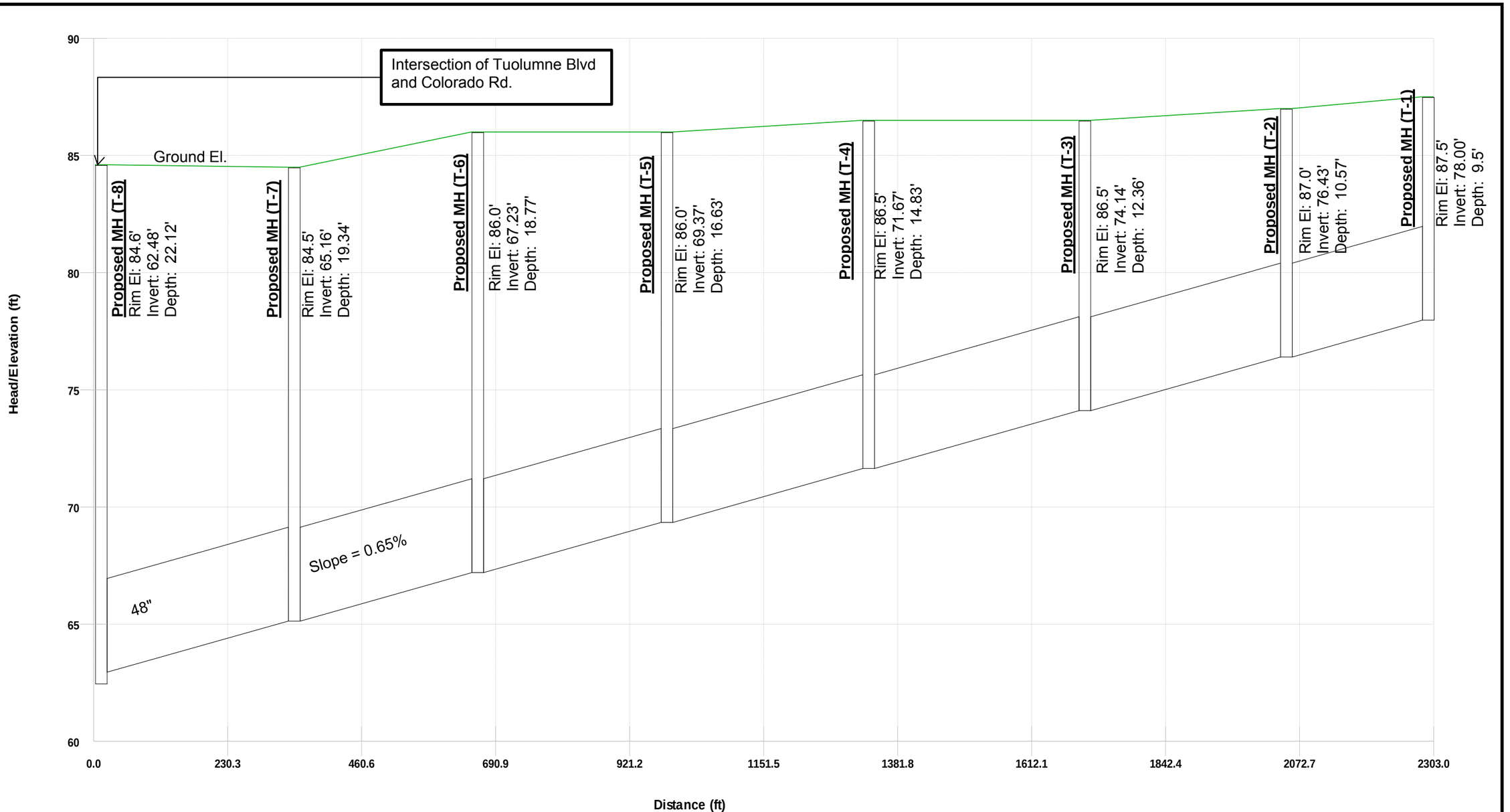
All Options - Tuolumne 48"



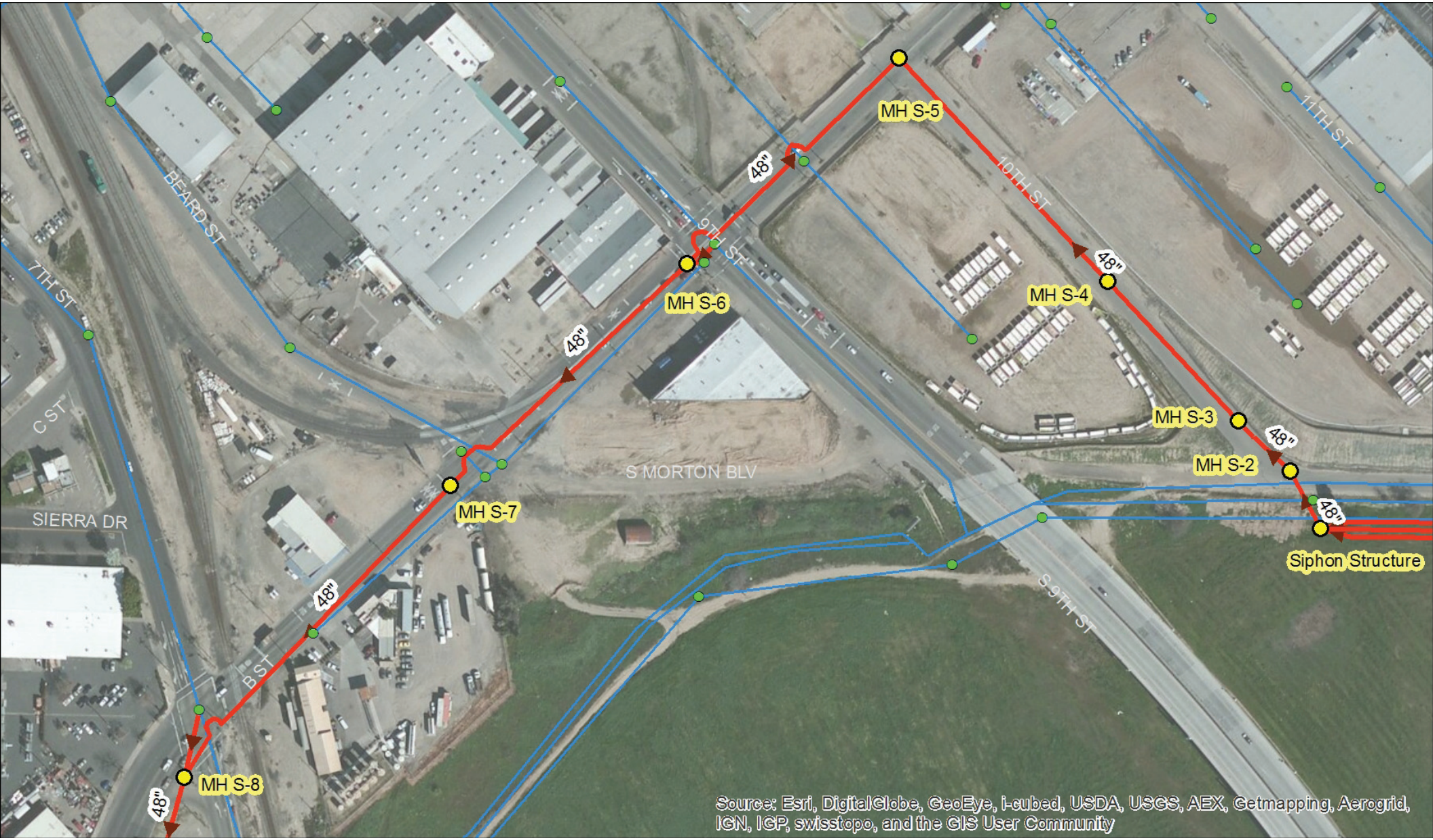


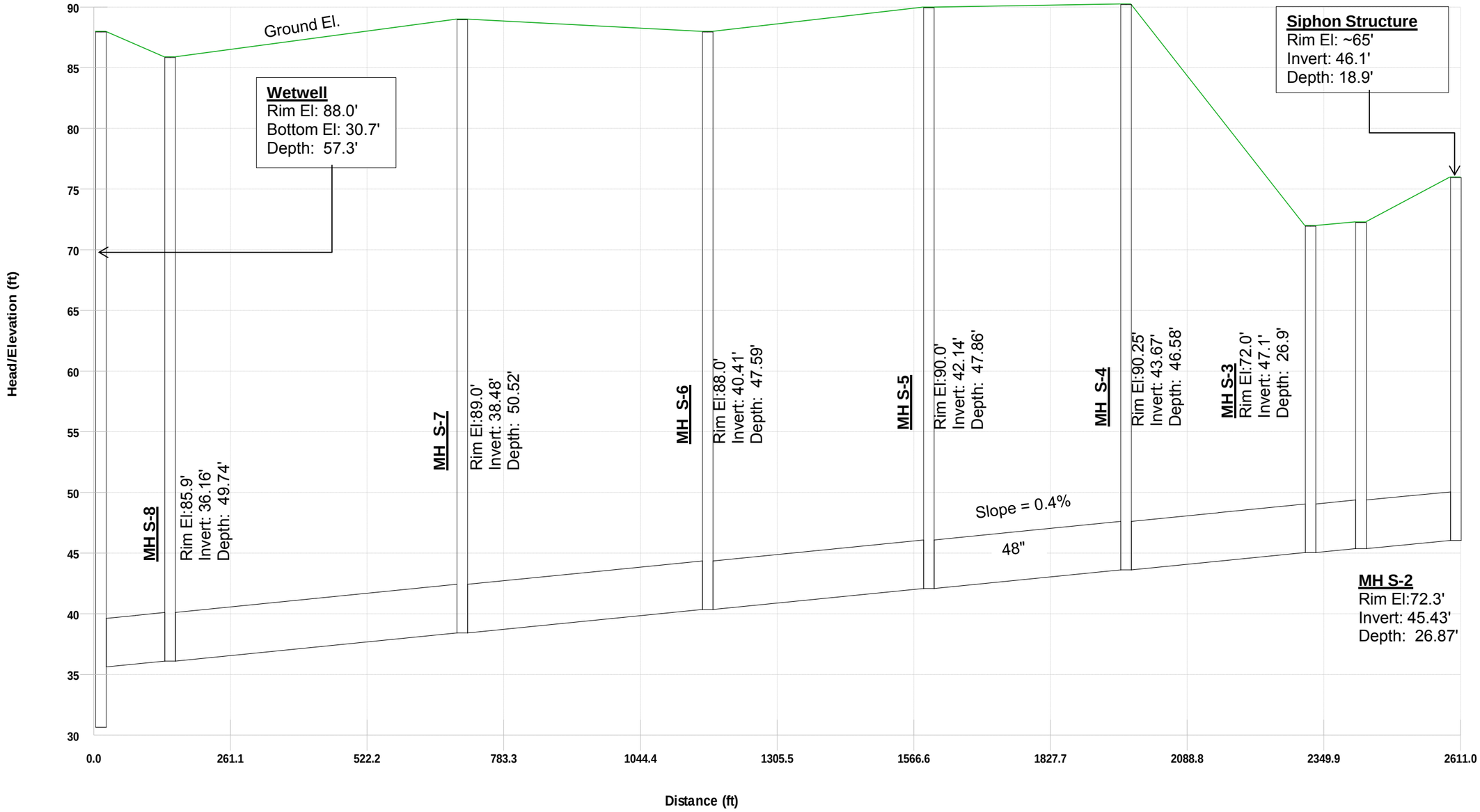
All Options - Tuolumne 48"
River Trunk, Beard Brook, CSL Project
City of Modesto

Option 4.02 - Force Main 24" and 36"



Option 4.02 and 7 - B St/10th St 48"





Option 4.02 and 7 - B St/10th St 48"

River Trunk, Beard Brook, CSL Project

City of Modesto

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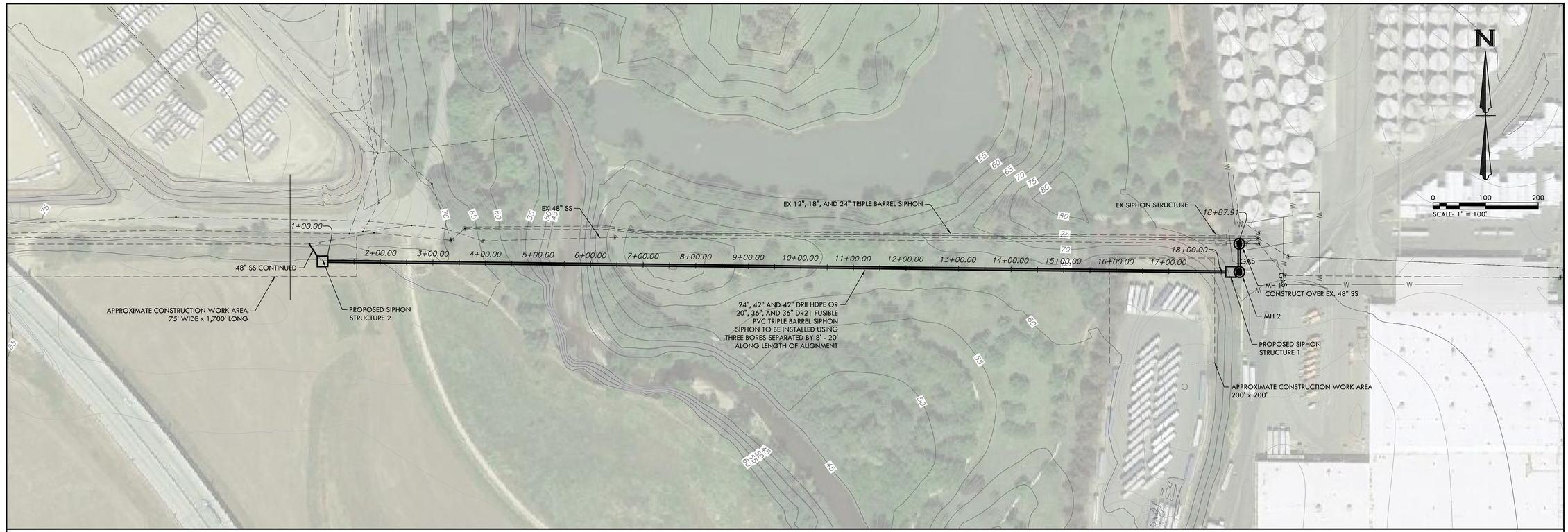

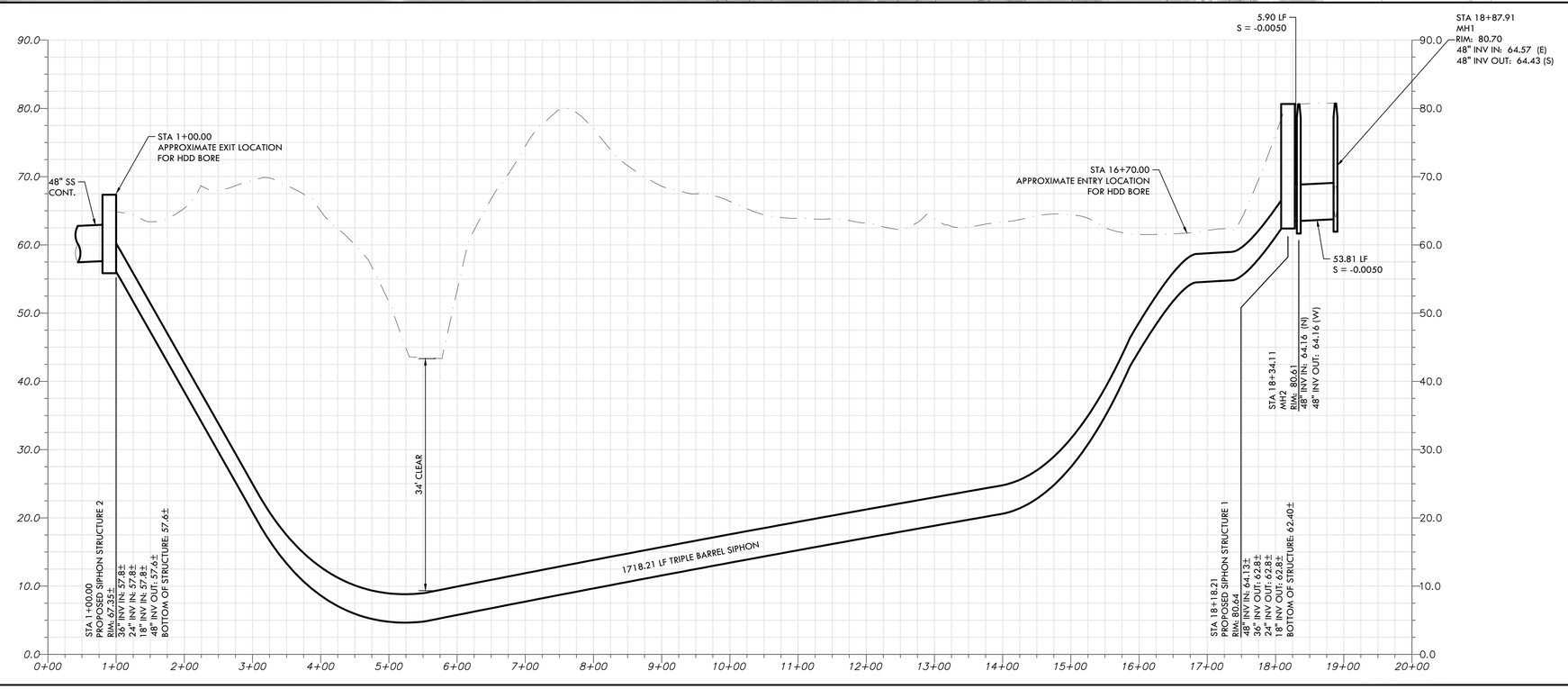

PROFILE SCALE
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1" = 10' VERTICAL

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PROPOSED BEARD CROSSING
STA 1+00.00 TO STA 21+17.96

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DRAWN BY	MRS
CHECKED BY	JKB
JOB NO.	J14050
DATE	7/22/2014
DRAWING	X-XX
SHEET NO.	1 OF 5

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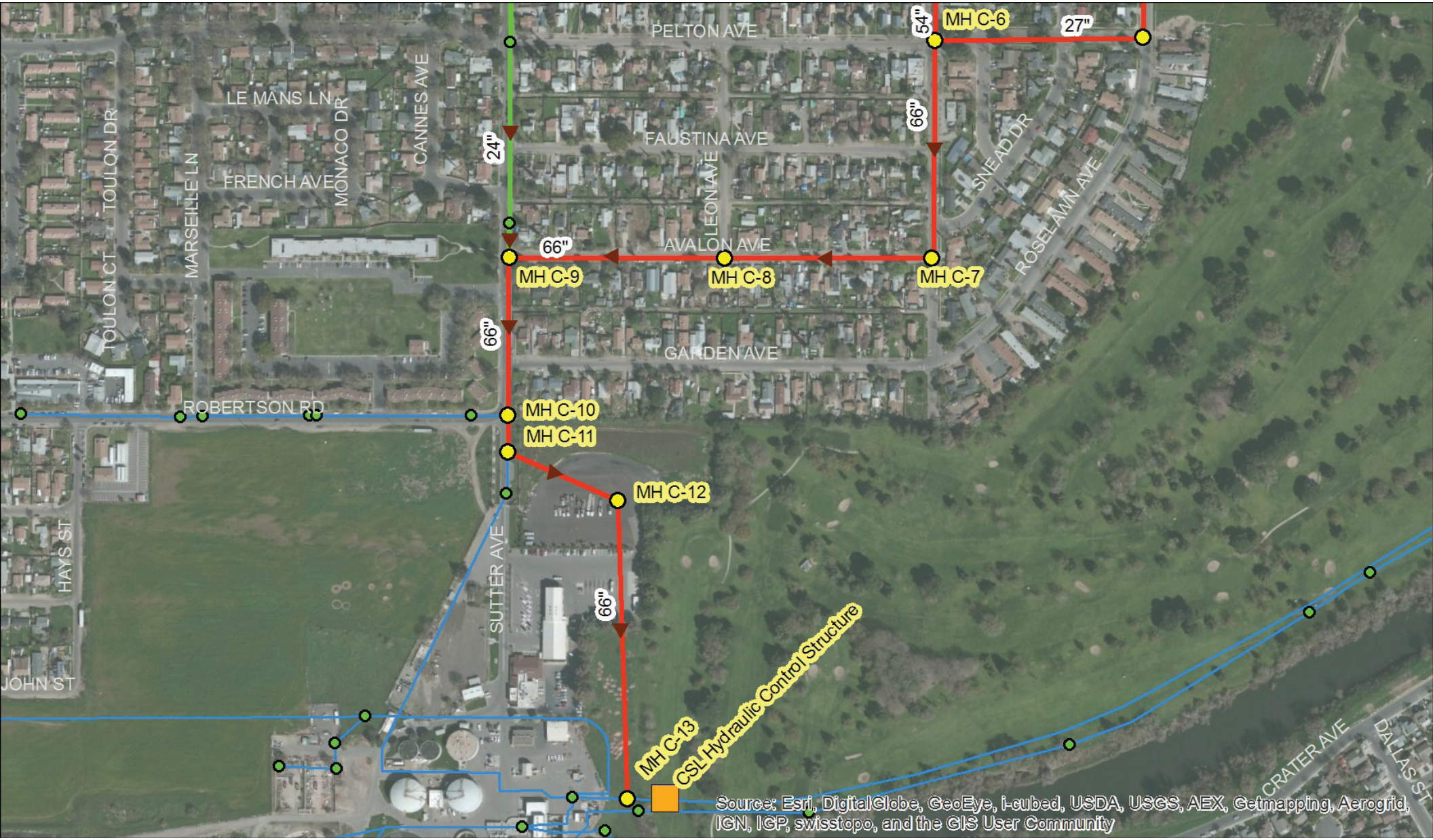
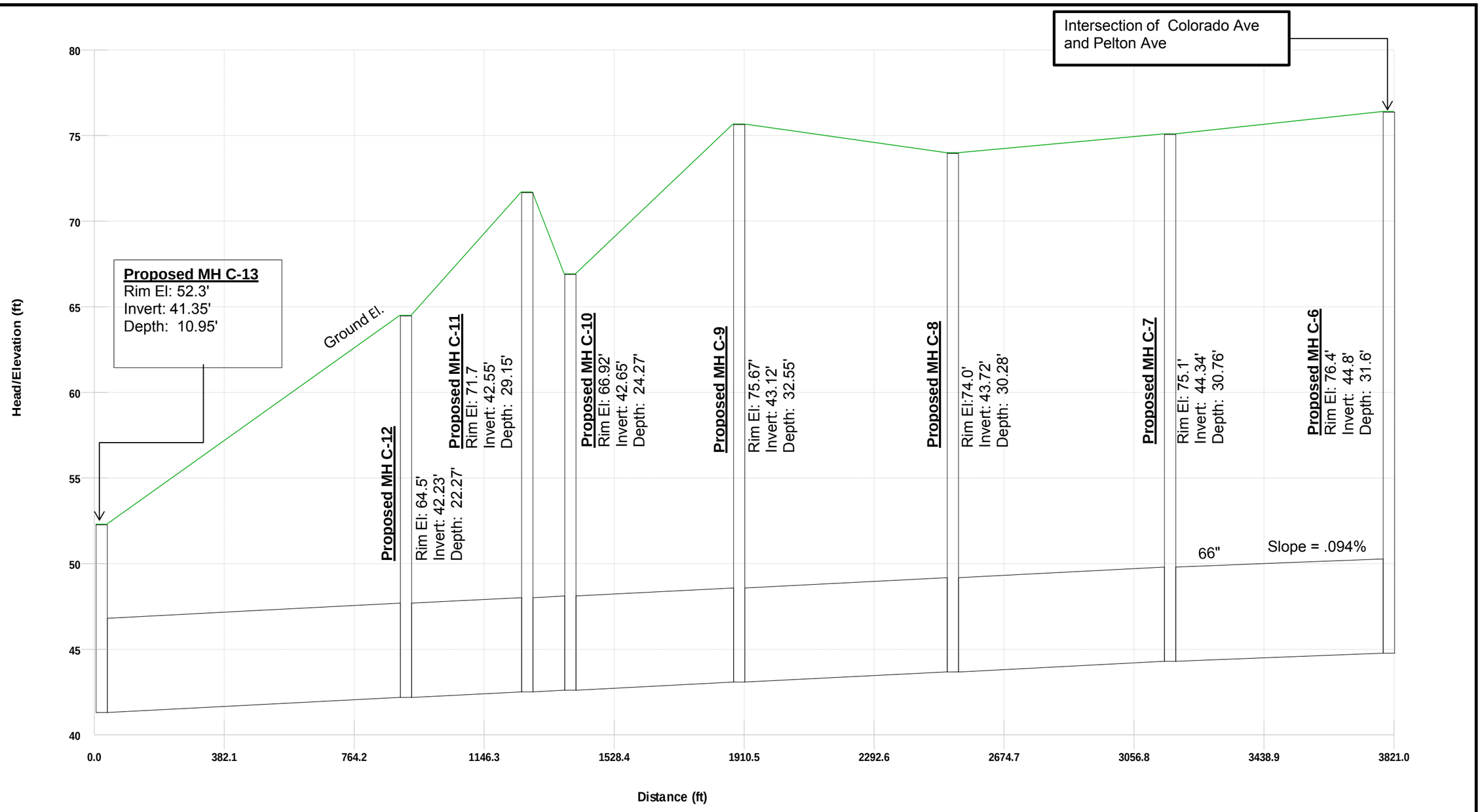
APPENDIX B – SCREENED ALTERNATIVE 7 DETAIL MAPS AND PROFILES

All Options - Avalon/Sutter 66"





All Options - Avalon/Sutter 66"
River Trunk, Beard Brook, CSL Project
City of Modesto

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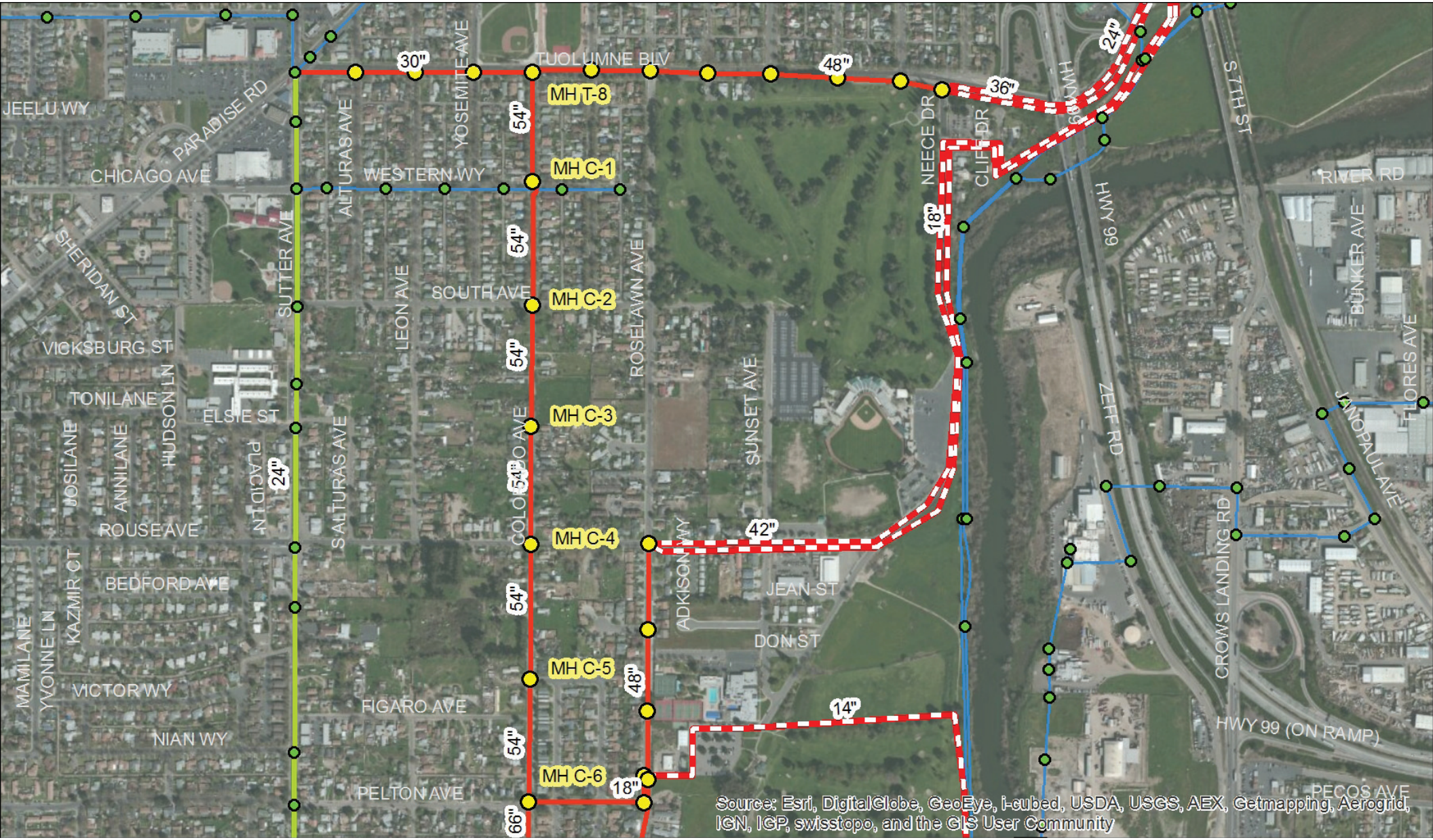
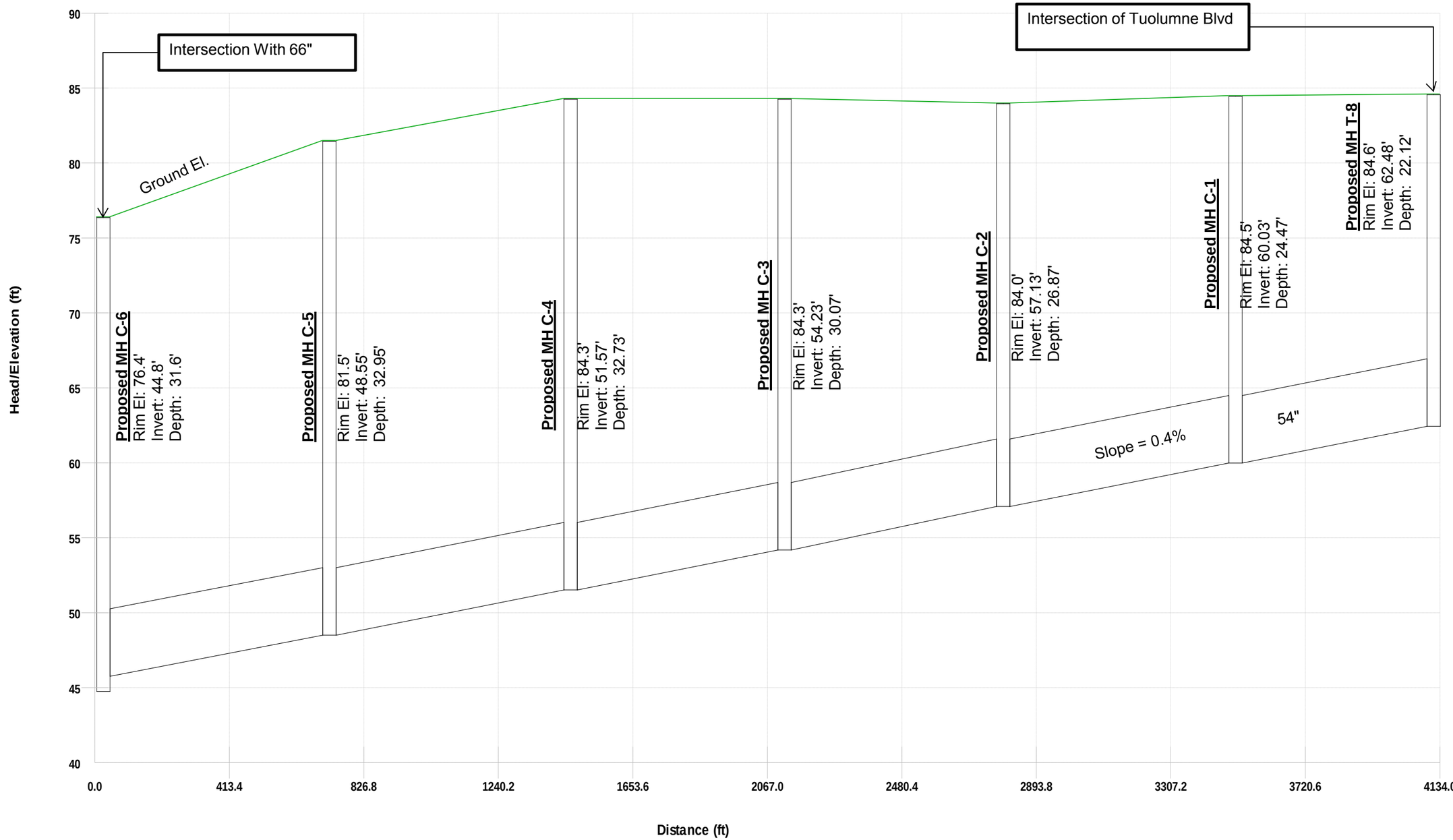
All Options - Colorado Ave 54"





All Options - Colorado Ave. 54"
River Trunk, Beard Brook, CSL Project
City of Modesto

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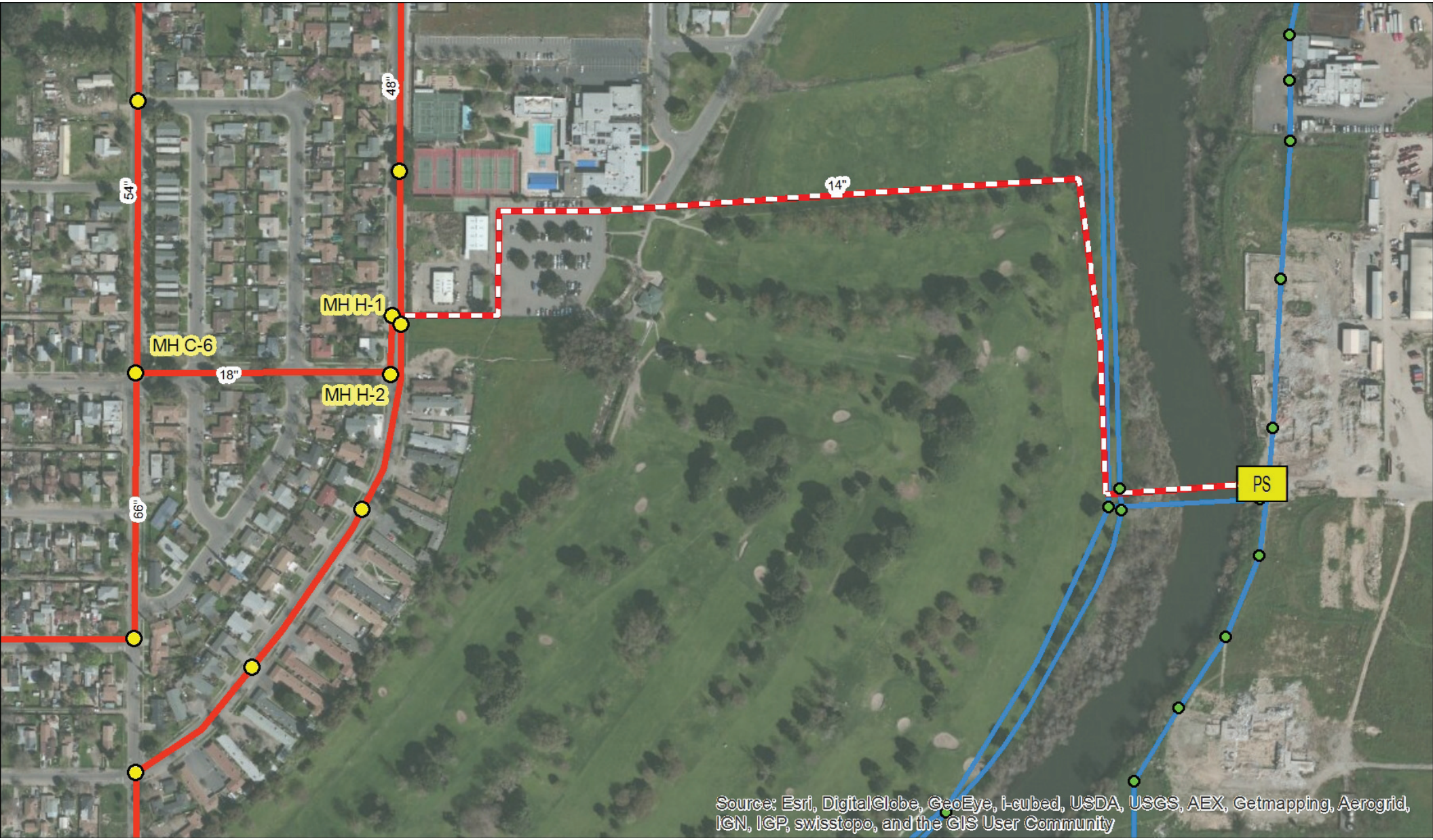
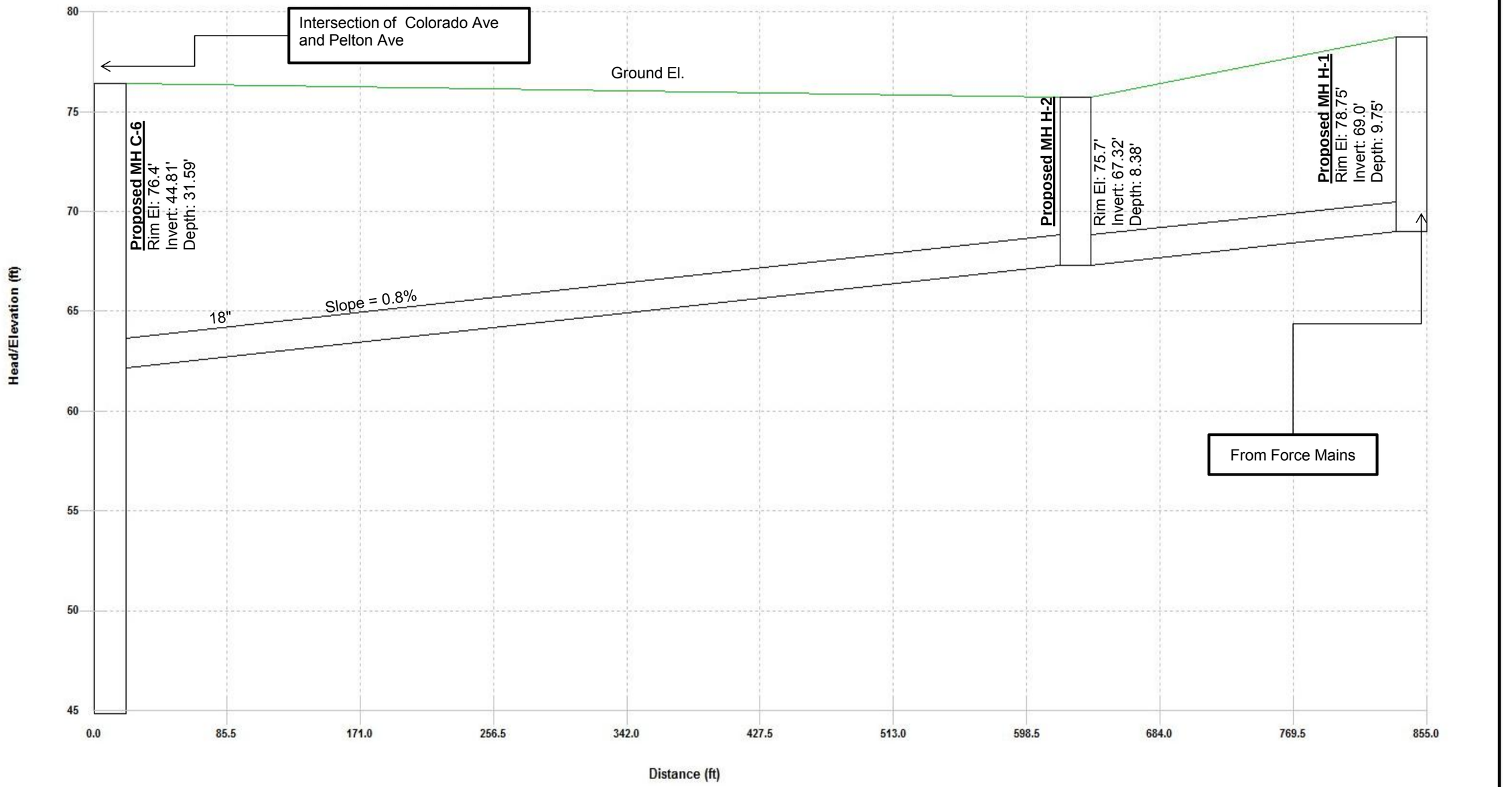
Option 7 - Shackleford 18" Gravity





Option 7 - Shackleford 18" Gravity
River Trunk, Beard Brook, CSL Project
City of Modesto

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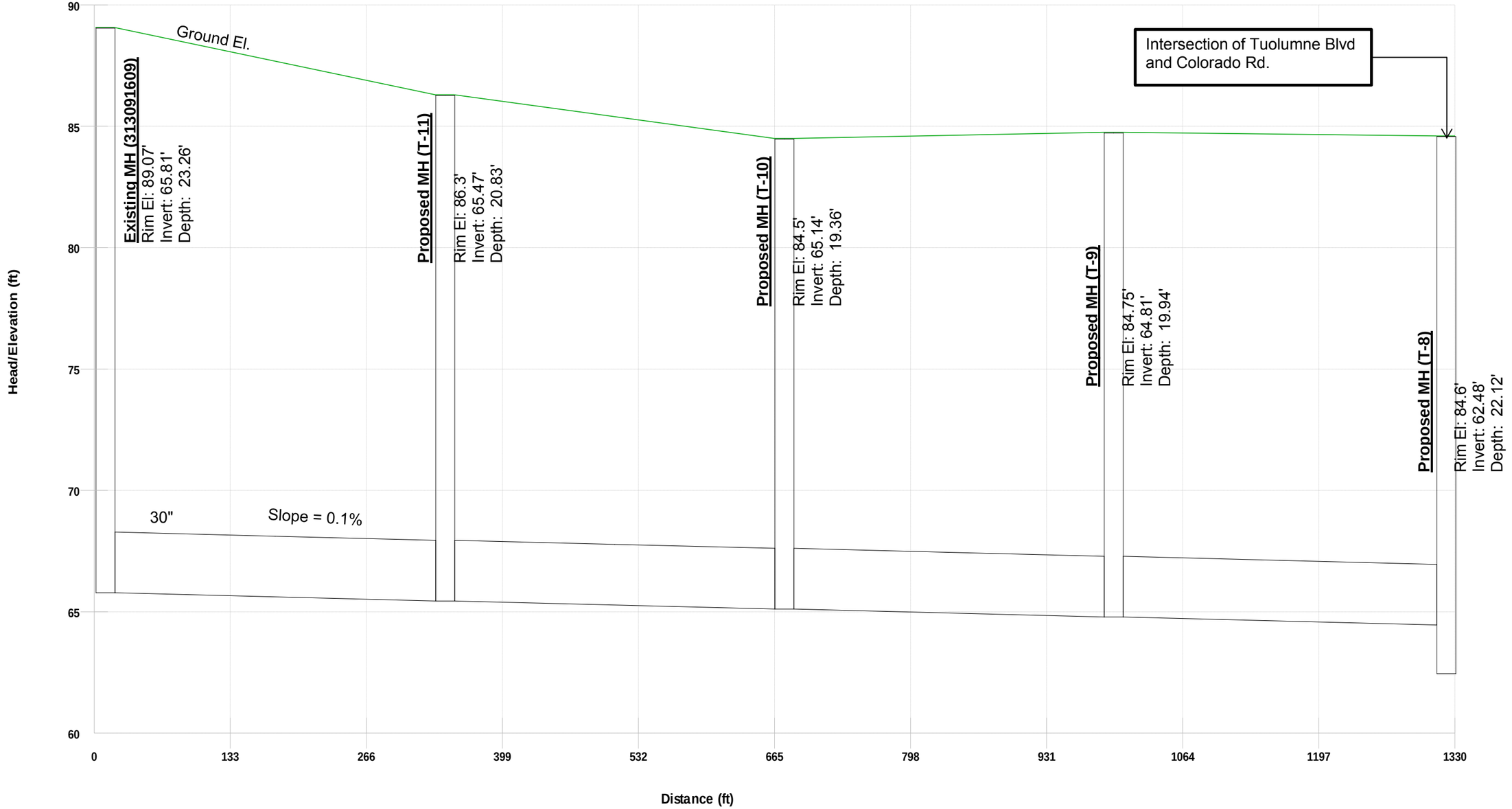
All Options - Tuolumne 30"





All Options - Tuolumne 30"
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City of Modesto

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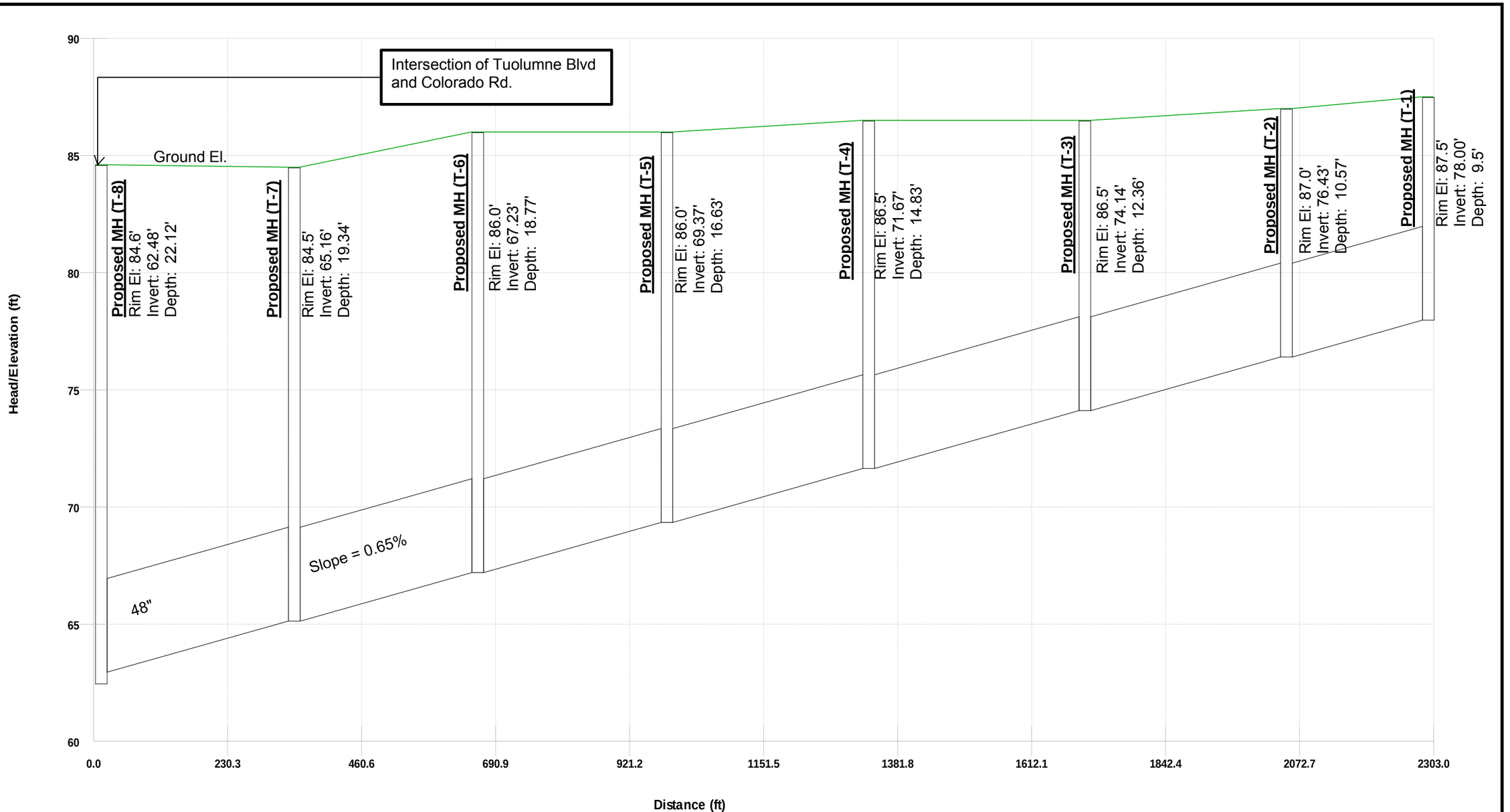
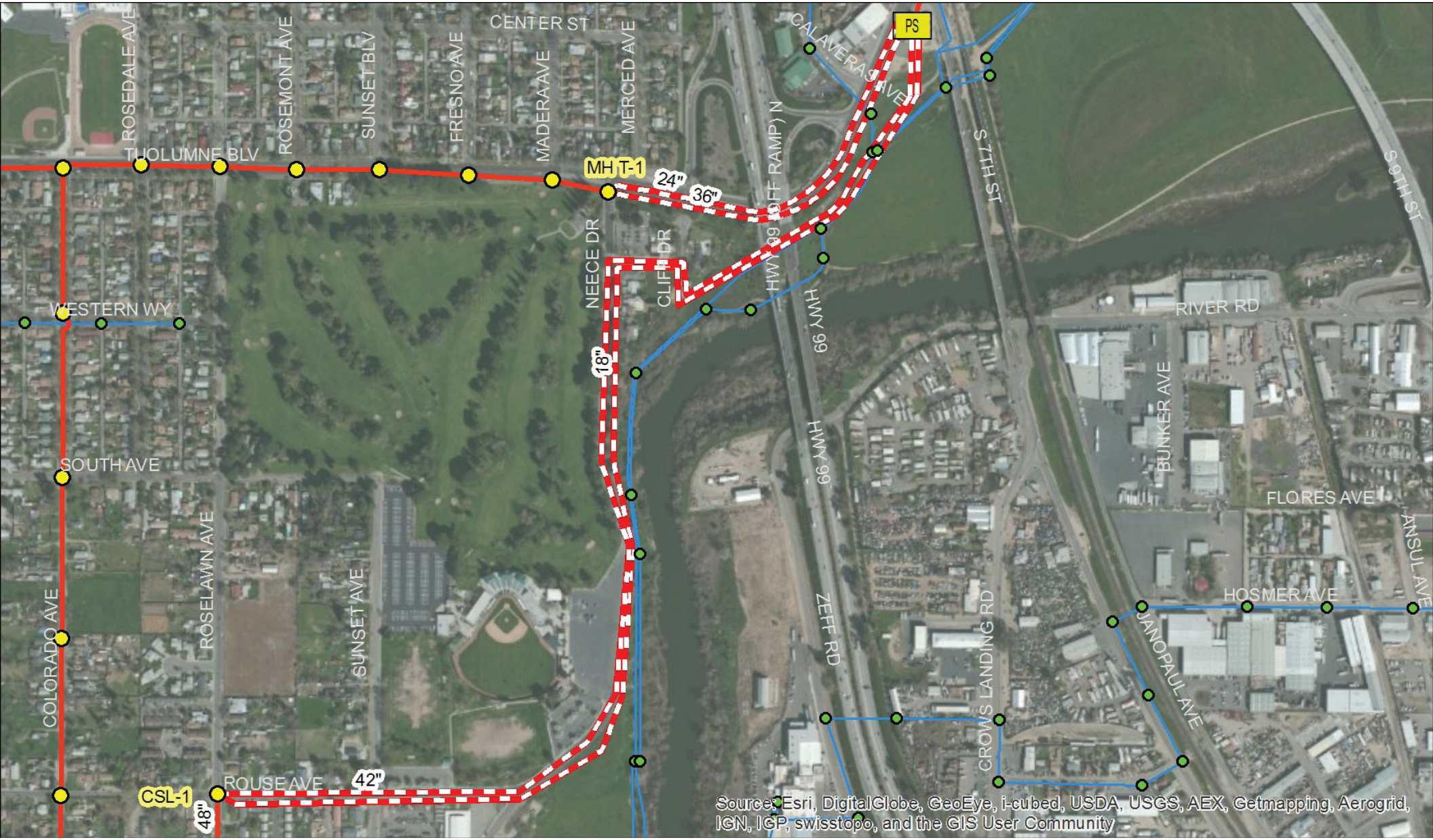
All Options - Tuolumne 48"



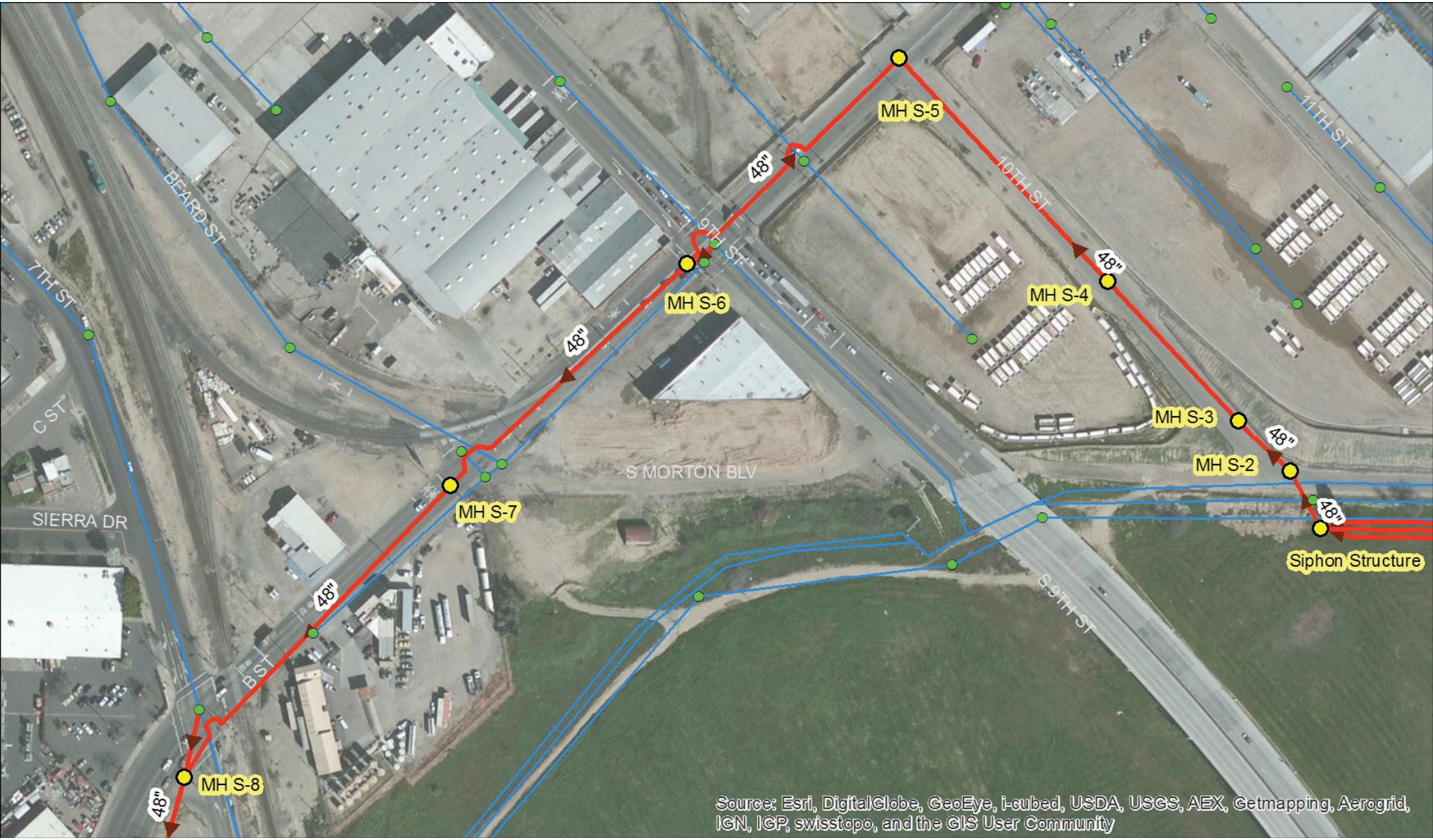


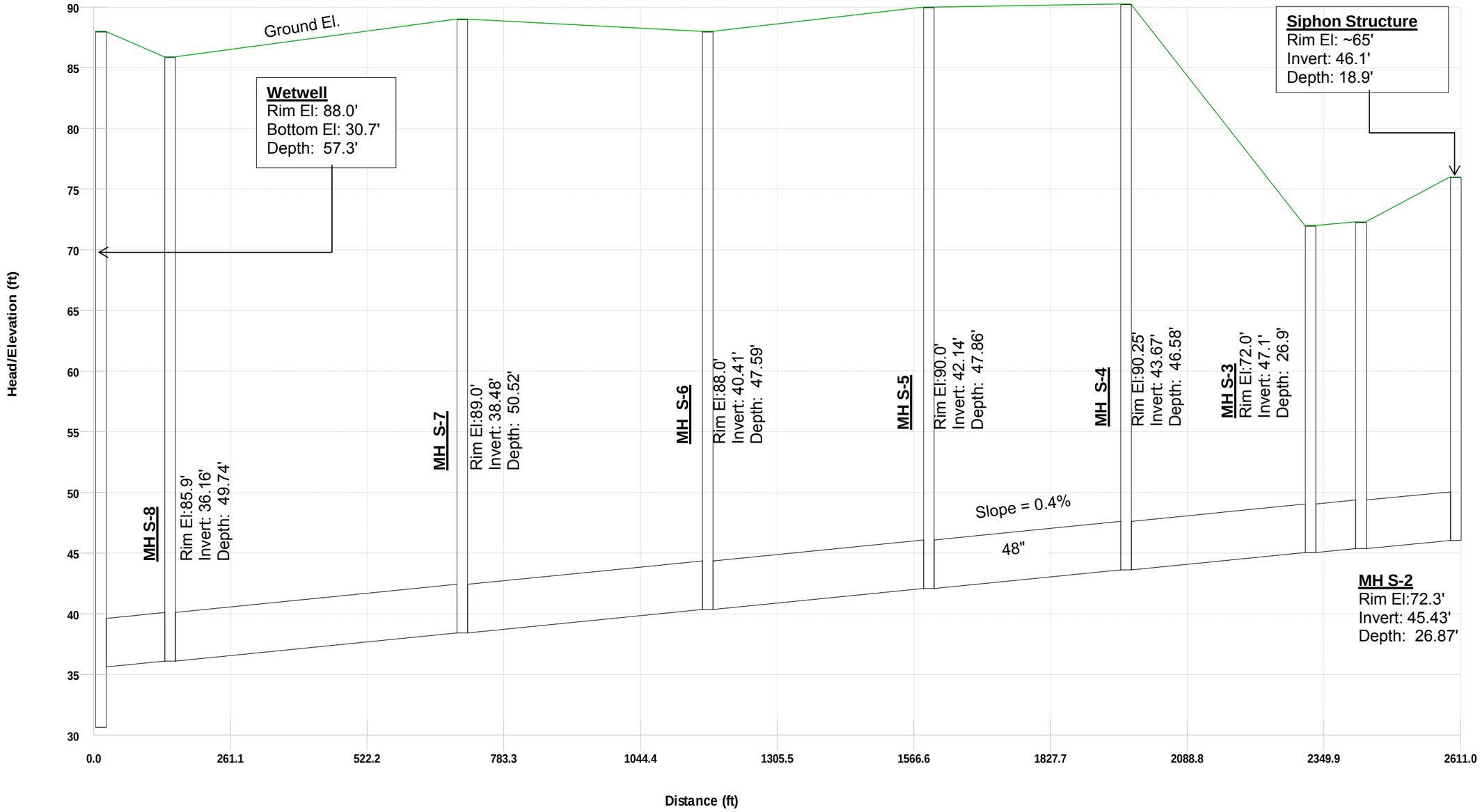
All Options - Tuolumne 48"
River Trunk, Beard Brook, CSL Project
City of Modesto

Option 7 - Force Main Domestic / CSL



Option 4.02 and 7 - B St/10th St 48"





Option 4.02 and 7 - B St/10th St 48"

River Trunk, Beard Brook, CSL Project

City of Modesto

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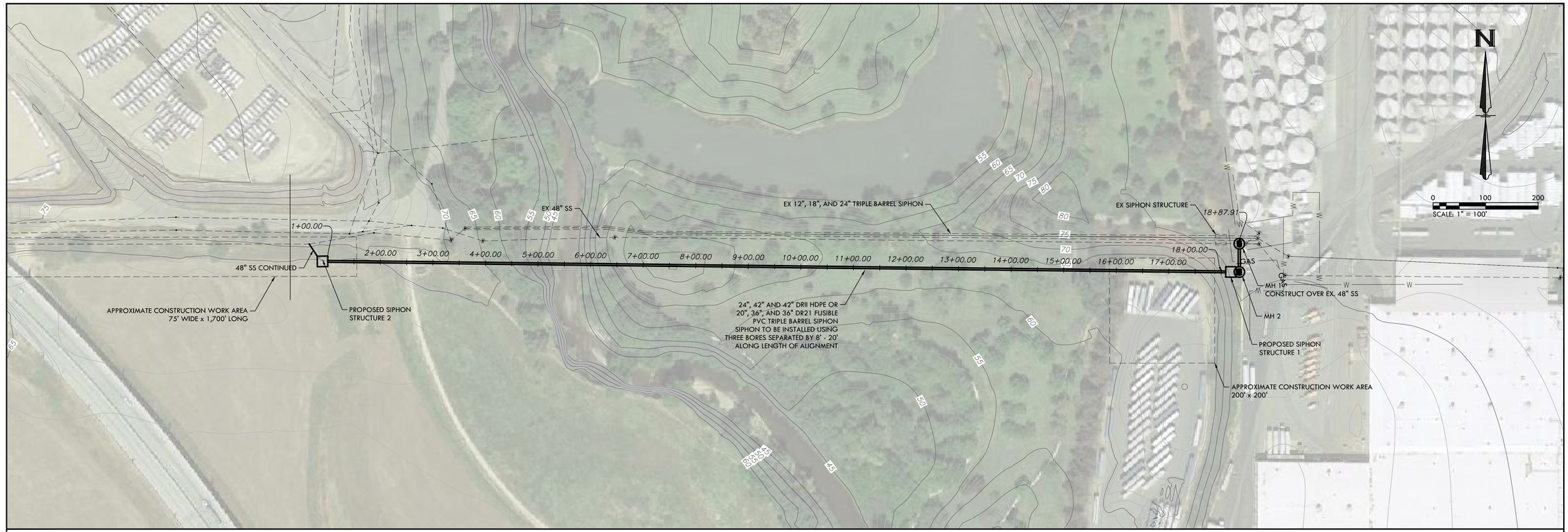

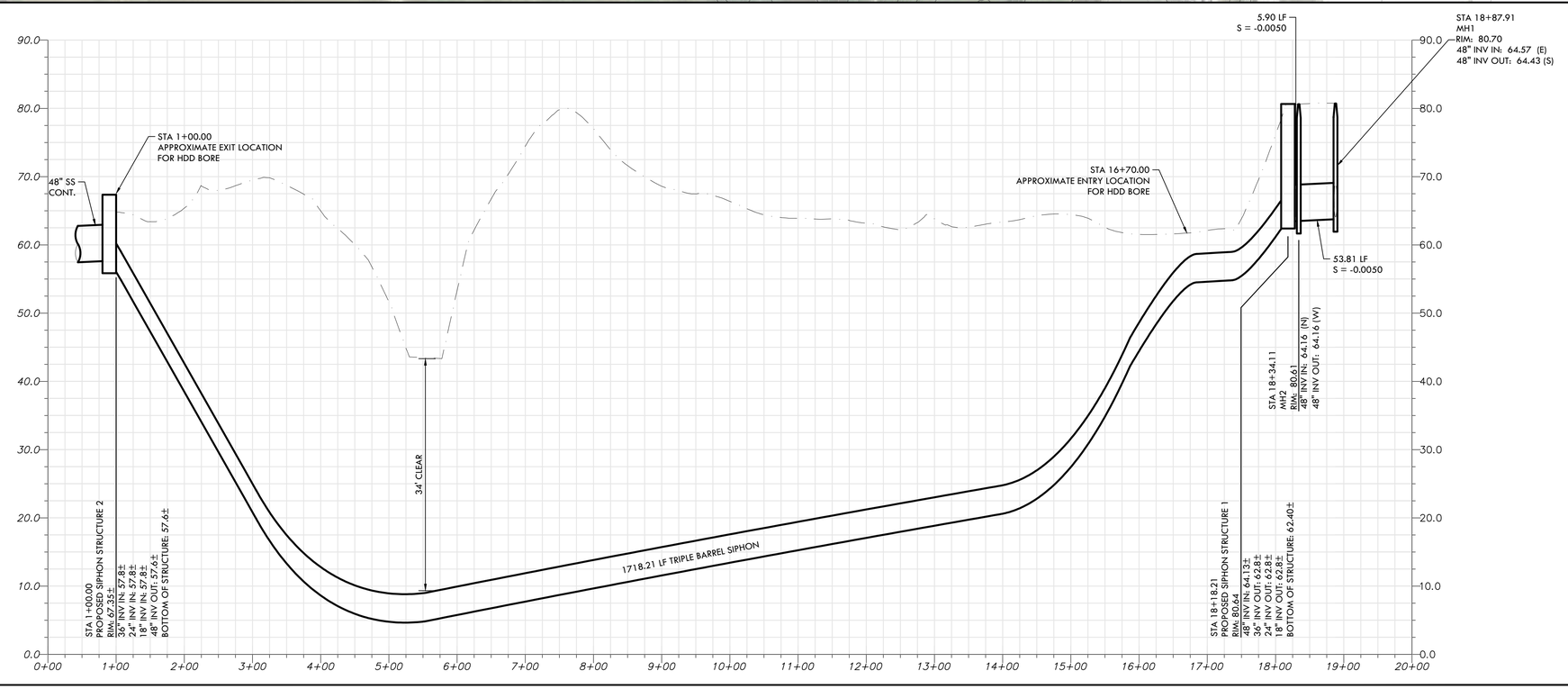

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1" = 100'HORIZONTAL
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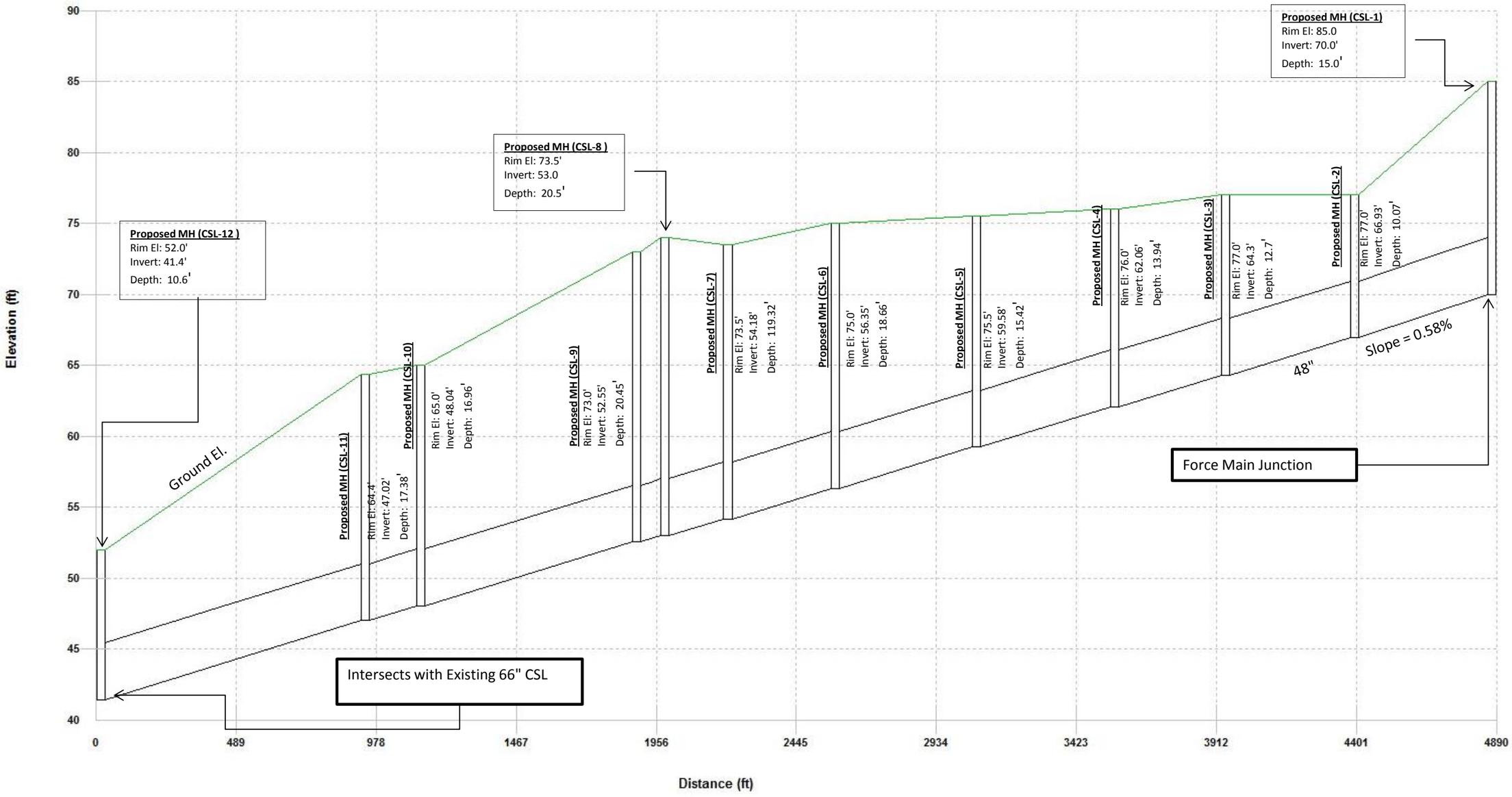
Option 7 - Can Seg Line 48"

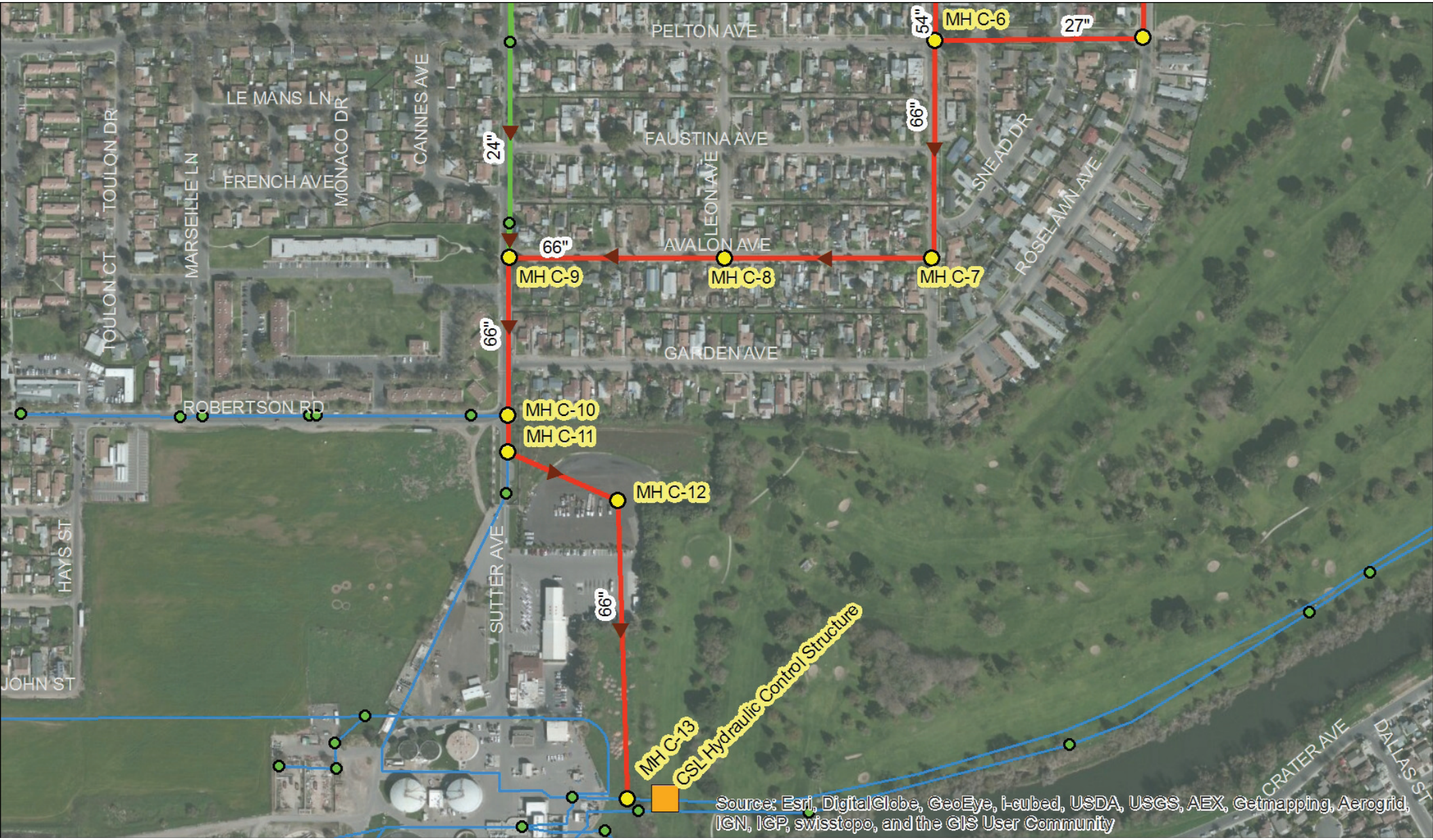


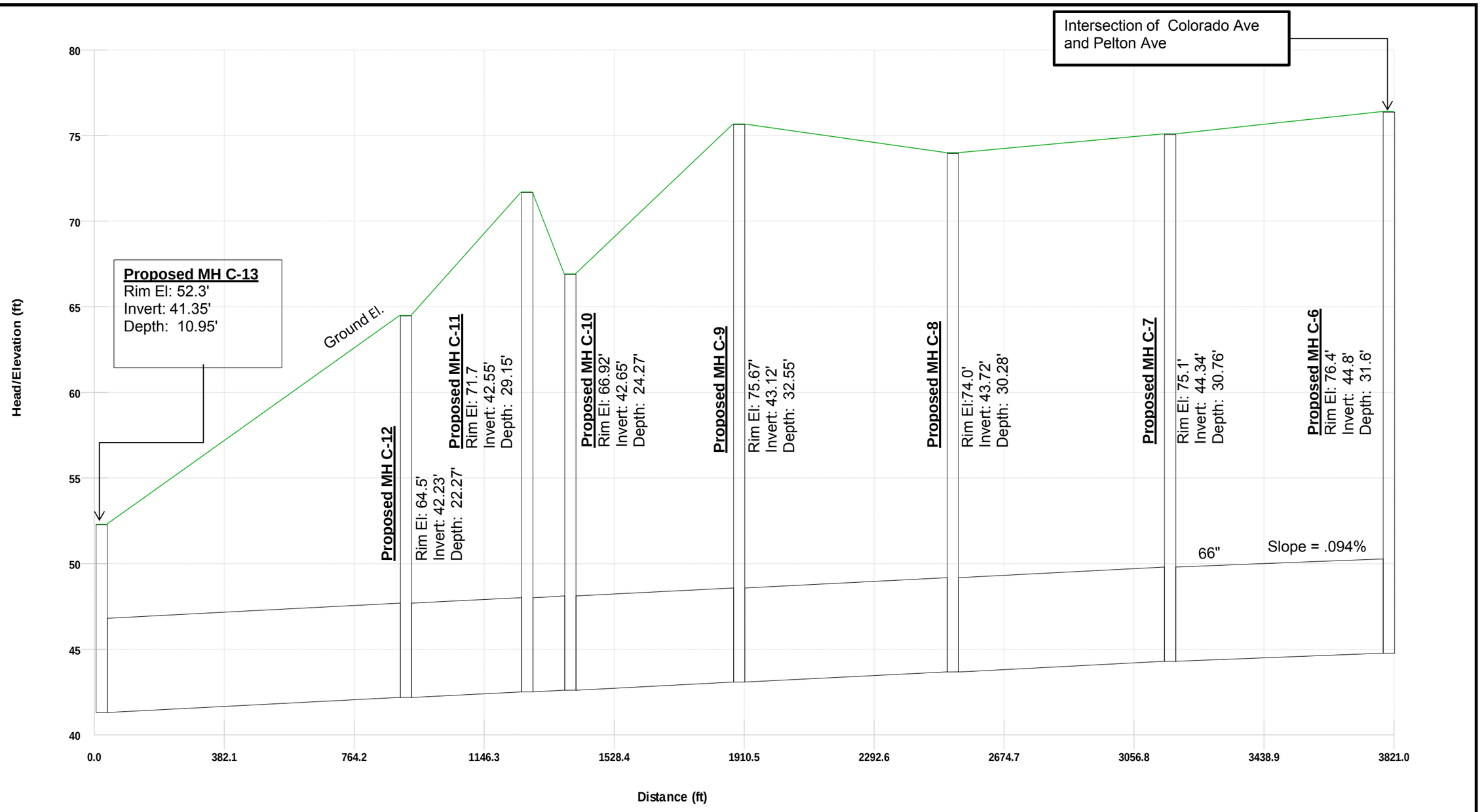


Option 7 - Can Seg Line 48"
River Trunk, Beard Brook, CSL Project
City of Modesto

APPENDIX C – SCREENED ALTERNATIVE 9 DETAIL MAPS AND PROFILES

All Options - Avalon/Sutter 66"





All Options - Avalon/Sutter 66"
River Trunk, Beard Brook, CSL Project
City of Modesto

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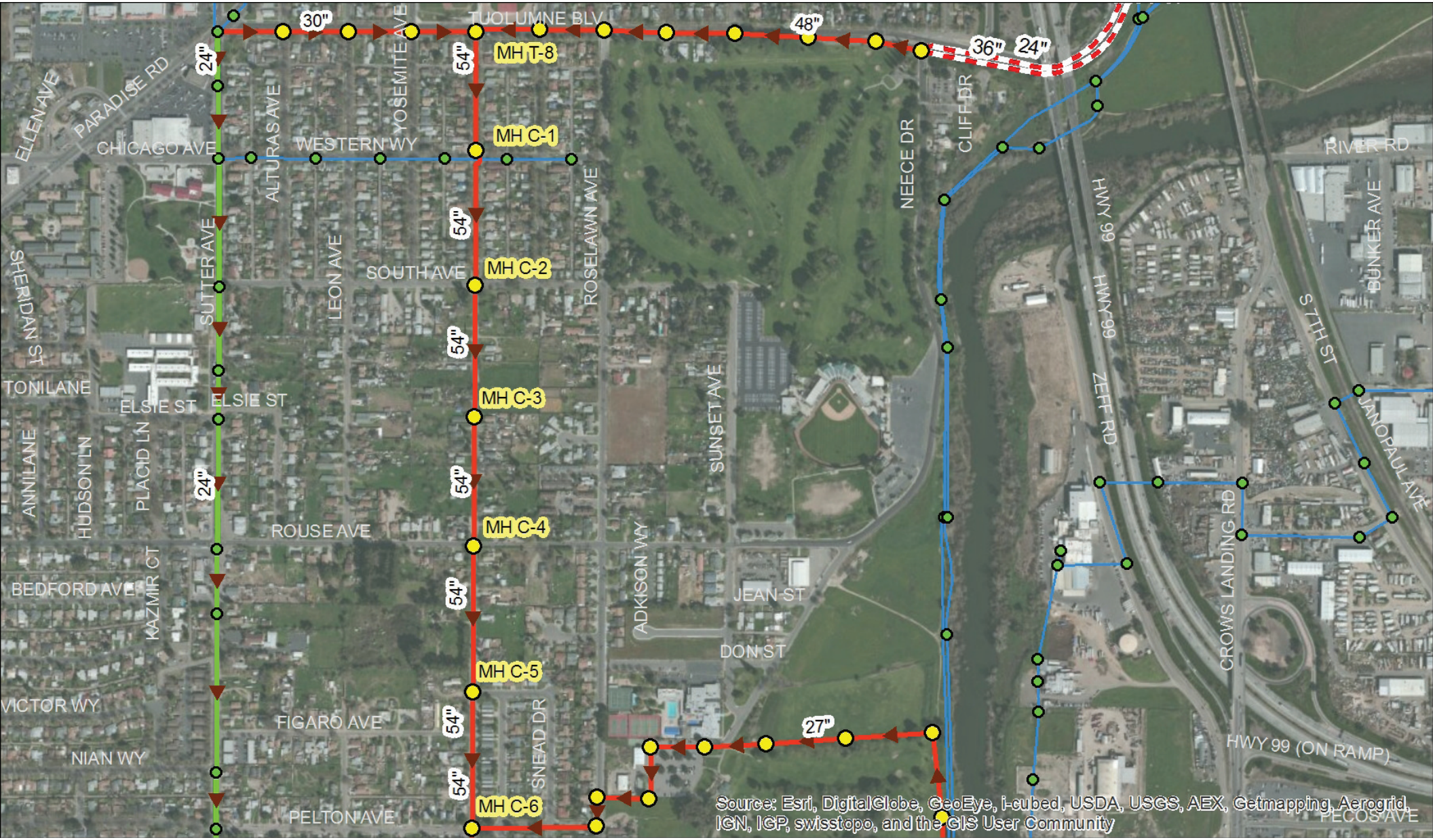
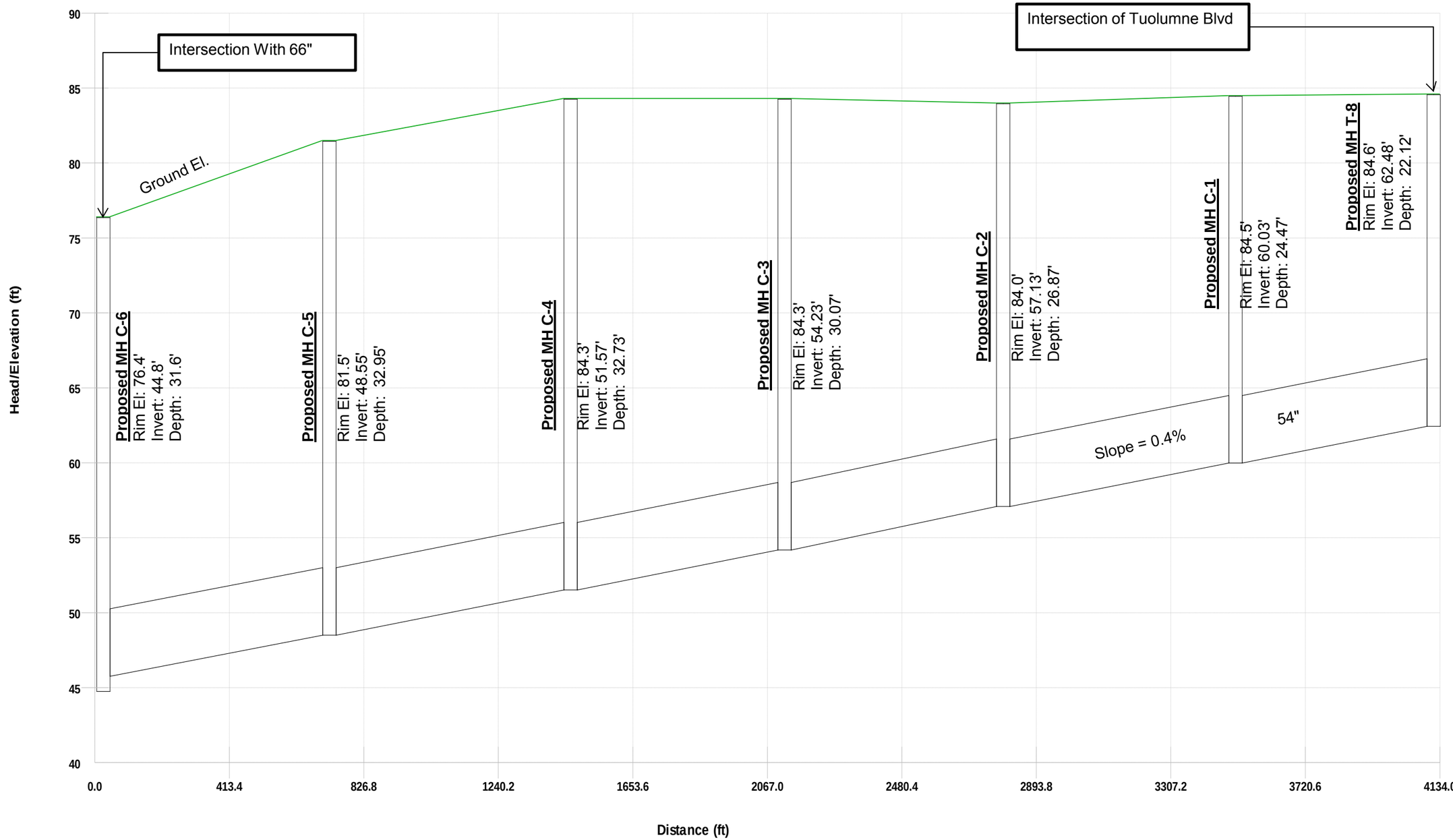
All Options - Colorado Ave. 54"





All Options - Colorado Ave. 54"
River Trunk, Beard Brook, CSL Project
City of Modesto

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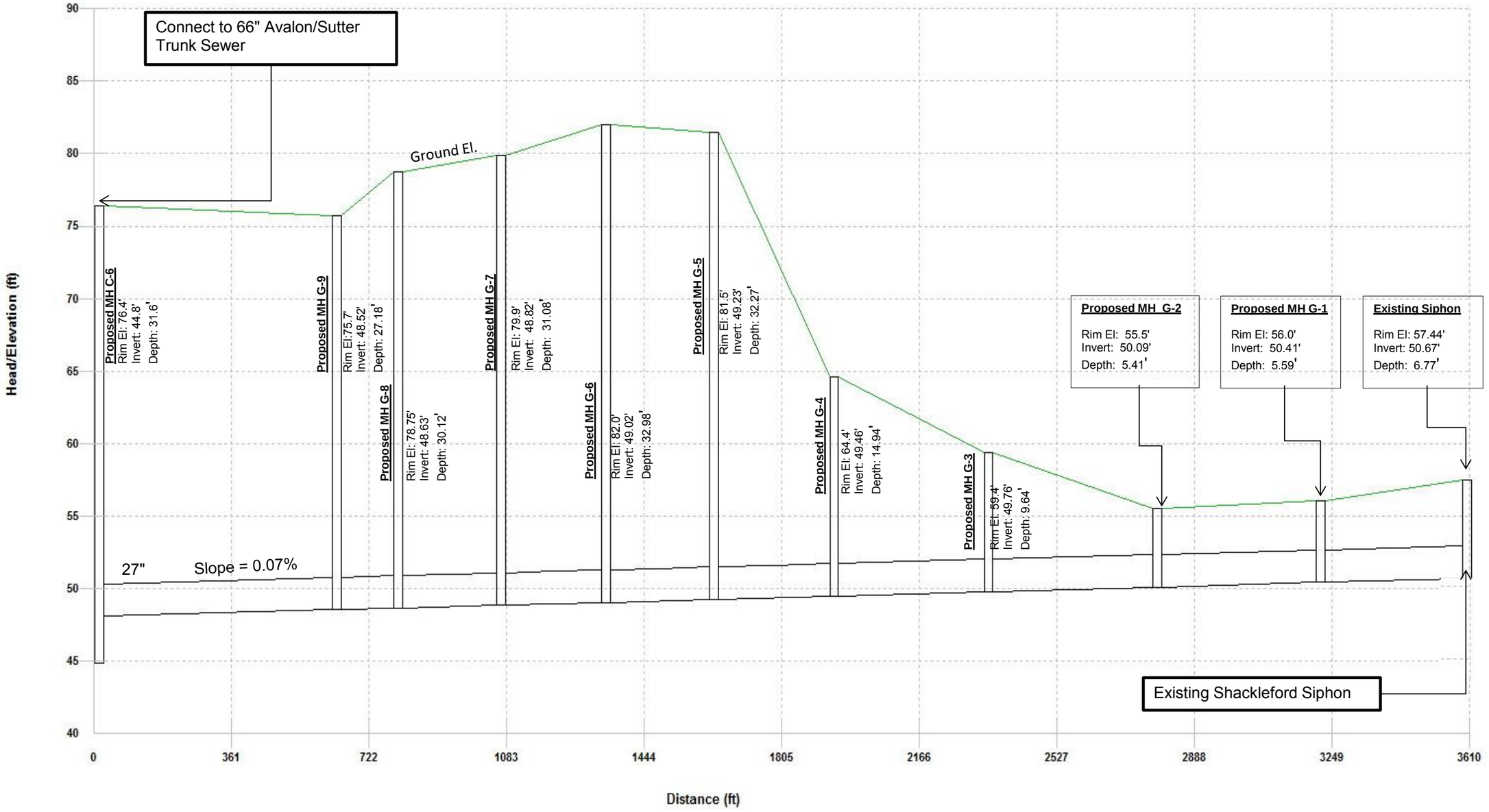
MODESTO CALIFORNIA

Option 4.02 and 9 - Shackleford Gravity





Option 4.02 and 9 - Shackleford Gravity
River Trunk, Beard Brook, CSL Project
City of Modesto

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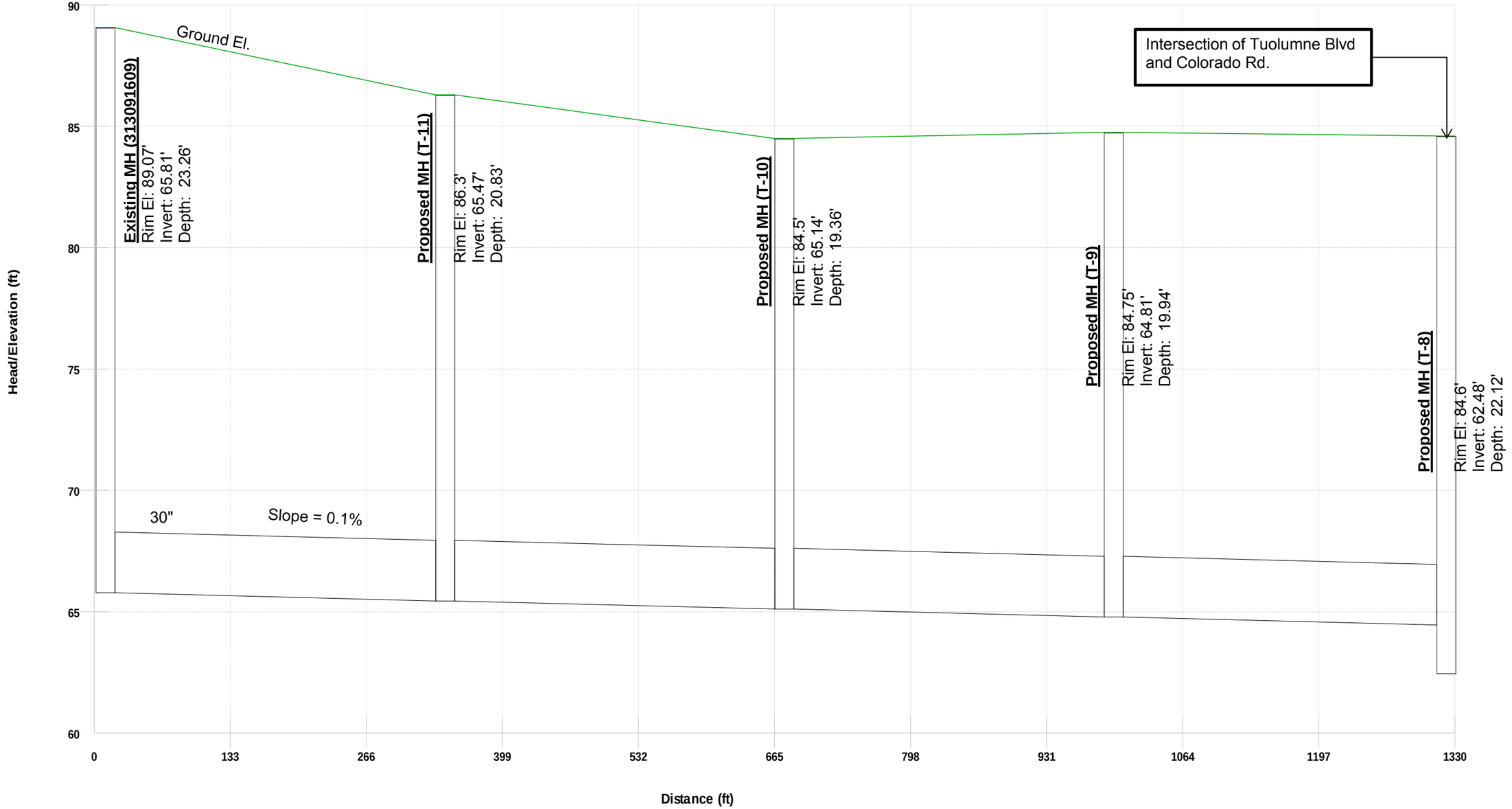
MODESTO CALIFORNIA

All Options - Tuolumne 30"





All Options - Tuolumne 30"
River Trunk, Beard Brook, CSL Project
City of Modesto

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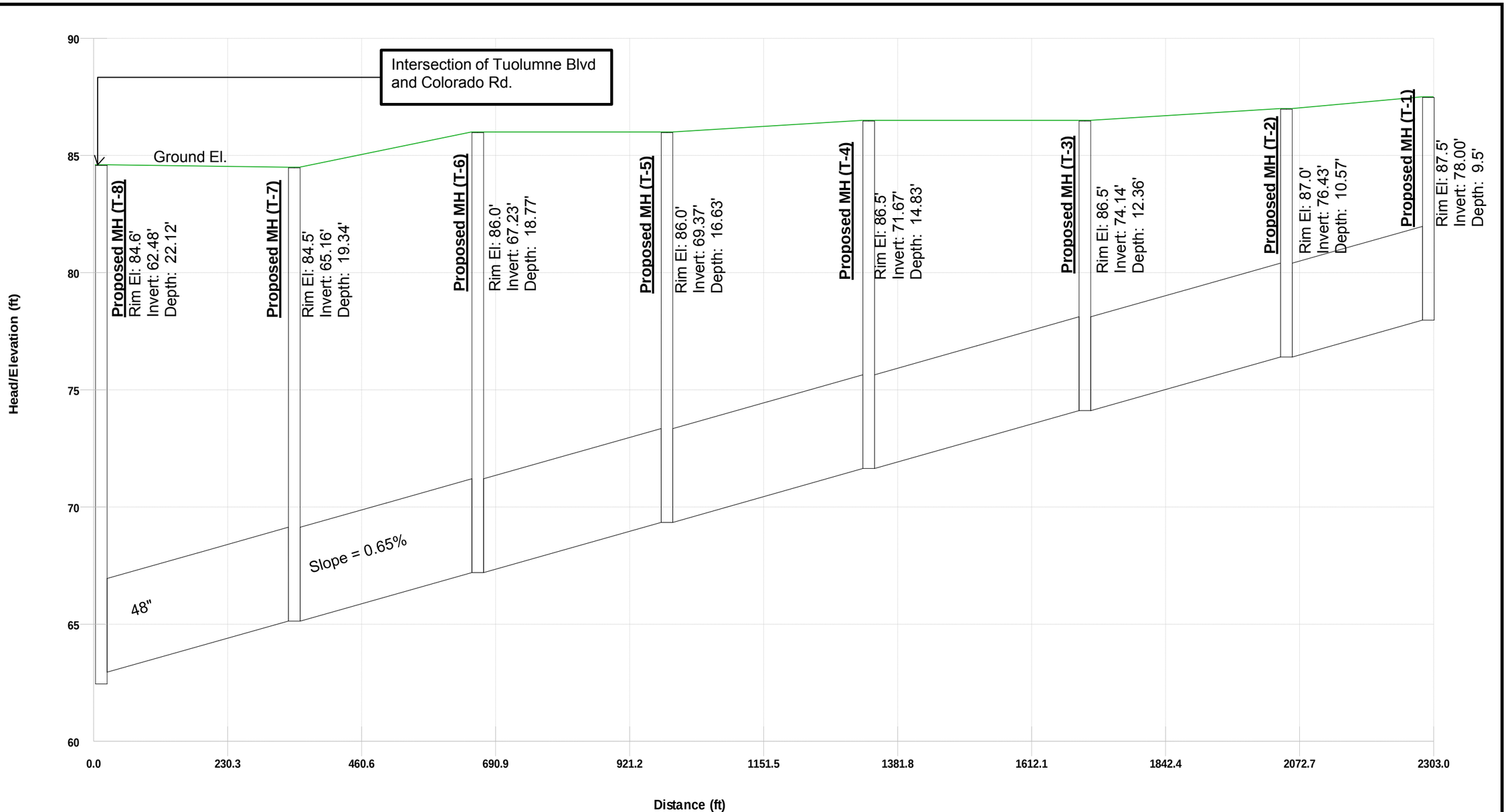
MODESTO
CALIFORNIA

All Options - Tuolumne 48"

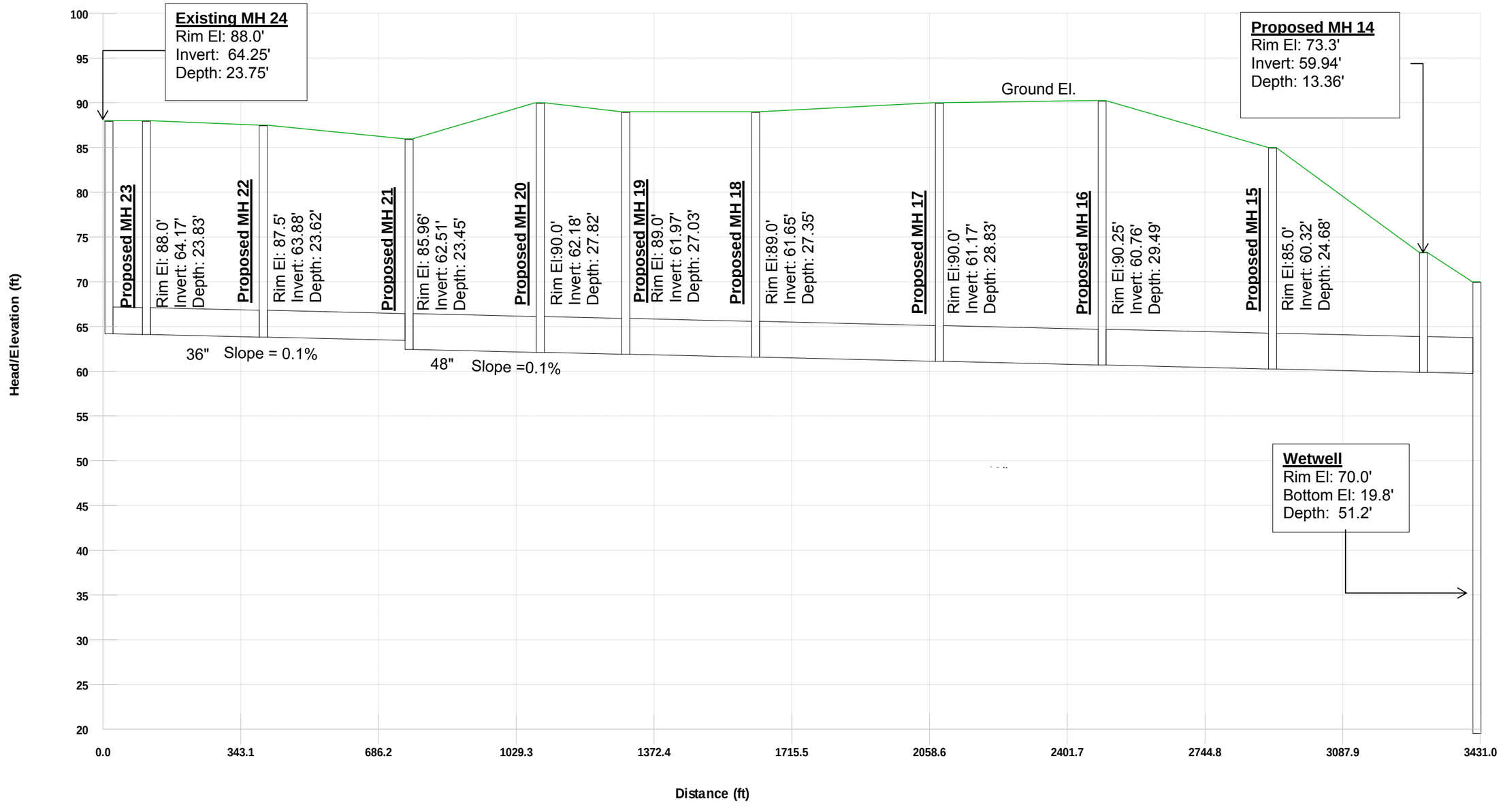




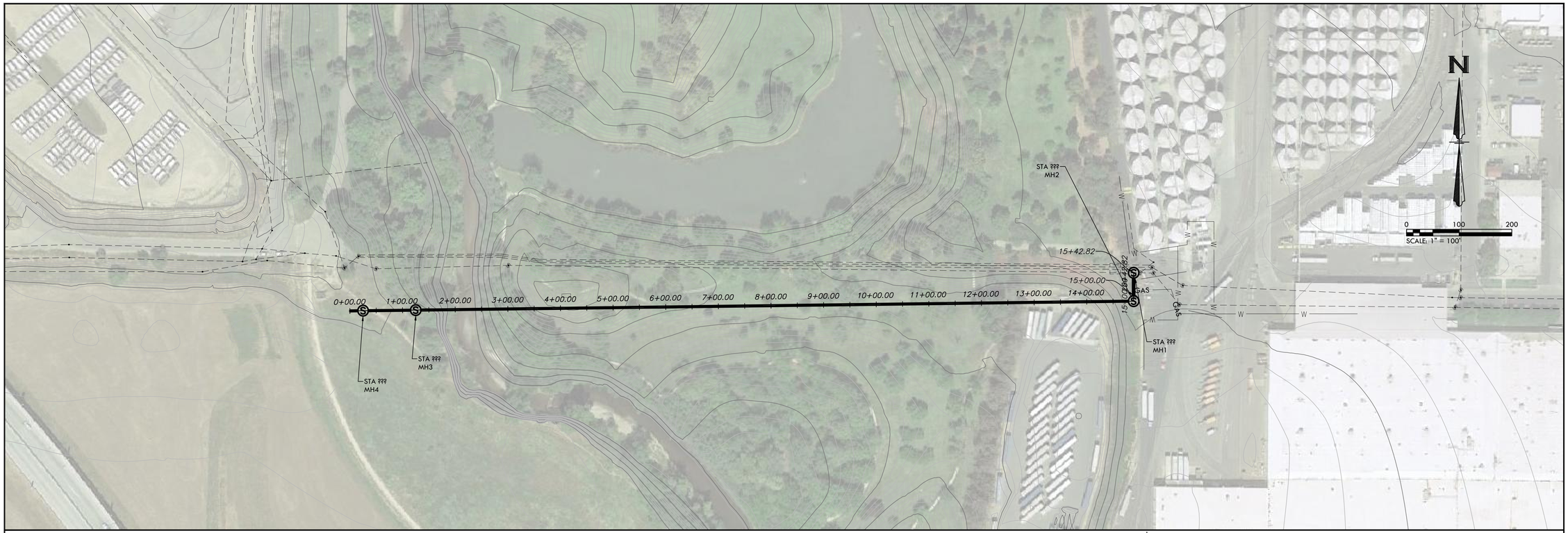
All Options - Tuolumne 48"
River Trunk, Beard Brook, CSL Project
City of Modesto

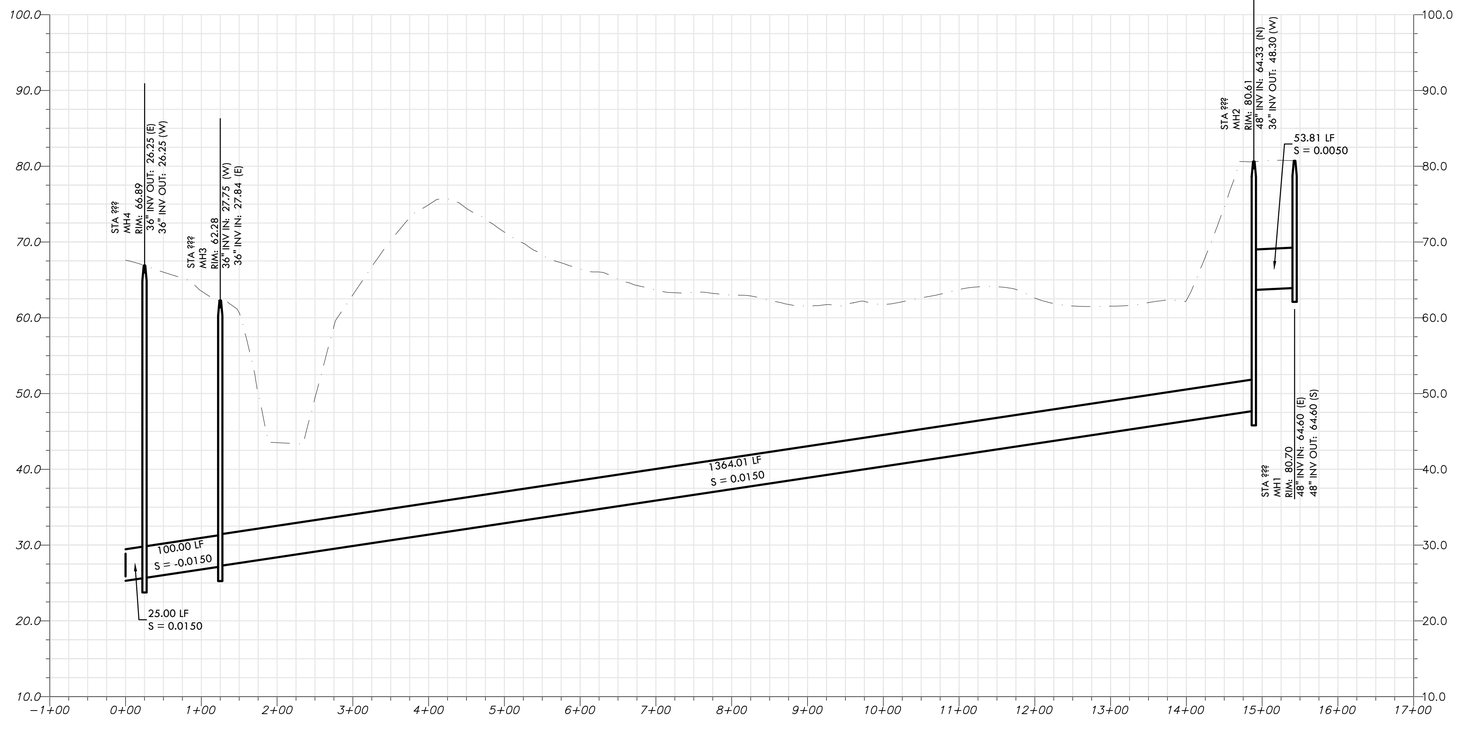
Option 9 - B St / 10th St





Option 9 - B St./ 10th St
River Trunk, Beard Brook, CSL Project
City of Modesto





PROFILE SCALE
1" = 100'HORIZONTAL
1" = 10' VERTICAL

PRELIMINARY

CALL BEFORE YOU DIG USA 800-227-2600

BLACKWATER
CONSULTING ENGINEERS, INC.
605 STANDIFORD AVE., SUITE N, MODESTO, CA 95350 PH. 209.322.1817

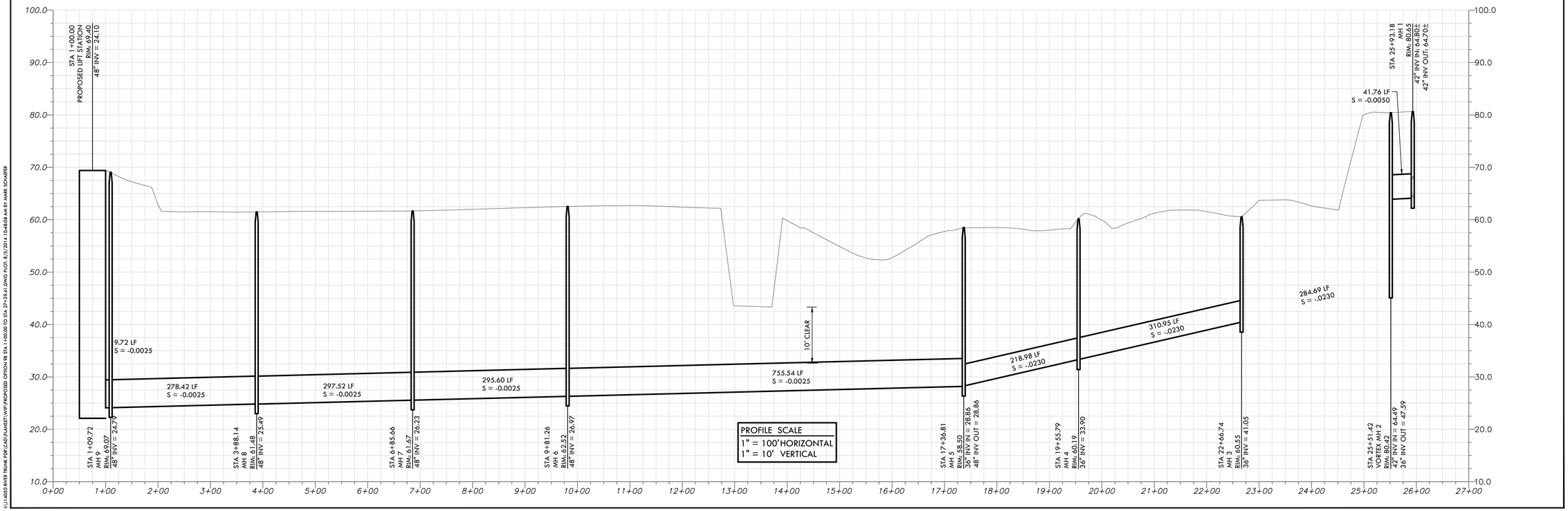
REV	DATE	DESCRIPTION	APP

PROPOSED BEARD CROSSING_GRAVITY
STA 1+00.00 TO STA 16+26.33

DESIGNED BY	AKF
DRAWN BY	MRS
CHECKED BY	JKB
JOB NO.	J14050
DATE	7/22/2014
DRAWING	X-XX
SHEET NO.	1 OF 5

\\SERVER\PROJECTS\J14050 RIVER TRUNK PKWY\CAD\PLANSET\WIP\1 PROPOSED BEARD CROSSING_GRAVITY STA 1+00.00 TO STA 16+26.33.DWG PLOT: 8/4/2014 4:05:21 PM BY MARK SCHAEFER





PRELIMINARY

CALL BEFORE YOU DIG
USA
800-227-2600

BLACKWATER
CONSULTING ENGINEERS, INC.
605 STANDIFORD AVE., SUITE N, MODESTO, CA 95350 PH. 209.322.1817

REV	DATE	DESCRIPTION	APP

PROPOSED OPTION 9B STA 1+00.00 TO STA 27+39.41

DESIGNED BY	AKF
DRAWN BY	MRS
CHECKED BY	JKB
JOB NO.	J14050
DATE	7/22/2014
DRAWING	X-XX
SHEET NO.	1 OF 5

J:\J14050 RIVER TRUNK FOR\CAD\PLANSET\VIP\PROPOSED OPTION 9B STA 1+00.00 TO STA 27+39.41.DWG PLOT: 8/5/2014 10:48:03 AM BY: MARK SCHAEFER

APPENDIX D – SCREENED ALTERNATIVE COST ESTIMATES

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PROJECT SUMMARY

Project:	**River Trunk, Beard Brook, CSL Project**	**Estimate Class:**	**4**
Client:	**City of Modesto**	**PIC:**	**MJB**
Location:	**(Modesto, CA)**	**PM:**	**TFT**
Zip Code:	**95351**	**Date:**	**8-Aug-14**
Carollo Job #	**9551A00**	**By:**	**RAH**
		Reviewed:	**TFT**
		Indirect Cost Multiplier:	**1.554800**

ALTERNATIVE 4A

NO.	DESCRIPTION	LENGTH (FT)	COST / LF	TOTAL
1	24" ϕ Rehabilitation along Sutter Ave	4140	$342	$1,414,000
2	30" ϕ Gravity Sewer along Tuolumne Blvd	1330	$731	$972,000
3	48" ϕ Gravity Sewer along Tuolumne Blvd	2310	$1,203	$2,779,000
4	54" ϕ Gravity Sewer along Colorado Ave	4140	$1,334	$5,523,000
5	66" ϕ Gravity Sewer: Colorado Ave to Sutter Treatment Facility	3820	$1,663	$6,353,000
6	27" ϕ Gravity Sewer: Shackleford to 66" ϕ Connection	3610	$712	$2,572,000
7	24" ϕ and (2) 42" ϕ Beard Brook Siphons	1800	$3,531	$6,355,000
8	48" ϕ Gravity Sewer: Beard Brook Siphon to Pumping Station	2830	$4,145	$11,731,000
9	Dual 24" ϕ and 36" ϕ Forcemains along Tuolumne Blvd	1750	$1,262	$2,209,000
10	River Trunk Pumping Station (53 mgd)			$24,721,000
11	CSL Diversion Structures			$466,000
12	48" ϕ River Trunk Rehabilitation	9000	$855	$7,696,000
13	River Bank Armorment			$3,887,000
	TOTAL ESTIMATED CONSTRUCTION COST			**$76,678,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

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PROJECT SUMMARY

Project:	**River Trunk, Beard Brook, CSL Project**	**Estimate Class:**	**4**
Client:	**City of Modesto**	**PIC:**	**MJB**
Location:	**(Modesto, CA)**	**PM:**	**TFT**
Zip Code:	**95351**	**Date:**	**8-Aug-14**
Carollo Job #	**9551A00**	**By:**	**RAH**
		Reviewed:	**TFT**
		Indirect Cost Multiplier:	**1.554800**

ALTERNATIVE 7

NO.	DESCRIPTION	LENGTH (FT)	COST / LF	TOTAL
1	24" ϕ Rehabilitation along Sutter Ave	4140	$342	$1,414,000
2	30" ϕ Gravity Sewer along Tuolumne Blvd	1330	$731	$972,000
3	48" ϕ Gravity Sewer along Tuolumne Blvd	2310	$1,203	$2,779,000
4	54" ϕ Gravity Sewer along Colorado Ave	4140	$1,334	$5,523,000
5	66" ϕ Gravity Sewer: Colorado Ave to Sutter Treatment Facility	3820	$1,663	$6,353,000
6	Shackleford (4.2 mgd) Pumping Station			$1,633,000
7	Shackleford 14" ϕ Forcemain and 18" ϕ Gravity Sewer	4555	$405	$1,847,000
8	48" ϕ Gravity Sewer: Beard Brook Siphon to Pumping Station	2830	$4,145	$11,731,000
9	Dual 24" ϕ and 36" ϕ Forcemains along Tuolumne Blvd	1750	$1,262	$2,209,000
10	24" ϕ and (2) 42" ϕ Beard Brook Siphons	1800	$3,531	$6,355,000
11	River Trunk (53 mgd) and CSL (51 mgd) Pumping Stations			$48,510,000
12	42" ϕ Forcemain along Neece Dr to Roselawn Ave	5700	$668	$3,806,000
13	18" ϕ Forcemain along Neece Dr to Roselawn Ave	5700	$340	$1,940,000
14	48" ϕ Gravity Sewer along Roselawn Ave	4890	$1,028	$5,028,000
	TOTAL ESTIMATED CONSTRUCTION COST			**$100,100,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

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PROJECT SUMMARY

Project:	**River Trunk, Beard Brook, CSL Project**	**Estimate Class:**	**4**
Client:	**City of Modesto**	**PIC:**	**MJB**
Location:	**(Modesto, CA)**	**PM:**	**TFT**
Zip Code:	**95351**	**Date:**	**8-Aug-14**
Carollo Job #	**9551A00**	**By:**	**RAH**
		Reviewed:	**TFT**
		Indirect Cost Multiplier:	**1.554800**

ALTERNATIVE 9A

NO.	DESCRIPTION	LENGTH (FT)	COST / LF	TOTAL
1	24" ϕ Rehabilitation along Sutter Ave	4140	$342	$1,414,000
2	30" ϕ Gravity Sewer along Tuolumne Blvd	1330	$731	$972,000
3	48" ϕ Gravity Sewer along Tuolumne Blvd	2310	$1,203	$2,779,000
4	54" ϕ Gravity Sewer along Colorado Ave	4140	$1,334	$5,523,000
5	66" ϕ Gravity Sewer: Colorado Ave to Sutter Treatment Facility	3820	$1,663	$6,353,000
6	27" ϕ Gravity Sewer: Shackleford to 66" ϕ Connection	3610	$712	$2,572,000
7	Dual 24" ϕ and 36" ϕ Forcemains along Floodplain and Tuolumne Blvd	4100	$1,401	$5,746,000
8	36" ϕ and 48" ϕ Gravity Sewer: B St to Pumping Station	3400	$1,416	$4,816,000
9	River Trunk Pumping Station (53 mgd)			$24,721,000
10	Option 9A - Beard Brook North Gravity Alignment			$5,991,000
11	CSL Diversion Structures			$466,000
12	48" ϕ River Trunk Rehabilitation	9000	$855	$7,696,000
13	River Bank Armorment			$3,887,000
	TOTAL ESTIMATED CONSTRUCTION COST			**$72,936,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

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PROJECT SUMMARY

Project:	**River Trunk, Beard Brook, CSL Project**	**Estimate Class:**	**4**
Client:	**City of Modesto**	**PIC:**	**MJB**
Location:	**(Modesto, CA)**	**PM:**	**TFT**
Zip Code:	**95351**	**Date:**	**8-Aug-14**
Carollo Job #	**9551A00**	**By:**	**RAH**
		Reviewed:	**TFT**
		Indirect Cost Multiplier:	**1.554800**

ALTERNATIVE 9B

NO.	DESCRIPTION	LENGTH (FT)	COST / LF	TOTAL
1	24" ϕ Rehabilitation along Sutter Ave	4140	$342	$1,414,000
2	30" ϕ Gravity Sewer along Tuolumne Blvd	1330	$731	$972,000
3	48" ϕ Gravity Sewer along Tuolumne Blvd	2310	$1,203	$2,779,000
4	54" ϕ Gravity Sewer along Colorado Ave	4140	$1,334	$5,523,000
5	66" ϕ Gravity Sewer: Colorado Ave to Sutter Treatment Facility	3820	$1,663	$6,353,000
6	27" ϕ Gravity Sewer: Shackleford to 66" ϕ Connection	3610	$712	$2,572,000
7	Dual 24" ϕ and 36" ϕ Forcemains along Floodplain and Tuolumne Blvd	4100	$1,401	$5,746,000
8	36" ϕ and 48" ϕ Gravity Sewer: B St to Pumping Station	3400	$1,416	$4,816,000
9	River Trunk Pumping Station (53 mgd)			$24,721,000
10	Option 9B - Beard Brook South Gravity Alignment			$7,076,000
11	CSL Diversion Structures			$466,000
12	48" ϕ River Trunk Rehabilitation	9000	$855	$7,696,000
13	River Bank Armorment			$3,887,000
	TOTAL ESTIMATED CONSTRUCTION COST			**$74,021,000**

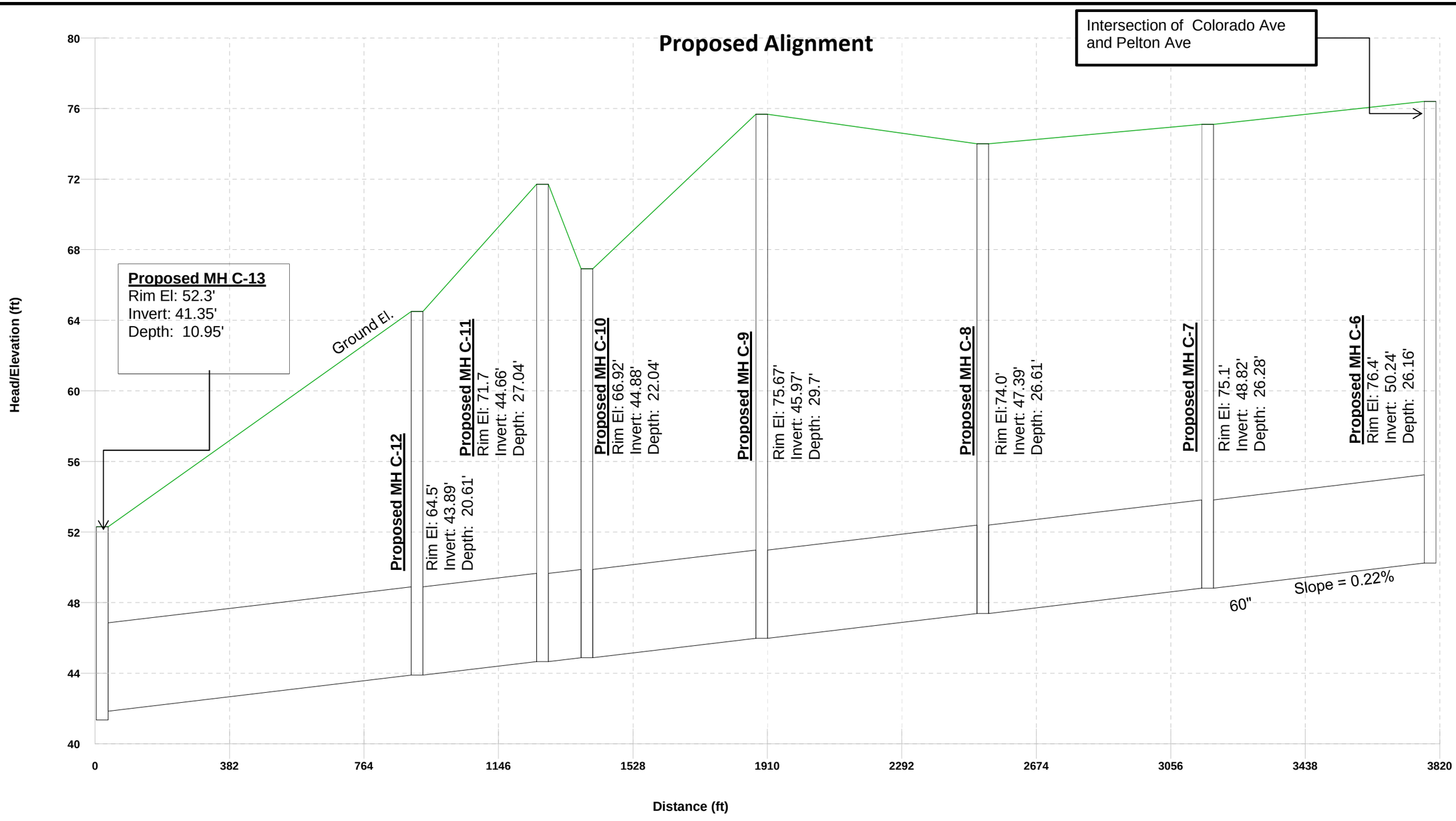
The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

APPENDIX E – SELECTED ALTERNATIVE 9 DETAIL MAPS AND PROFILES

Avalon/Sutter 60"



Proposed Alignment



Avalon/Sutter 60"
River Trunk, Beard Brook, CSL Project
City of Modesto

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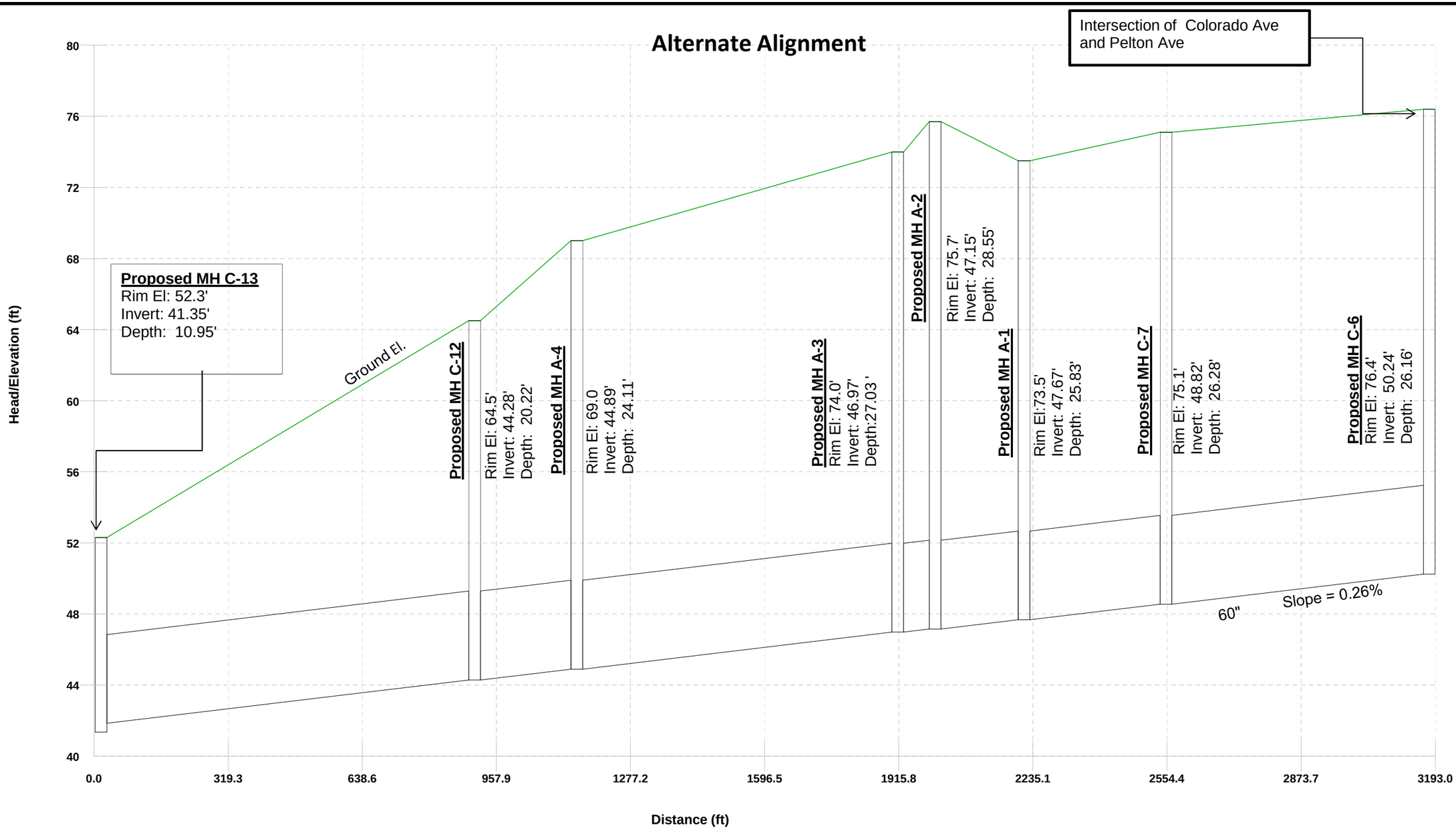
Alternate Alignment



Avalon/Sutter 60"
River Trunk, Beard Brook, CSL Project
City of Modesto

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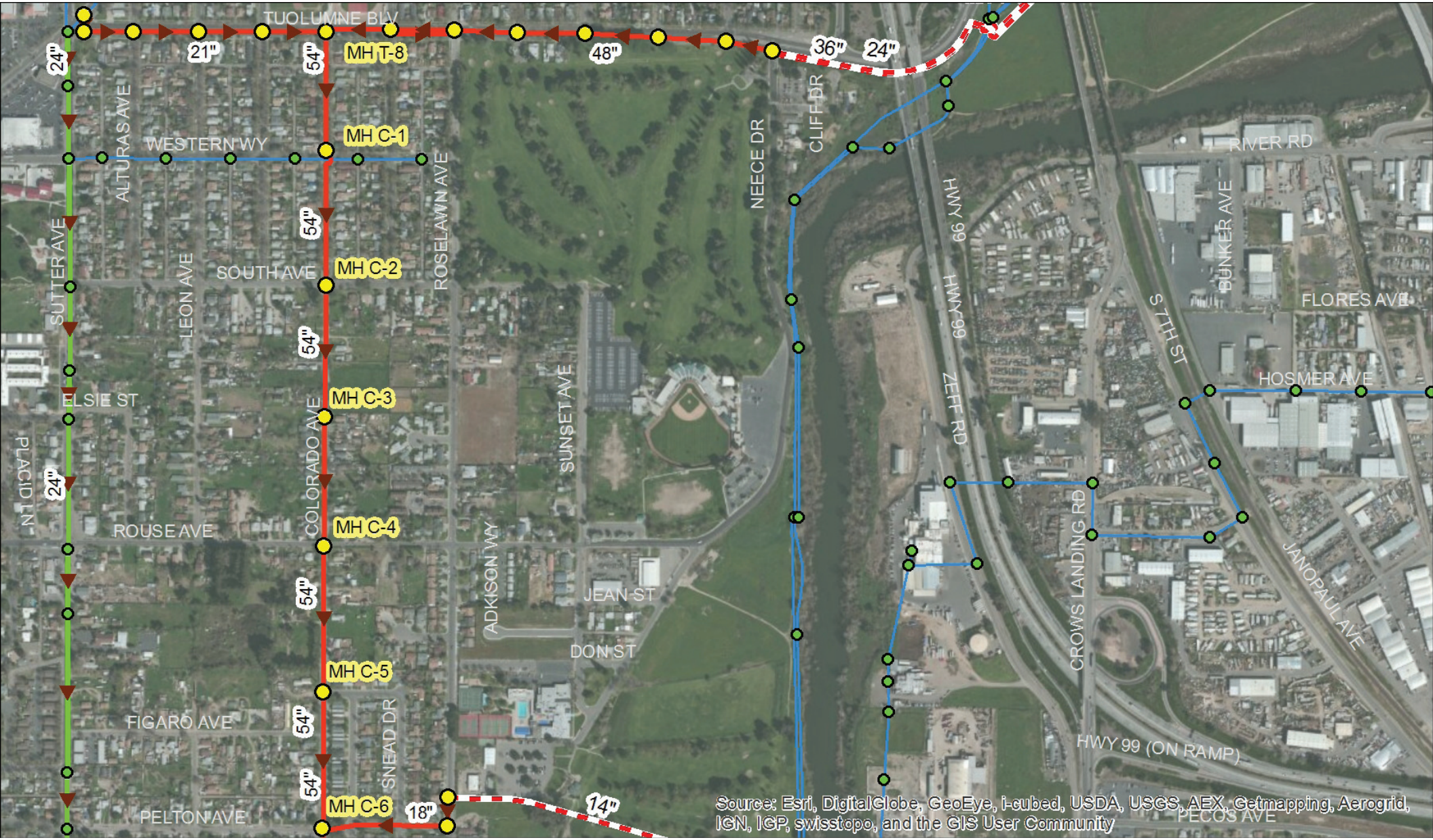
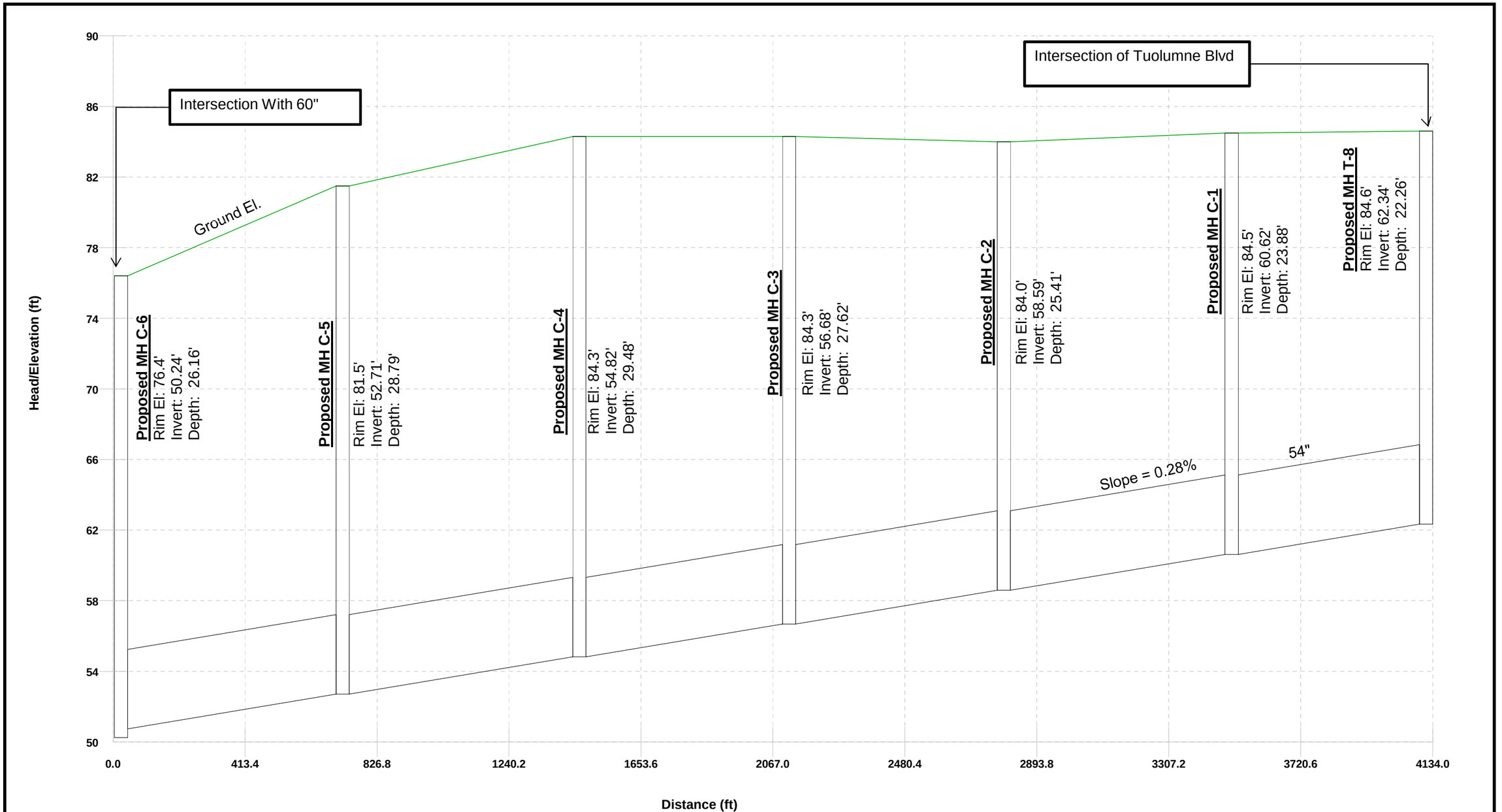
Colorado Ave 54"





Colorado Ave. 54"
River Trunk, Beard Brook, CSL Project
City of Modesto

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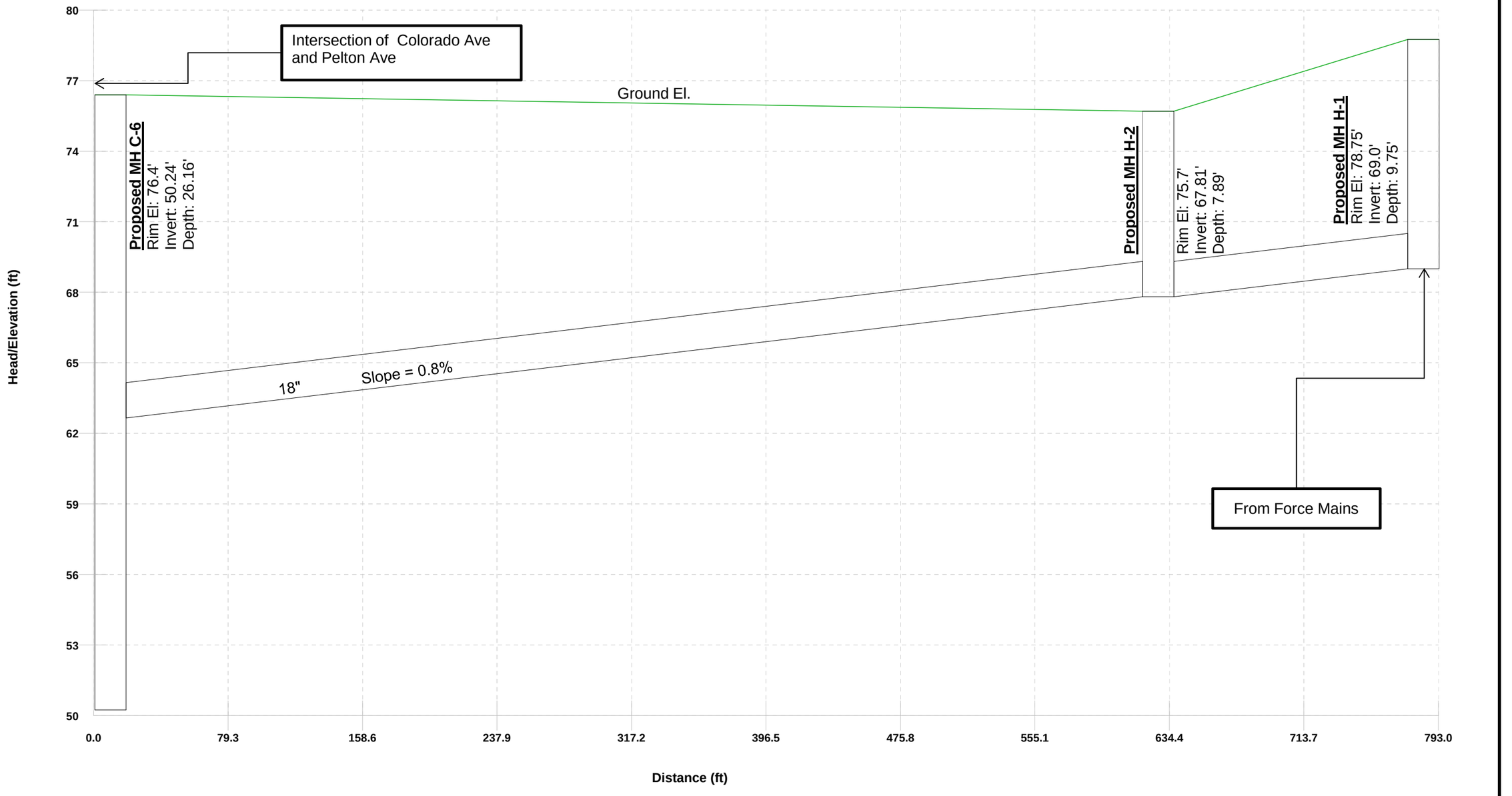
CALIFORNIA

Shackleford 18" Gravity





Shackleford 18" Gravity
River Trunk, Beard Brook, CSL Project
City of Modesto

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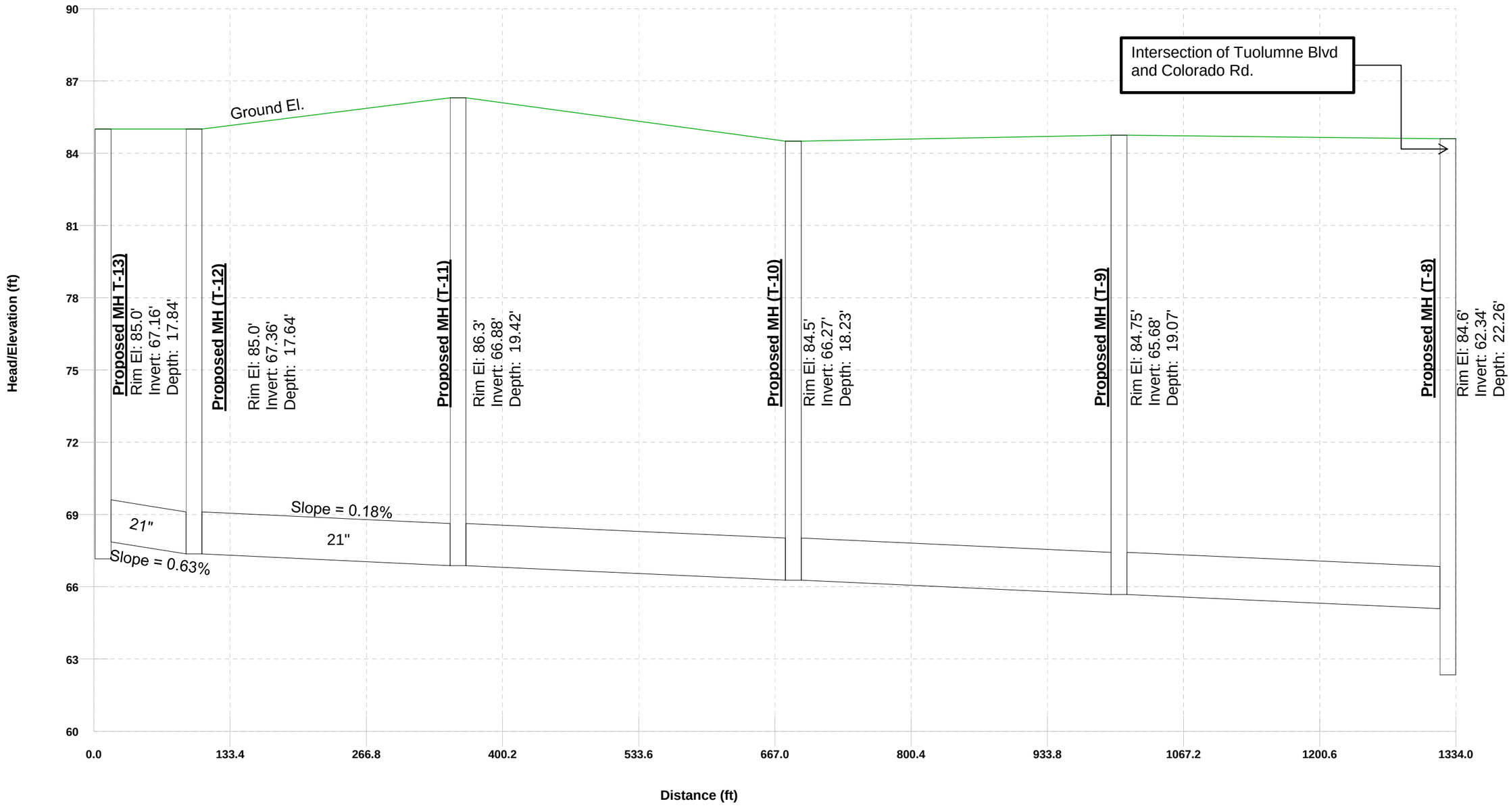
CALIFORNIA

Tuolumne 21"


MH T-13
MH T-12
MH T-11
MH T-10
MH T-9
MH T-8
21"
21"
21"
21"
21"
21"
48"
54"
24"
24"
24"
TUOLUMNE BLV
N MARTIN LUTHER KING DR
PARADISE AVE
PARADISE RD
SUTTER AVE
ALTURAS AVE
LEON AVE
YOSEMITE AVE
COLORADO AVE
CHICAGO AVE
WESTERN WY
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Tuolumne 21"
River Trunk, Beard Brook, CSL Project
City of Modesto

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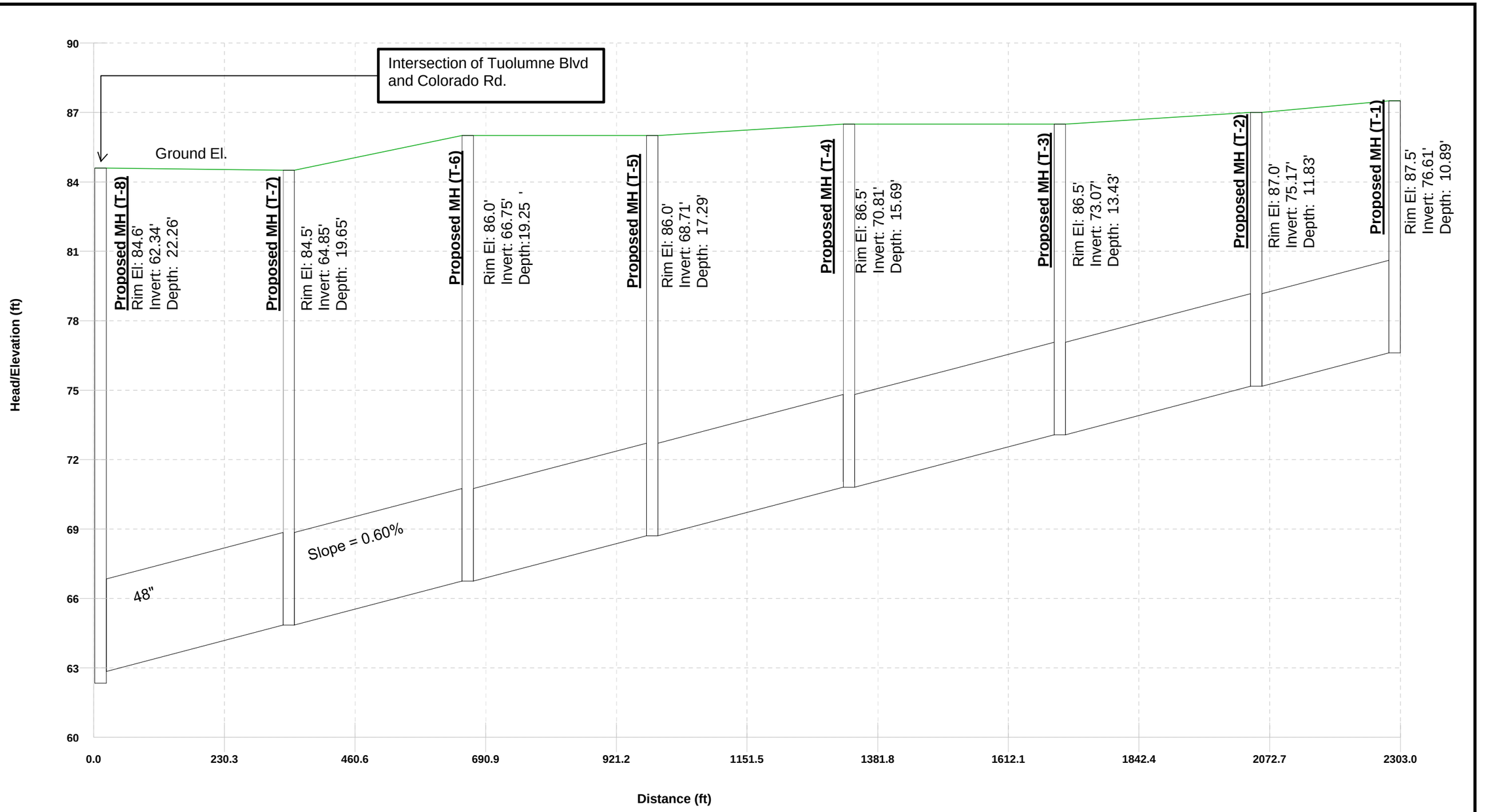
Tuolumne 48"

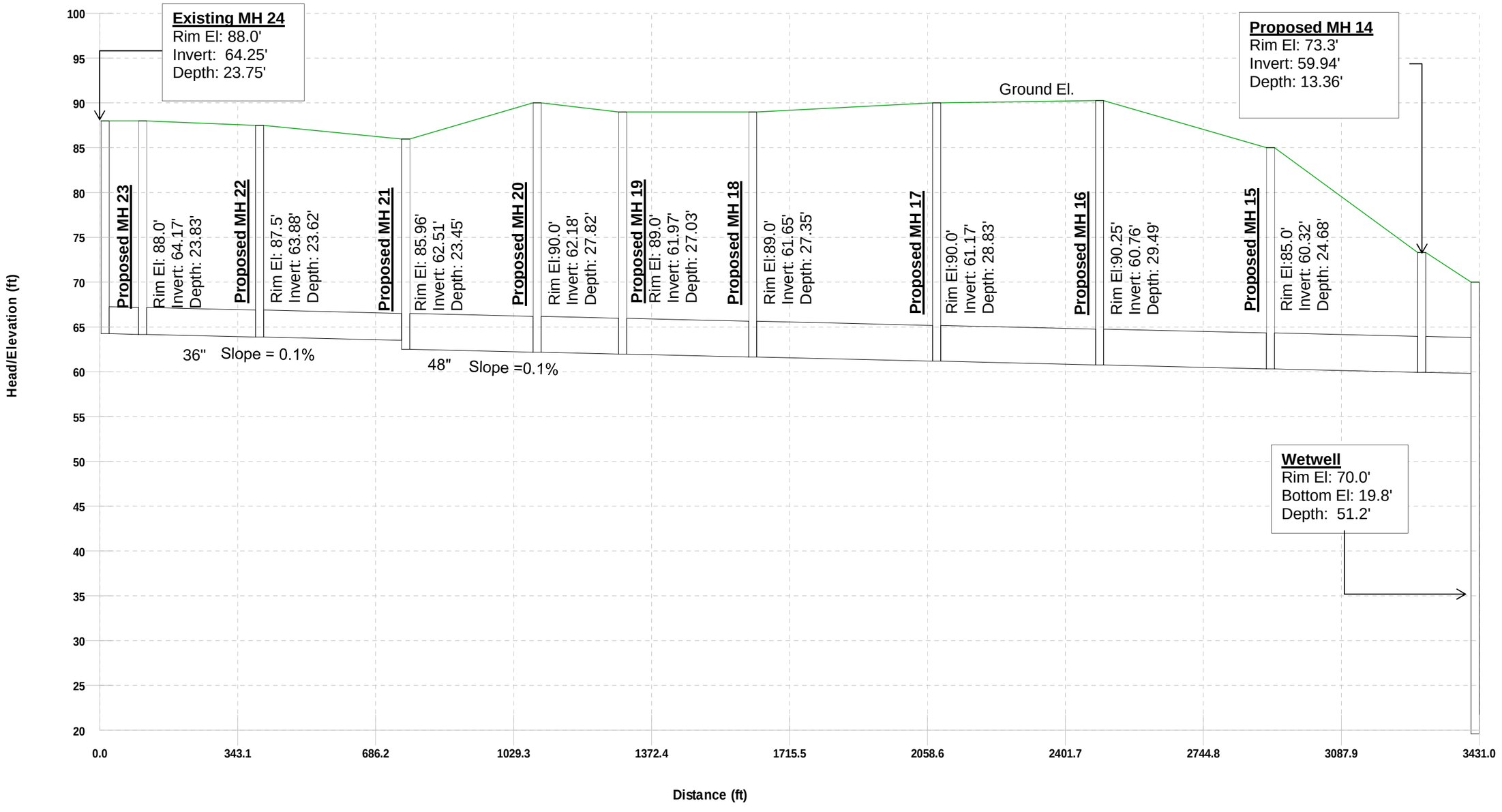

CENTER ST
ROSEDALE AVE
ROSEMONT AVE
SUNSET BLV
FRESNO AVE
MADERA AVE
MERCED AVE
HWY 99 (OFF RAMP) S
MH T-8
48"
MH T-7
48"
MH T-6
48"
MH T-5
48"
MH T-4
48"
MH T-3
48"
MH T-2
48"
MH T-1
36"
24"
ROSELAWN AVE
COLORADO AVE
WESTERN WY
FAIRWAY DR
NEECE DR
CLIFF DR
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Tuolumne 48"
River Trunk, Beard Brook, CSL Project
City of Modesto

B St / 10th St

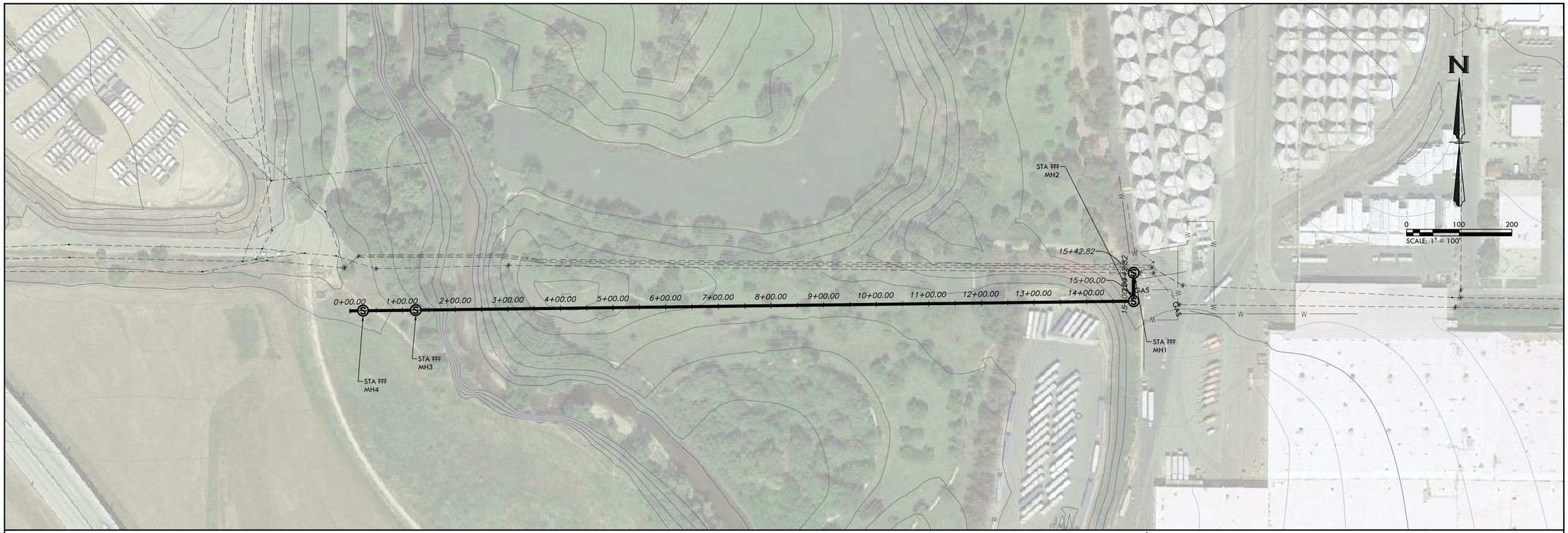

MH 17
48"
MH 18
MH 16
48"
MH 15
48"
MH 14
24"
PS
36"
48"
MH 19
MH 21
48"
MH 22
36"
MH 23
36"
MH 24
MH T-1
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

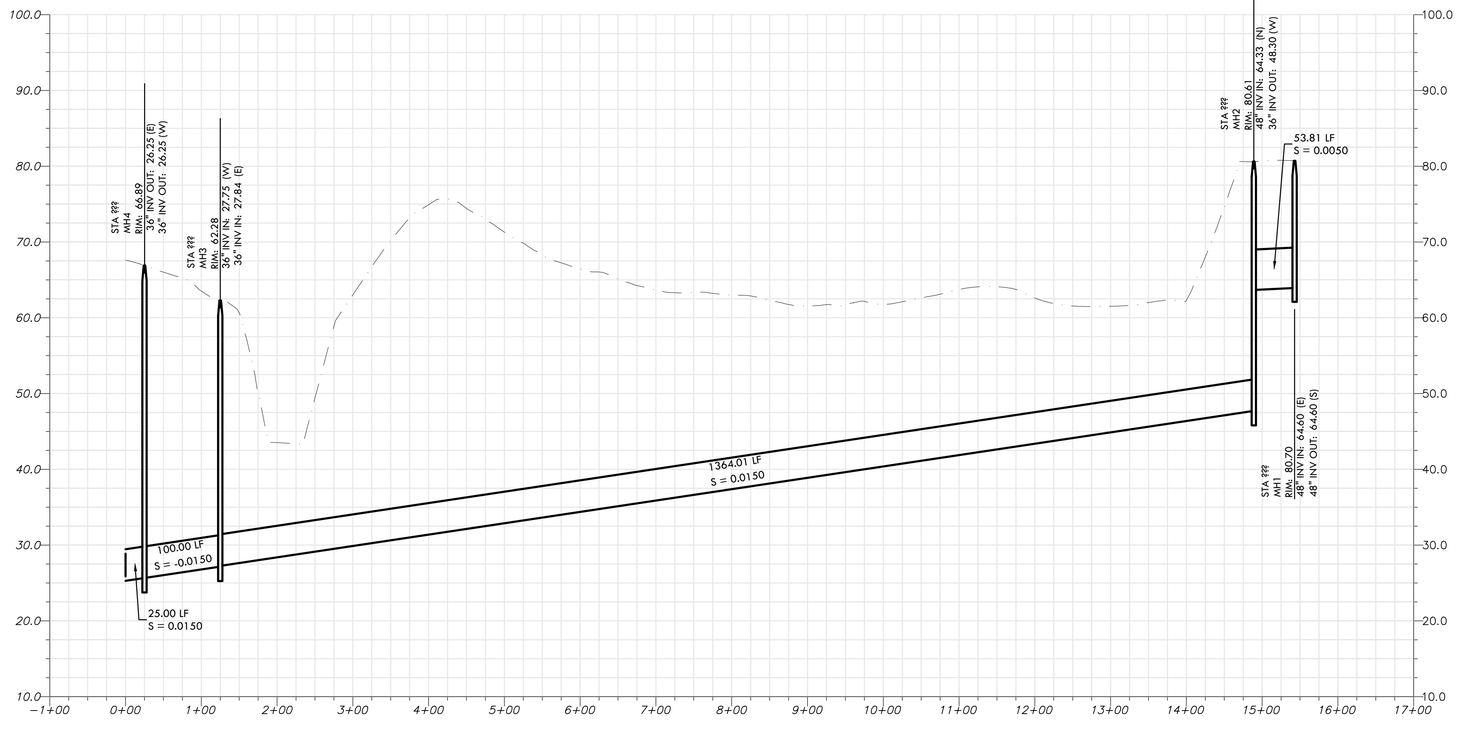


B St./ 10th St
River Trunk, Beard Brook, CSL Project
City of Modesto

carollo

MODESTO
CALIFORNIA





PROFILE SCALE
1" = 100'HORIZONTAL
1" = 10' VERTICAL

PRELIMINARY

CALL BEFORE YOU DIG USA 800-227-2600

BLACKWATER
CONSULTING ENGINEERS, INC.
605 STANDIFORD AVE., SUITE N, MODESTO, CA 95350 PH. 209.322.1817

REV	DATE	DESCRIPTION	APP

PROPOSED BEARD CROSSING_GRAVITY
STA 1+00.00 TO STA 16+26.33

DESIGNED BY	AKF
DRAWN BY	MRS
CHECKED BY	JKB
JOB NO.	J14050
DATE	7/22/2014
DRAWING	X-XX
SHEET NO.	1 OF 5

\\SERVER\PROJECTS\J14050 RIVER TRUNK PKWY\CAD\PLANSET\WIP\1 PROPOSED BEARD CROSSING_GRAVITY STA 1+00.00 TO STA 16+26.33.DWG PLOT: 8/4/2014 4:05:21 PM BY MARK SCHAEFER

APPENDIX F – SELECTED ALTERNATIVE COST ESTIMATE

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PROJECT SUMMARY

Project:	**River Trunk, Beard Brook, CSL Project**	**Estimate Class:**	**4**
Client:	**City of Modesto**	**PIC:**	**MJB**
Location:	**(Modesto, CA)**	**PM:**	**TFT**
Zip Code:	**95351**	**Date:**	**24-Aug-14**
Carollo Job #	**9551A00**	**By:**	**RAH**
		Reviewed:	**TFT**
		Indirect Cost Multiplier:	**1.554800**

ALTERNATIVE 9A

NO.	DESCRIPTION	LENGTH (FT)	COST / LF	TOTAL
1	24" Rehabilitation along Sutter Ave	4140	$342	$1,414,000
2	21" Gravity Sewer along Tuolumne Blvd	1330	$599	$797,000
3	48" Gravity Sewer along Tuolumne Blvd	2310	$1,203	$2,779,000
4	54" Gravity Sewer along Colorado Ave	3860	$1,323	$5,106,000
5	60" Gravity Sewer: Colorado Ave to Sutter Treatment Facility	3820	$1,604	$6,128,000
6	Shackleford 14" Forcemain and 18" Gravity Sewer	3060	$473	$1,446,000
7	Dual 24" and 36" Forcemains along Floodplain and Tuolumne Blvd	4100	$1,401	$5,746,000
8	36" and 48" Gravity Sewer: B St to Pumping Station	3400	$1,416	$4,816,000
9	River Trunk Pumping Station (53 mgd)			$24,721,000
10	Option 9 - Beard Brook North Gravity Alignment			$5,991,000
11	CSL Diversion Structures			$466,000
12	48" River Trunk Rehabilitation	9000	$855	$7,696,000
13	River Bank Armorment			$3,887,000
14	Shackleford (4.2 mgd) Pumping Station			$1,633,000
	TOTAL ESTIMATED CONSTRUCTION COST			**$72,626,000**
5A	Alternative 60" Gravity Sewer: Colorado to Treatment Facility	3190	$1,650	$5,263,000

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

APPENDIX G – PERMIT REQUIREMENT

Project: River Trunk Permitting
Project No.: 27750
Last Update: 7/25/2014
Lead Agency: City of Modesto
Option 4.02

Segment ID	Key #	Agency	Address	Contact Person	Act/Requirement	Permit Name	Requirement Verified w/ Contact Person	Application Status	Notes
A, D, E	1	Stanislaus County Department of Public Works, Development Services Division; Soft Deadline=TBD	1010 10th Street, Suite 4204, Modesto, CA 95354	(209) 525-4130	N/A	Encroachment/Construction Permit	required, per public works website		saved application form
	2	California State Lands Commission, Land Management Division; Soft Deadline=TBD	100 Howe Avenue, Suite 100-South, Sacramento, CA 95825-8202	Marlene Schroeder, Marlene.Schroeder@slc.ca.gov, (916) 574-2320; Ninette Lee, leen@slc.ca.gov, (916) 574-1869	N/A	New application for General Lease- Public Agency Use, PRC 8514.9	not requried, per CSLC letter dated 07/24/2014		06/18/2014 Call and email to Ninette for confirmation of jurisdiction. She doesn't think SLC has jurisdiction over Dry Creek, but she is checking and will get back to us in next couple of weeks. 6/19/2014 MV replied to Marlene question's necessary to start Title Unit Title Seach for jurisidiction. 07/15/2014 MV emailed Marlene for status of Dry Creek determination. 07/24/2014 Marlene emailed letter confirming CSLC does not have jurisdiction over the Modesto Dry Creek.
B	3	Union Pacific Railroad	9451 Atkinson Street, Roseville, CA 95747	Peggy Ygbuhay, (916) 789-5152; Nicholas Andersen (402) 544-8801		Nonintrusive Civil Engineering Survey Permit, Pipeline Crossings Agreement, Railroad Protective Liability Insurance	required, per UPRR website and Nicholas Andersen		06/18/2014 Call and email (via uprr website not outlook) to Peggy for confirmation of required permit/agreements. 06/19/2014 Call and email (via uprr website not outlook) to Nicholas for confirmation of required permit/agreements. 06/19/2014 got contact info from Nicholas, emailed him preliminary layout and asked for permit requirements. 07/15/2014 MV emailed follow up reminder to Nicholas. 07/16/2014 Nicholas email confirmed required online application for a pipeline crossing per website, and pipeline design per AREMA Standards (available for purchase online).
C	4	Caltrans District 10	1976 East Charter Way/MLK Jr Blvd, Stockton, CA 95205	Ruhollah Afzal rohullah.afzal@dot.ca.gov (209) 576-6299; Pete Simon (stockton) (209) 948-7891	N/A	Encroachment Permit	required, per caltrans website		saved application form
A	5	U.S. Army Corps of Engineers, Sacramento District, Regulatory Division; Soft Deadline=TBD	650 Capitol Mall, Suite 5-200,Sacramento, California 95814-4708	Zach Simmons, Zachary.M.Simmons@usace.army.mil, (916) 557-6746, Additional Contact Person: Paul Maniccia	Section 404 of the Clean Water Act	Nation Wide Permit #12 (NWP 12)	Only required if dredge or fill material discharged, per Zach Simmons		06/18/2014 Call and email to Zach for confirmation of jurisdiction. 06/23/2014 Zach email explains Tuolumne is jurisdictional under Sec 10 & 404, and Dry Creek is jurisdictional under Sec 404 only. A Sec 404 water only requires permit for the placement of fill material, HDD under Dry Creek would not require a permit.
A	6	California Department of Fish and Wildlife, Region 4-Central Region; Soft Deadline=TBD	1234 E. Shaw Avenue Fresno, CA 93710	Sarah Paulson, (559) 243-4014 spaulson@dfg.ca.gov	Fish and Game Code Section 1602	Lake or Streambed Alteration Agreement	required, per Sarah email 06/18/2014		06/18/2014 Call and email to Sarah for confirmation of jurisdiction. 06/18/2014 Sarah email confirmed Lake or Streambed Alteration Agreement required (same as Shackelford)
A, F	7	Central Valley Flood Protection Board (formerly the Reclamation Board); Soft Deadline=TBD	3310 El Camino Avenue Room 151 Sacramento, CA 95821	Sam Brandon, (916) 574-2380 sam.brandon@water.ca.gov main office, (916) 574-0675	Water Code 8710, California Code of Regulations Title 23 Waters Div. 1	Encroachment Permit	required, per Title 23 table 8.1		06/18/2014 call to Sam Brandon for direction.
ALL Segments	8	San Joaquin Valley Air Pollution Control District; Soft Deadline=TBD	4800 Enterprise Way, Modesto, CA 95356	Adam Mumford, Adam.Mumford@valleyair.org, (209) 404-5584	Rule 8021	Regulation VIII Fugutive PM10 Prohibitions Construction Notification Form	required, per Adam Mumford		06/18/2014 email to Adam Mumford, received reply confirmation 06/19/2014
	9	Central Valley Regional Water Quality Control Board; Soft Deadline=TBD	11020 Sun Center Drive # 200 Rancho Cordova, California 95670-6114	Elizabeth Lee, emlee@waterboards.ca.gov, (916) 464-4787	Section 401 of Clean Water Act	Section 401 Certification	depends on whether 404 permit is required		withdrawal of 401 WQC application if Army Corps of Engineerings determines 404 permit is not required. A 404 permit would only be required if placement of fill material in Dry Creek or Tuolumne River.

	10	U.S. Environmental Protection Agency, Region IX; Soft Deadline=TBD	75 Hawthorne Street San Francisco, California 94105-3901	Jared Blumenfeld blumenfeld.jared@epa.gov (415) 947-8702 Doug Eberhardt eberhardt.doug@epa.gov (415) 972-3420	Endangered Species Act, Section 7	Consultation	depends on funding, question for City		6/18/2014 call to Doug Eberhardt. EPA is only envolved if project if Federal Earmarked/congress funding or State Revolving Funding
	11	NOAA, National Marine Fisheries Service; Soft Deadline=TBD	650 Capitol Mall, Suite 8-300 Sacramento, California 95814 4706	Monica Gutierrez monica.gutierrez@noaa.gov; Rhonda Reed, Supervisor for Modesto Area Permits, (916) 930-3609 Mike Tucker (916) 799-2359	Endangered Species Act, Section 7	Consultation	Army Corps to Initiate Consultation		Army Corps will initiate this permit. 06/19/2014 Email to Maria to confirm process. 06/23/2014 Monica email confirmed Army initiates consultation.
	12	U.S. Fish and Wildlife Service, Region 8-Pacific Southwest Region, San Joaquin Valley Division; Soft Deadline=TBD	2800 Cottage Way, Room W2605 Sacramento, California 95825 1846	Josh Emery, joshua_emery@fws.gov (916) 414-6692	Endangered Species Act, Section 7	Consultation	Army Corps to Initiate Consultation		Army Corps will initiate Consultation. 06/19/2014 Email to Josh to confirm process
	13	California Coastal Commission; Soft Deadline=TBD		Larry Simon lsimon@coastal.ca.gov P (415) 904-5288 F (415) 904-5400	Coastal Zone Management Act	Consistency Certification	not requried		06/18/2014 email to Larry to confirm CZMA review is not required. 06/19/2014 Larry email confirmed Consistency Certification not required.

Project: River Trunk Permitting
Project No.: 27750
Last Update: 7/25/2014
Lead Agency: City of Modesto
Option 7

Segment ID	Key #	Agency	Address	Contact Person	Act/Requirement	Permit Name	Requirement Verified w/ Contact Person	Application Status	Notes
A, E, F	1	Stanislaus County Department of Public Works, Development Services Division; Soft Deadline=TBD	1010 10th Street, Suite 4204, Modesto, CA 95354	(209) 525-4130	N/A	Encroachment/Construction Permit	required, per public works website		saved application form
G	2	California State Lands Commission, Land Management Division; Soft Deadline=TBD	100 Howe Avenue, Suite 100-South, Sacramento, CA 95825-8202	Marlene Schroeder, Marlene.Schroeder@slc.ca.gov, (916) 574-2320; Ninette Lee, leen@slc.ca.gov, (916) 574-1869	N/A	New application for General Lease- Public Agency Use, PRC 8514.9	required, per Ninette Lee		06/18/2014 Call and email to Ninette for confirmation of jurisdiction. She doesn't think SLC has jurisdiction over Dry Creek, but she is checking and will get back to us in next couple of weeks. 6/19/2014 MV replied to Marlene question's necessary to start Title Unit Title Seach for jurisidiction. 07/15/2014 MV emailed Marlene for status of Dry Creek determination. 07/24/2014 Marlene emailed letter confirming CSLC does not have jurisdiction over Modesto Dry Creek. CSLC does have jurisdiction over Tuolumne River (same as Shackelford)
B	3	Union Pacific Railroad	9451 Atkinson Street, Roseville, CA 95747	Peggy Ygbuhay, (916) 789-5152; Nicholas Andersen (402) 544-8801		Preliminary Engineering Agreement, License, Right of Entry, Construction and Maintenance Agreements	required, per UPRR website		06/18/2014 Call and email (via uprr website not outlook) to Peggy for confirmation of required permit/agreements. 06/19/2014 Call and email (via uprr website not outlook) to Nicholas for confirmation of required permit/agreements. 06/19/2014 got contact info from Nicholas, emailed him preliminary layout and asked for permit requirements. 07/15/2014 MV emailed follow up reminder to Nicholas. 07/16/2014 Nicholas email confirmed required online application for a pipeline crossing per website, and pipeline design per AREMA Standards (available for purchase online).
C, D	4	Caltrans District 10	1976 East Charter Way/MLK Jr Blvd, Stockton, CA 95205	Ruhollah Afzal rohullah.afzal@dot.ca.gov (209) 576-6299; Pete Simon (stockton) (209) 948-7891	N/A	Encroachment Permit	required, per caltrans website		saved application form
A, G	5	U.S. Army Corps of Engineers, Sacramento District, Regulatory Division; Soft Deadline=TBD	650 Capitol Mall, Suite 5-200,Sacramento, California 95814-4708	Zach Simmons, Zachary.M.Simmons@usace.army.mil, (916) 557-6746, Additional Contact Person: Paul Maniccia	Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act of 1899	Nation Wide Permit #12 (NWP 12)	required at minimum under Section 10, per Zach Simmons		06/18/2014 Call and email to Zach for confirmation of jurisdiction. 06/23/2014 Zach email explains Tuolumne is jurisdictional under Sec 10 & 404, and Dry Creek is jurisdictional under Sec 404 only. A Sec 404 water only requires permit for the placement of fill material, HDD under Dry Creek would not require a permit.
A, G	6	California Department of Fish and Wildlife, Region 4-Central Region; Soft Deadline=TBD	1234 E. Shaw Avenue Fresno, CA 93710	Sarah Paulson, (559) 243-4014 spaulson@dfg.ca.gov	Fish and Game Code Section 1602	Lake or Streambed Alteration Agreement	required, per Sarah Paulson		06/18/2014 Call and email to Sarah for confirmation of jurisdiction. 06/18/2014 Sarah email confirmed Lake or Streambed Alteration Agreement required (same as Shackelford)
A, D, G, H,	7	Central Valley Flood Protection Board (formerly the Reclamation Board); Soft Deadline=TBD	3310 El Camino Avenue Room 151 Sacramento, CA 95821	Sam Brandon, (916) 574-2380 sam.brandon@water.ca.gov main office, (916) 574-0675	Water Code 8710, California Code of Regulations Title 23 Waters Div. 1	Encroachment Permit	required, per Title 23 table 8.1		06/18/2014 call to Sam Brandon for direction.
ALL Segments	8	San Joaquin Valley Air Pollution Control District; Soft Deadline=TBD	4800 Enterprise Way, Modesto, CA 95356	Adam Mumford, Adam.Mumford@valleyair.org, (209) 404-5584	Rule 8021	Regulation VIII Fugutive PM10 Prohibitions Construction Notification Form	required, per Adam Mumford		06/18/2014 email to Adam Mumford, received reply confirmation 06/19/2014
	9	Central Valley Regional Water Quality Control Board; Soft Deadline=TBD	11020 Sun Center Drive # 200 Rancho Cordova, California 95670-6114	Elizabeth Lee, emlee@waterboards.ca.gov, (916) 464-4787	Section 401 of Clean Water Act	Section 401 Certification	depends on whether 404 permit is required		withdrawal of 401 WQC application if Army Corps of Engineerings determines 404 permit is not required. A 404 permit would only be required if placement of fill material in Dry Creek or Tuolumne River.

	10	U.S. Environmental Protection Agency, Region IX; Soft Deadline=TBD	75 Hawthorne Street San Francisco, California 94105-3901	Jared Blumenfeld blumenfeld.jared@epa.gov (415) 947-8702 Doug Eberhardt eberhardt.doug@epa.gov (415) 972-3420	Endangered Species Act, Section 7	Consultation	depends on funding, question for City		6/18/2014 call to Doug Eberhardt. EPA is only envolved if project if Federal Earmarked/congress funding or State Revolving Funding
	11	NOAA, National Marine Fisheries Service; Soft Deadline=TBD	650 Capitol Mall, Suite 8-300 Sacramento, California 95814-4706	Monica Gutierrez monica.gutierrez@noaa.gov; Rhonda Reed, Supervisor for Modesto Area Permits, (916) 930-3609 Mike Tucker (916) 799-2359	Endangered Species Act, Section 7	Consultation	Army Corps to Initiate Consultation, per Monica Gutierrez		Army Corps will initiate this permit. 06/19/2014 Email to Maria to confirm process. 06/23/2014 Monica email confirmed Army initiates consultation.
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Project: River Trunk Permitting
Project No.: 27750
Last Update: 07/25/2014
Lead Agency: City of Modesto
Option 9

Segment ID	Key #	Agency	Address	Contact Person	Act/Requirement	Permit Name	Requirement Verified w/ Contact Person	Application Status	Notes
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ALL Segments	8	San Joaquin Valley Air Pollution Control District; Soft Deadline=TBD	4800 Enterprise Way, Modesto, CA 95356	Adam Mumford, Adam.Mumford@valleyair.org, (209) 404-5584	Rule 8021	Regulation VIII Fugutive PM10 Prohibitions Construction Notification Form	required, per Adam Mumford		06/18/2014 email to Adam Mumford, received reply confirmation 06/19/2014
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	12	U.S. Fish and Wildlife Service, Region 8-Pacific Southwest Region, San Joaquin Valley Division; Soft Deadline=TBD	2800 Cottage Way, Room W2605 Sacramento, California 95825-1846	Josh Emery, joshua_emery@fws.gov (916) 414-6692	Endangered Species Act, Section 7	Consultation	Army Corps to Initiate Consultation		Army Corps will initiate Consultation. 06/19/2014 Email to Josh to confirm process
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Legend

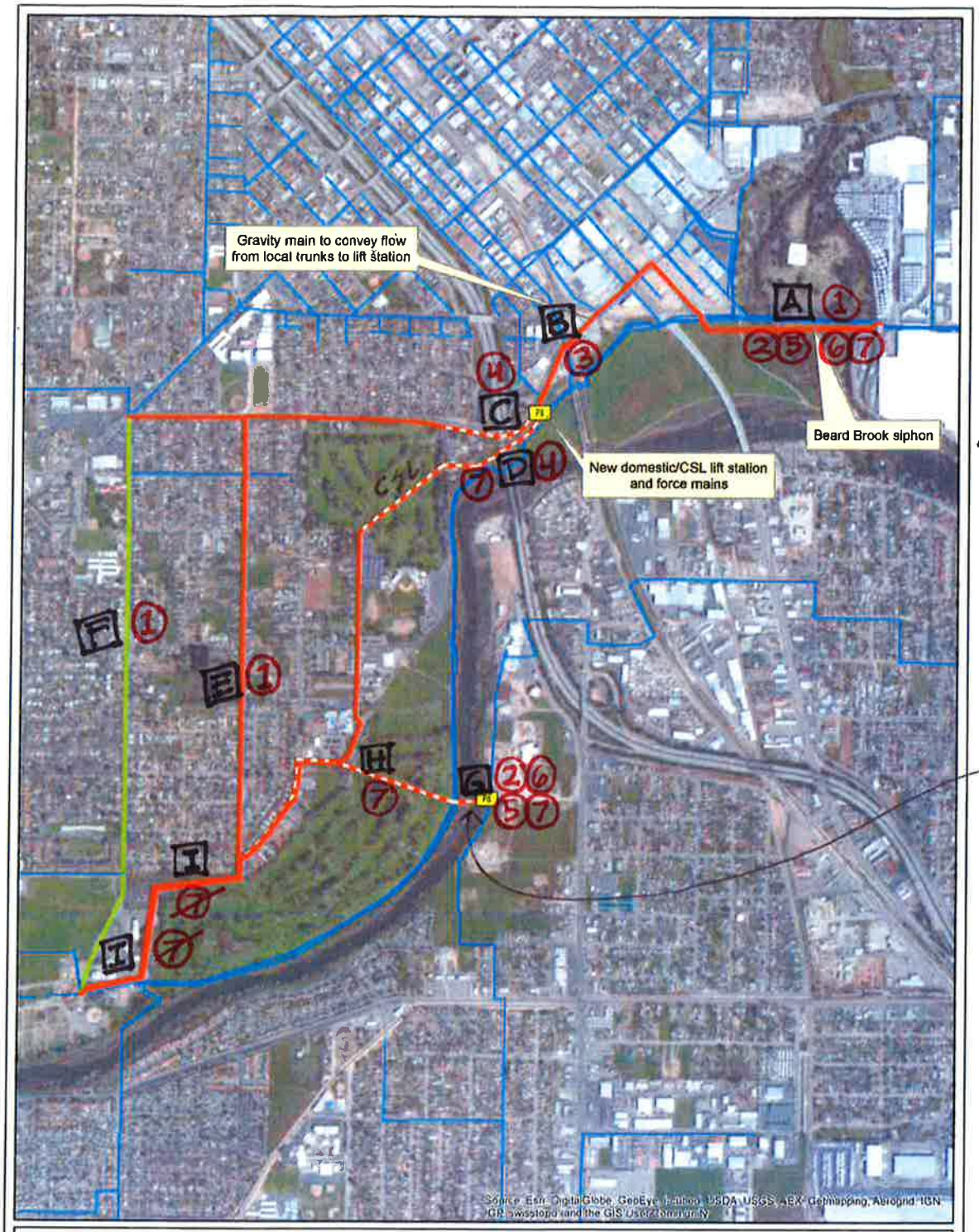
- Proposed Lift Station
- Junction Structure
- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitaton
- Existing Sewers

C SEGMENT I.D.

4 PERMIT KEY #

Option 4.02
River Trunk, Beard Brook, CSL Project
City of Modesto

0 1,000 2,000 Feet



Legend

- Proposed Lift Station
- Junction Structure
- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitaton
- Existing Sewers

[C] SEGMENT I.D.

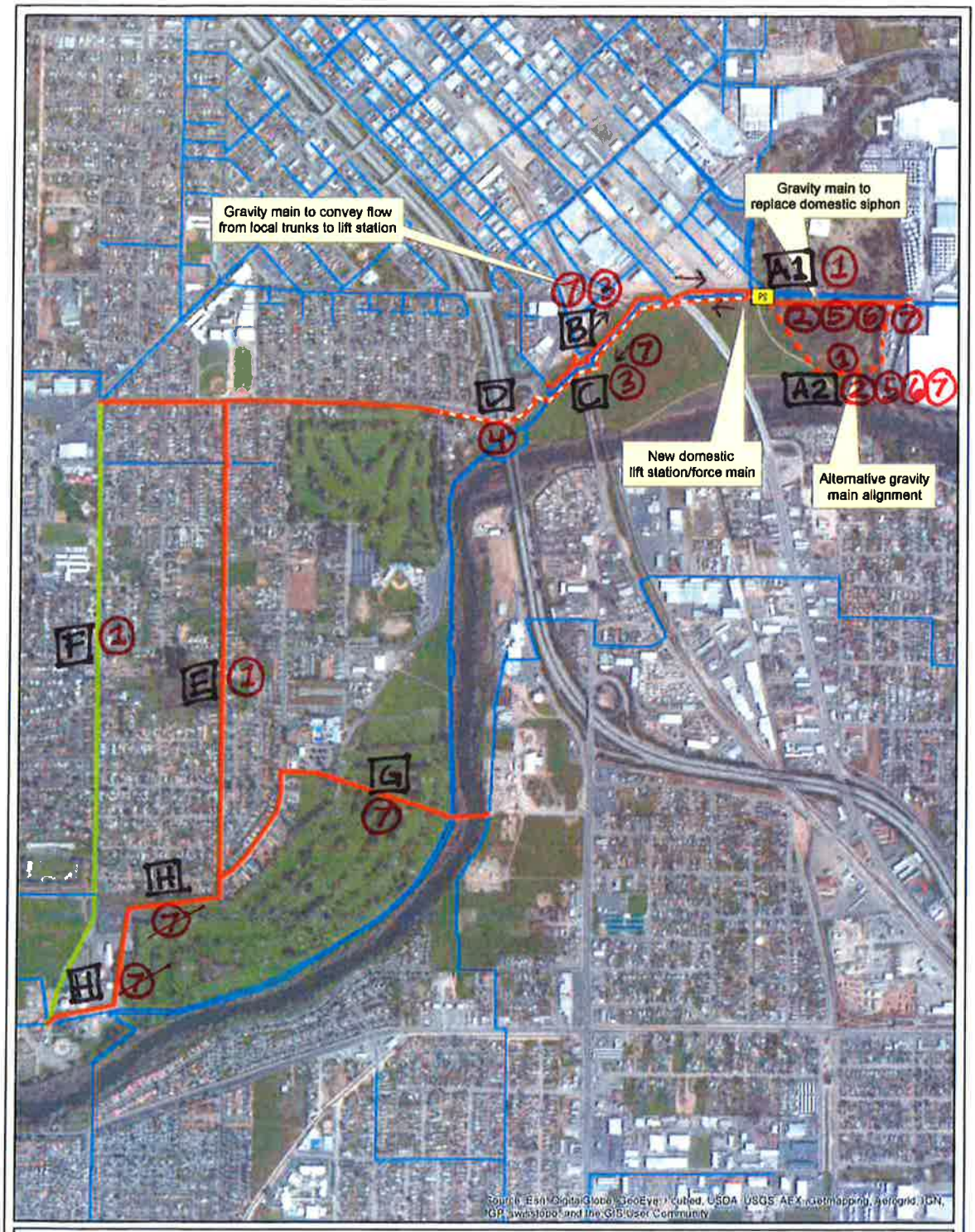
(4) PERMIT KEY #

Option 7
River Trunk, Beard Brook, CSL Project
City of Modesto

0 1,000 2,000 Feet

MODESTO

Carollo



Legend

- Proposed Pump Station
- Junction Structure
- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitaton
- Existing Sewers

[C] SEGMENT I.D.

(4) PERMIT KEY #

Option 9
River Trunk, Beard Brook, CSL Project
City of Modesto

0 1,000 2,000 Feet

MODESTO

Carollo



Legend

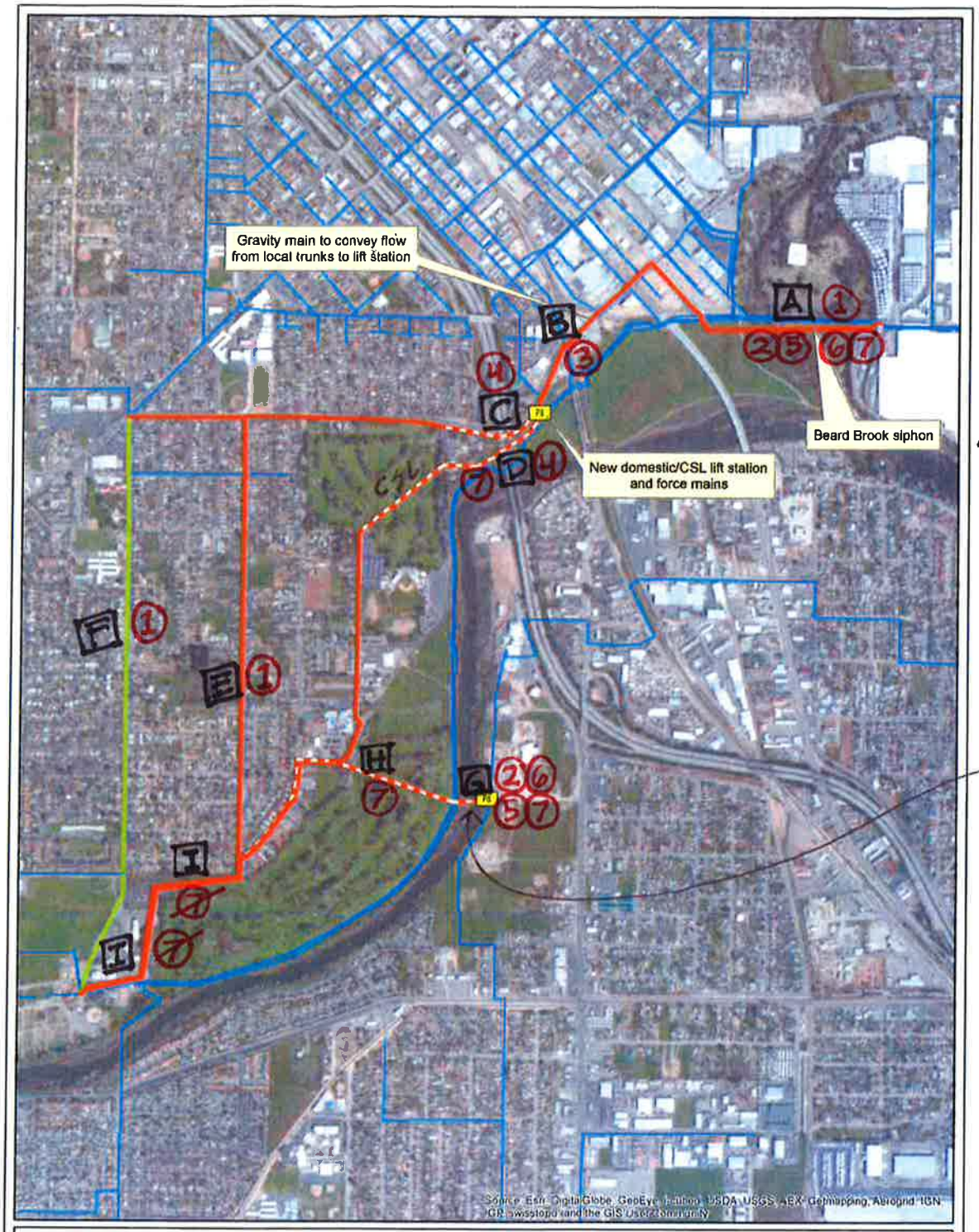
- Proposed Lift Station
- Junction Structure
- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitaton
- Existing Sewers

C SEGMENT I.D.

4 PERMIT KEY #

Option 4.02
River Trunk, Beard Brook, CSL Project
City of Modesto

0 1,000 2,000 Feet



Legend

- Proposed Lift Station
- Junction Structure
- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitaton
- Existing Sewers

[C] SEGMENT I.D.

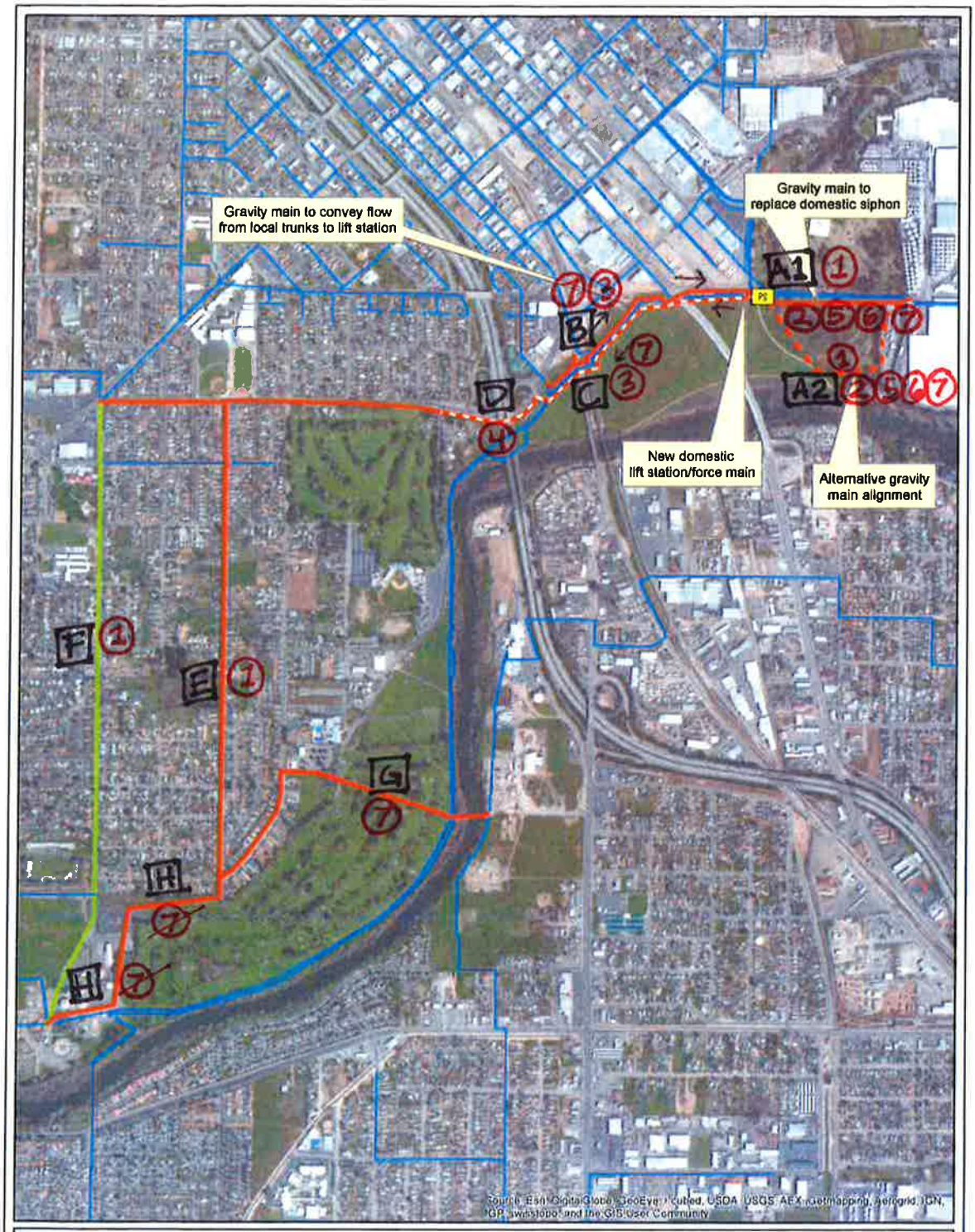
(4) PERMIT KEY #

Option 7
River Trunk, Beard Brook, CSL Project
City of Modesto

0 1,000 2,000 Feet

MODESTO

Carollo



Legend

- Proposed Pump Station
- Junction Structure
- Proposed Gravity Sewer
- Proposed Force Main
- Proposed Rehabilitaton
- Existing Sewers

[C] SEGMENT I.D.

(4) PERMIT KEY #

Option 9
River Trunk, Beard Brook, CSL Project
City of Modesto

0 1,000 2,000 Feet

MODESTO

Carollo

CALIFORNIA STATE LANDS COMMISSION
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

JENNIFER LUCCHESI, *Executive Officer*
(916) 574-1800 *Fax* (916) 574-1810
California Relay Service TDD Phone 1-800-735-2929
from Voice Phone 1-800-735-2922

Contact Phone: **(916) 574-2320**
Contact Fax: **(916) 574-1925**

Established in 1938

July 24, 2014

File Ref: SD 2014-06-25.3

O'dell Engineering
Attn: Matt Vinson, Project Manager
1165 Scenic Drive, Ste. B
Modesto, CA 95350

Subject: **Proposed Sewer Project, crossing the Modesto Dry Creek, city of Modesto, Stanislaus County**

Dear Mr. Vinson:

This letter is in response to your request for a determination by the California State Lands Commission (CSLC) whether it asserts a sovereign title interest in the property that the above referenced proposed project will occupy.

The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways. The CSLC also has certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (PRC §6301 and §6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust.

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On tidal waterways, the State's sovereign fee ownership extends landward to the mean high tide line, except for areas of fill or artificial accretion or where the boundary has been fixed by agreement or a court. On navigable non-tidal waterways, including lakes, the State holds fee ownership of the bed of the waterway landward to the ordinary low water mark and a Public Trust easement landward to the ordinary high water mark, except where the boundary has been fixed by agreement or a court. Such boundaries may not be readily apparent from present day site inspections.

Based upon the information provided and a preliminary review of our records, we have determined that the proposed project will not be located on State sovereign land under the jurisdiction of the CSLC. We understand the city of Modesto is proposing a sewer project crossing the Modesto Dry Creek, just north of where the creek discharges to the Tuolumne River. Both the bed of the creek and the uplands at this location are within lands the State did not acquire or patent and are Federal Lands patented by the United States. Therefore, a lease from the CSLC is not required for the project.

Please also be advised that the Modesto Dry Creek, adjacent to the subject location, may be subject to a public navigational easement. This easement provides that members of the public have the right to navigate and exercise the incidences of navigation in a lawful manner on State waters that are capable of being physically navigated by oar or motor-propelled small craft. Such uses may include, but not be limited to, boating, rafting, sailing, rowing, fishing, fowling, bathing, skiing, and other water-related public uses. The proposed project must not restrict or impede the easement right of the public.

This determination is without prejudice to any future assertion of State ownership or public rights, should circumstances change, or should additional information come to our attention. This letter is not intended, nor should it be construed as, a waiver or limitation of any right, title, or interest of the State of California in any lands under its jurisdiction.

If you have any questions, please contact Marlene Schroeder, Public Land Management Specialist at (916) 574-2320 or by email at Marlene.Schroeder@slc.ca.gov.

Sincerely,

Ninette Lee
Public Land Manager I

cc: Marlene Schroeder

Tim Loper

To: Matt Vinson
Cc: Tim Taylor; Randy O'Dell
Subject: RE: River Trunk Schedule

From: Matt Vinson [mailto:MVinson@odellengineering.com]
Sent: Friday, July 25, 2014 12:23 PM
To: Tim Loper
Cc: Tim Taylor; Randy O'Dell
Subject: RE: River Trunk Schedule

Tim,

River Trunk Permitting correspondence updates:

- Nick with Union Pacific Railroad confirmed pipe crossing application procedures online per uprr website. The procedures indicate that an application for surveying within railroad right of way needs to be emailed (single page application form), online pipeline crossing application submitted through UPRR website, pipeline design needs to be per AREMA Standards (available for purchase online), and Railroad Protective Liability Insurance needs to be provided (either through uprr or another provider).

- Marlene with California State Lands Commission emailed a letter stating they do not have jurisdiction over the Modesto Dry Creek. Those related permits would not be required for options 4.02 and 9 (which only cross Dry Creek and do not cross the Tuolumne River).

See the attached updated permit list. Let me know if you have any questions.

Thank you,

O'DELL ENGINEERING
Reliable | Insightful | Attentive

Matt Vinson
Project Manager, SWPPP Director
P:(209) 571-1765 ext. 108 | F:(209) 571-2466 | C:(209) 918-9212
E: mvinson@odellengineering.com | W: http://www.odellengineering.com

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From: Matt Vinson [mailto:MVinson@odellengineering.com]
Sent: Tuesday, July 08, 2014 11:31 AM
To: Tim Loper
Cc: Tim Taylor; Randy O'Dell
Subject: RE: River Trunk Schedule

UPRR: I have confirmation that the project will require an application for a utility crossing agreement, and a right of entry will be issued for the project upon approval. I am still waiting for Nicholas to confirm if any other procedures, applications, or permits with the UPRR could be applicable to this project.

Central Valley Flood Protection Board: I have confirmation of permit requirements via Title 23 and FEMA Map showing floodway zones (see attached FEMA maps). Mr. Sam Brandon directed me to the title requirements. The only unclear issue is whether the exact placement of segements D in option 7, B in option 9, and C in option 9 will be placed in the floodway. those segments on the exhibit are close the border of the floodway.

Regards,

Matt Vinson
Project Manager, SWPPP Director
P:(209) 571-1765 ext. 108 | F:(209) 571-2466 | C:(209) 918-9212
E: mvinson@odellengineering.com | W: http://www.odellengineering.com

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From: Matt Vinson [mailto:MVinson@odellengineering.com]
Sent: Wednesday, July 02, 2014 9:56 AM
To: Tim Loper
Cc: Tim Taylor; Randy O'Dell
Subject: RE: River Trunk Schedule

Hi Tim Loper,

That will be fine, I'll await your call. For your consideration, I've attached our Permitting List and rough Exhibit to help identify pipe segments with permit requirements. In the permit list we've listed all the possible agencies and permits for the project, then confirmed with the agencies whether the permit is required or not.
Current Status Summary:

- I have reached out to all relevant jurisdictions. Most of the permits have been confirmed with Agency contacts, clear statements on website, or in permit documents.
- We are waiting to hear back from the State Lands Commission to confirm whether they have jurisdiction over Dry Creek.
- Section 404 of the Clean Water Act permit requirement depends on type of construction (i.e. HDD vs Trenching).
- Section 401 water quality certification requirement depends on whether project is subject to Section 404 permit.
- EPA involvement depends on project funding (Federal Earmarked, Congress Funding, or State Revolving Funding)

Talk to you soon.

Randall O'Dell
PE, Civil Engineer, QSD, QSP
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APPENDIX E - PERMIT & EASEMENT MATRIX AND FIGURE

Project: River Trunk Permitting
Project No.: 27750
Last Update: 02/24/2015
Lead Agency: City of Modesto
Option 9 Revised

Key #	Agency	Address	Contact Person	Act/Requirement	Permit Name / Easement	Requirement Verified w/ Contact Person	Application Status	Notes
1	Stanislaus County Department of Public Works, Development Services Division; Soft Deadline=TBD	1010 10th Street, Suite 4204, Modesto, CA 95354	(209) 525-4130	N/A	Encroachment/Construction Permit	required, per public works website		County ROW
2	California State Lands Commission, Land Management Division; Soft Deadline=TBD	100 Howe Avenue, Suite 100-South, Sacramento, CA 95825-8202	Marlene Schroeder, Marlene.Schroeder@slc.ca.gov, (916) 574-2320; Ninette Lee, leen@slc.ca.gov, (916) 574-1869	N/A	Submit for approval of improvements under General Lease- Public Agency Use, PRC 8514.9	requried for work under Tuolumne River, per Ninette Lee		07/24/2014 Marlene emailed letter confirming CSLC does not have jurisdiction over the Modesto Dry Creek. The forcemain crossing the Tuolumne River will need to be approved by SLC under General Lease-Public Agency Use, PRC 8514.9. The existing lease agreement terminates 08/22/2038
3	Union Pacific Railroad	9451 Atkinson Street, Roseville, CA 95747	Peggy Ygbuhay, (916) 789-5152; Nicholas Andersen (402) 544-8801		Preliminary Engineering Agreement, License, Right of Entry, Construction and Maintenance Agreements	required, per UPRR website		06/18/2014 Call and email (via uprr website not outlook) to Peggy for confirmation of required permit/agreements. 06/19/2014 Call and email (via uprr website not outlook) to Nicholas for confirmation of required permit/agreements. 06/19/2014 got contact info from Nicholas, emailed him preliminary layout and asked for permit requirements. 07/15/2014 MV emailed follow up reminder to Nicholas. 07/16/2014 Nicholas email confirmed required online application for a pipeline crossing per website, and pipeline design per AREMA Standards (available for purchase online).
4	Caltrans District 10	1976 East Charter Way/MLK Jr Blvd, Stockton, CA 95205	Ruhollah Afzal rohullah.afzal@dot.ca.gov (209) 576-6299; Pete Simon (stockton) (209) 948-7891	N/A	Encroachment Permit	required, per caltrans website		
5	U.S. Army Corps of Engineers, Sacramento District, Regulatory Division; Soft Deadline=TBD	650 Capitol Mall, Suite 5-200,Sacramento, California 95814-4708	Zach Simmons, Zachary.M.Simmons@usace.army.mil, (916) 557-6746, Additional Contact Person: Paul Maniccia	Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act of 1899	Nation Wide Permit #12 (NWP 12)	required at minimum under Section 10, per Zach Simmons		06/18/2014 Call and email to Zach for confirmation of jurisdiction. 06/23/2014 Zach email explains Tuolumne is jurisdictional under Sec 10 & 404, and Dry Creek is jurisdictional under Sec 404 only. A Sec 404 water only requires permit for the placement of fill material, HDD under Dry Creek would not require a permit.
6	California Department of Fish and Wildlife, Region 4-Central Region; Soft Deadline=TBD	1234 E. Shaw Avenue Fresno, CA 93710	Sarah Paulson, (559) 243-4014 spaulson@dfg.ca.gov	Fish and Game Code Section 1602	Lake or Streambed Alteration Agreement	required, per Sarah Pualson		06/18/2014 Call and email to Sarah for confirmation of jurisdiction. 06/18/2014 Sarah email confirmed Lake or Streambed Alteration Agreement required (same as Shackelford)
7	Central Valley Flood Protection Board (formerly the Reclamation Board); Soft Deadline=TBD	3310 El Camino Avenue Room 151 Sacramento, CA 95821	Sam Brandon, (916) 574-2380 sam.brandon@water.ca.gov main office, (916) 574-0675	Water Code 8710, California Code of Regulations Title 23 Waters Div. 1	Encroachment Permit	required, per Title 23 table 8.1		06/18/2014 call to Sam Brandon for direction.
8	San Joaquin Valley Air Pollution Control District; Soft Deadline=TBD	4800 Enterprise Way, Modesto, CA 95356	Adam Mumford, Adam.Mumford@valleyair.org, (209) 404-5584	Rule 8021	Regulation VIII Fugutive PM10 Prohibitions Construction Notification Form	required, per Adam Mumford		06/18/2014 email to Adam Mumford, received reply confirmation 06/19/2014
9	Central Valley Regional Water Quality Control Board; Soft Deadline=TBD	11020 Sun Center Drive # 200 Rancho Cordova, California 95670-6114	Elizabeth Lee, emlee@waterboards.ca.gov, (916) 464-4787	Section 401 of Clean Water Act	Section 401 Certification	depends on whether 404 permit is required		withdrawal of 401 WQC application if Army Corps of Engineerings determines 404 permit is not required. A 404 permit would only be required if placement of fill material in Dry Creek or Tuolumne River.

Key #	Agency	Address	Contact Person	Act/Requirement	Permit Name / Easement	Requirement Verified w/ Contact Person	Application Status	Notes
10	U.S. Environmental Protection Agency, Region IX; Soft Deadline=TBD	75 Hawthorne Street San Francisco, California 94105-3901	Jared Blumenfeld blumenfeld.jared@epa.gov (415) 947-8702 Doug Eberhardt eberhardt.doug@epa.gov (415) 972-3420	Endangered Species Act, Section 7	Consultation	depends on funding, question for City		6/18/2014 call to Doug Eberhardt. EPA is only envolved if project if Federal Earmarked/congress funding or State Revolving Funding
11	NOAA, National Marine Fisheries Service; Soft Deadline=TBD	650 Capitol Mall, Suite 8-300 Sacramento, California 95814-4706	Maria Rea maria.rea@noaa.gov Monica Gutierrez monica.gutierrez@noaa.gov; Rhonda Reed, Supervisor for Modesto Area Permits, (916) 930-3609 Mike Tucker (916) 799-2359	Endangered Species Act, Section 7	Consultation	Army Corps to Initiate Consultation, per Monica Gutierrez		Army Corps will initiate this permit. 06/19/2014 Email to Maria to confirm process. 06/23/2014 Monica email confirmed Army Initiates consultation.
12	U.S. Fish and Wildlife Service, Region 8-Pacific Southwest Region, San Joaquin Valley Division; Soft Deadline=TBD	2800 Cottage Way, Room W2605 Sacramento, California 95825-1846	Josh Emery, joshua_emery@fws.gov (916) 414-6692	Endangered Species Act, Section 7	Consultation	Army Corps to Initiate Consultation		Army Corps will initiate Consultation. 06/19/2014 Email to Josh to confirm process
13	California Coastal Commission; Soft Deadline=TBD		Larry Simon lsimon@coastal.ca.gov P (415) 904-5288 F (415) 904-5400	Coastal Zone Management Act	Consistency Certification	not requried, per Larry Simon		06/18/2014 email to Larry to confirm CZMA review is not required. 06/19/2014 Larry email confirmed Consistency Certification not required.
14	City of Modesto	1010 10th Street, Modesto, CA 95354	P (209) 577-5200	n/a	Temporary Construction Easement			City owned parcels, not City ROW
15	E & J Gallo Winery	600 Yosemite Blvd, Modesto, CA 95354 PO Box 1130 Modesto, CA 95353	P 1-877-687-9463	n/a	Permanent Utility Easement & Temporary Construction Easement			Proposed sewer alignment passes through APNs 035016010 & 035016011
16	WH Breshears Inc.	720 B St., Modesto, California 95354	P (209) 522-7291	n/a	Permanent Utility Easement & Temporary Construction Easement			Proposed sewer alignment passes through APN 102017009
17	Shaibi Yehia Ahmed Qassem (TE) / Kasim Fatima (TE)	Tuolumne Blvd & 7th Street, Modesto, California 95351		n/a	Permanent Utility Easement & Temporary Construction Easement			Proposed sewer alignmnet passes through south corner of APN 102016001
18	Southwest Hide Co & Modesto Holding Co	925 Crows Landing Rd, Modesto, CA 95351	P (209) 577-5721	n/a	Permanent Utility Easement & Temporary Construction Easement			If necessary to cover proposed Shackelford pump station and structures
19	Varni Brothers Corporation	400 Hosmer Ave, Modesto, CA 95351	P (209) 521-1777	n/a	Permanent Utility Easement & Temporary Construction Easement			If necessary to cover proposed pump station and structures

River Trunk Pump Station

Shackelford Pump Station

Sutter Avenue Primary Treatment Facility

Tuolumne River

Dry Creek

Legend

- Pump Station
- Proposed Gravity Main
- Proposed Force Main
- Existing Sewer Main
- Flood Plain
- Modesto City Limits
- Parcels

0 1,500 3,000 Feet

PERMITS AND EASEMENT NEEDS

FIGURE 1

CITY OF MODESTO
RIVER TRUNK REALIGNMENT, BEARD BROOK SIPHON, AND CANNERY SEGREGATION PROJECT

D:\Modesto_DEM\Figure 1.mxd

APPENDIX F - PRELIMINARY LIST OF SPECIFICATIONS

CITY OF MODESTO

UTILITY PLANNING AND PROJECTS DEPARTMENT

RIVER TRUNK BEARD BROOK SIPHON CSL DIVERSION PROJECT

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PROJECT SPECIFICATIONS

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01612	SEISMIC DESIGN CRITERIA
01614	WIND DESIGN CRITERA
01756	COMMISSIONING AND PROCESS START-UP
01757	DISINFECTION
01759	WATER LEAKAGE TEST FOR CONCRETE STRUCTURES
01770	CLOSEOUT PROCEDURES

DIVISION 02 - SITE CONSTRUCTION

SECTION NO.	TITLE
02050	SOILS AND AGGREGATES FOR EARTHWORK
02084	PRECAST DRAINAGE STRUCTURES
02200	SITE CLEARING
02222	BUILDING DEMOLITION
02240	DEWATERING
02260	EXCAVATION SUPPORT AND PROTECTION
02300	EARTHWORK
02312	CONTROLLED LOW STRENGTH MATERIAL (CLSM)
02318	TRENCHING
02465	SLURRY SEAL
02552	TEMPORARY BYPASS PUMPING
02591	VORTEX FLOW MANHOLE INSERT
02620	FILTER FABRIC
02621	STABILIZATION FABRIC
02667	BIOFILTER MEMBRANE LINERS
02742A	ASPHALTIC CONCRETE PAVING
02772	CONCRETE CURBS, GUTTERS, AND SIDEWALKS
02820	FENCES AND GATES
02890	TRAFFIC STRIPING, MARKERS, AND MARKINGS

02892	SIGNALS AND SIGNAL ELECTRICAL SYSTEMS
02894	TRAFFIC LOOPS
02952	PAVEMENT RESTORATION AND REHABILITATION

DIVISION 03 - CONCRETE

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03071	EPOXIES
03072	EPOXY RESIN/PORTLAND CEMENT BONDING AGENT
03102	CONCRETE FORMWORK
03150	CONCRETE ACCESSORIES
03154	HYDROPHILIC RUBBER WATERSTOP
03200	CONCRETE REINFORCING
03300	CAST-IN-PLACE CONCRETE
03302	MASS CONCRETE
03366	TOOLED CONCRETE FINISHING
03600	GROUTING
03931	EPOXY INJECTION SYSTEM

DIVISION 04 - MASONRY

SECTION NO.	**TITLE**
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DIVISION 05 - METALS

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05120	STRUCTURAL STEEL
05190	MECHANICAL ANCHORING AND FASTENING TO CONCRETE AND MASONRY
05310	STEEL DECKING
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DIVISION 06 - WOOD AND PLASTICS

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06100	ROUGH CARPENTRY

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION NO.	**TITLE**

07190	WATER REPELLENTS
07220	ROOF DECK INSULATION
07415	STANDING SEAM SHEET METAL ROOFING
07530	ELASTOMERIC MEMBRANE ROOFING
07600	FLASHING AND SHEET METAL
07700	ROOF SPECIALTIES AND ACCESSORIES
07722	ROOF HATCHES
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08320	FLOOR ACCESS DOORS

DIVISION 09 - FINISHES

SECTION NO.	**TITLE**
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09960	HIGH-PERFORMANCE COATINGS

DIVISION 11 - EQUIPMENT

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16133 DUCT BANKS
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16222 LOW VOLTAGE MOTORS UP TO 500 HORSEPOWER
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