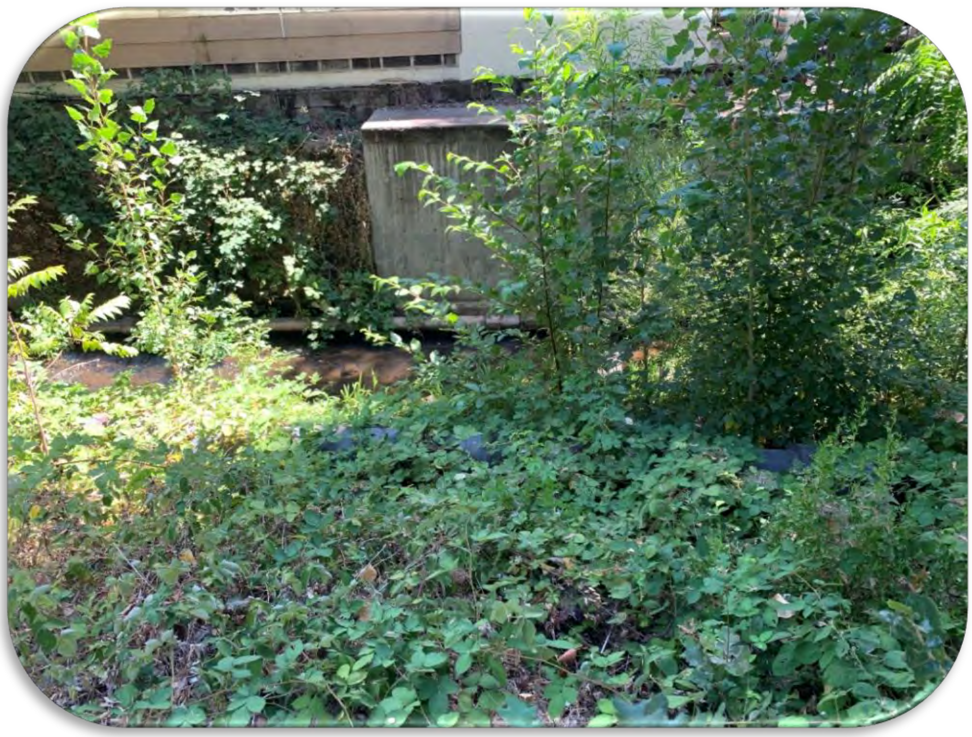
CITY OF PLACERVILLE

HANGTOWN CREEK SEWER RELOCATION PROJECT

TECHNICAL MEMORANDUM 4.0 MAIN STREET TRUNK SEWER ALTERNATIVE CONCEPTUAL STUDY



December 2020

Dewberry | drake haglan

CITY OF PLACERVILLE

HANGTOWN CREEK SEWER RELOCATION PROJECT

TECHNICAL MEMORANDUM 4.0
MAIN STREET TRUNK SEWER ALTERNATIVE CONCEPTUAL STUDY

December 2020

Submitted to:
City of Placerville
3101 Center Street
Placerville, CA 95667

Prepared by:
Dewberry | Drake Haglan
11060 White Rock Road, Suite 200
Rancho Cordova, CA 95670
916.363.4210

CONTENTS

Appendices

List of Tables

List of Figures

CITY OF PLACERVILLE
HANGTOWN CREEK SEWER RELOCATION PROJECT
TECHNICAL MEMORANDUM 4.0
MAIN STREET TRUNK SEWER ALTERNATIVE CONCEPTUAL STUDY
December 2020

Consistent with a workplan submitted to the Regional Water Quality Control Board (Regional Board) in May 2017, the City of Placerville (City) desires to relocate a 16-inch trunk sewer (Trunk) from a current alignment within Hangtown Creek (Creek) between Locust Avenue and Clay Street to facilitate access for maintenance and to improve resiliency during wet weather. As shown in June 2014 construction drawings prepared by Domenichelli and Associates (Draft Relocation Drawings) [1], the Trunk would be intercepted near the intersection of Locust Avenue and Main Street and constructed in a bike path north of the Creek to a connection to a 24-inch sewer near Clay Street. Relocation of the Trunk would necessitate re-routing of several sewer laterals from commercial customers that discharge to the current Trunk location in the Creek. Lateral reconstruction would likely involve deep crossings of the Creek for future connections to the relocated Trunk.

Because of the difficult construction associated with re-routing the sewer laterals and the goal to limit work within the Creek, a second alternative will be developed for relocation of the Trunk. Under this option, the Trunk would be intercepted in Main Street and extended south in Main Street to Clay Street (Main Street Alternative). At Clay Street, the Trunk would be routed north to a connection to the existing 24-inch sewer. Sewer laterals that are now routed to the north to the existing Trunk would be reversed and then constructed to the south for connection to the Trunk in Main Street.

The initial steps in the development of the Main Street Alternative included: 1) collecting background data, 2) undertaking utility research, 3) conducting field surveys and topographic mapping, and 4) initiating geotechnical investigations. The results of these activities were summarized in technical memorandum (TM) 1.0, Existing Conditions [2]. Using the available database, the horizontal and vertical alignment for the Main Street Alternative were developed in TM 2.0, Horizontal and Vertical Alignment for Trunk Sewer [3]. Alternatives for re-routing of building sewer laterals were explored in TM 3.0, Re-routing of Sewer Laterals [4], to further support the development of a Main Street Alternative. Further refinements in the conceptual design have since been undertaken incorporating feedback from City staff on earlier TMs. The Main Street Alternative conceptual design is presented in TM 4.0, organized as follows: 1) Background Information; 2) Summary of Design Criteria; 3) Discussion of Utility Constraints/Available Pipeline Corridor; 4) Review of Sewer Lateral Re-Routing Options; 5) Description of Main Street Trunk Sewer Alternative; 6) Summary of Probable Construction Costs for Main Street Trunk Sewer Alternative; and 7) Discussion of Advantages/Disadvantages of Main Street Trunk Sewer Alternative. TM 4.0 is summarized below.

1.0 BACKGROUND INFORMATION

Background information includes information concerning: 1) existing sewer laterals and trunk sewer, 2) 2014 Proposed Trunk Sewer and Sewer Laterals Relocation Plan, 3) existing utilities, 4) field investigations/topographic mapping, and 5) geotechnical investigation. Each is discussed below

1.1 Description of Existing Sewer Laterals and Trunk Sewer

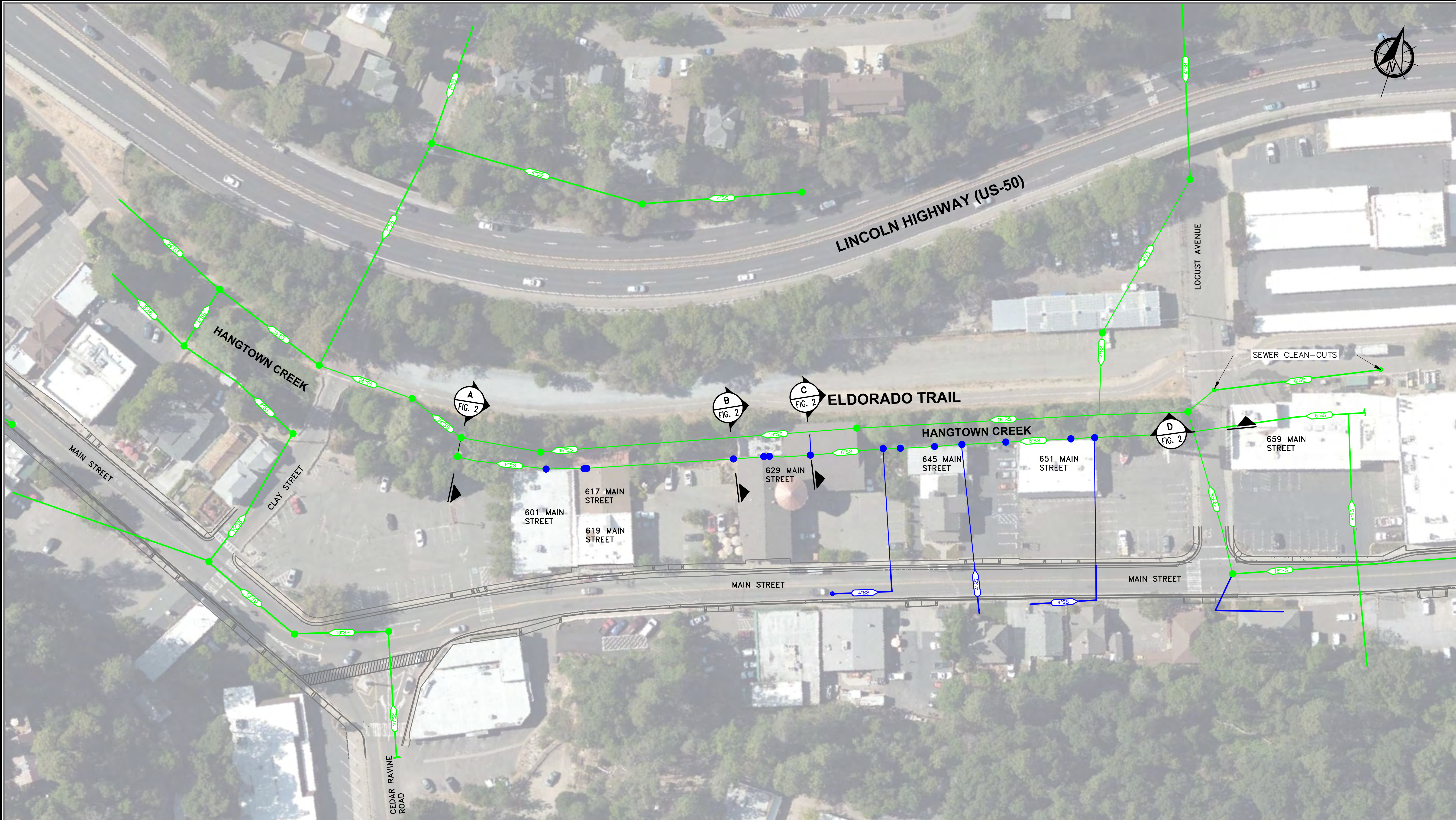
The alignment of the Trunk and the location of building sewer lateral connections are illustrated in Figures 1 and 2. The Trunk is routed west within Main Street until Locust Avenue, where the alignment shifts southwest to Hangtown Creek. The Trunk and manholes are located within the Creek for approximately 750 ft until the beginning of a 24-inch trunk sewer east of Clay Street. The 24-inch sewer is located north of Hangtown Creek within a paved pedestrian/bicycle path (aka, El Dorado Trail). Because of the location of the Trunk in Hangtown Creek, the pipeline and manholes are subject to damage during high flows in the Creek, triggered by significant storm events. Sewer overflows are also possible with limited access to repair or to contain spills by City forces.

Building laterals are generally 4-inch in diameter and penetrate the floodwall prior to connecting to 6-inch collector sewers. The collector sewers are routed within the Creek bottom along the southerly flood wall until an inter-connection across the Creek to the previously referenced 24-inch sewer. Because the laterals and collector sewers are located within the Creek similar to the Trunk, sewer overflows and damages during storm events are also possible.

1.2 2014 Proposed Trunk Sewer and Sewer Laterals Relocation Plan

The proposed June 2014 trunk sewer and sewer laterals relocation plan are illustrated in Figures 3 and 4. The trunk would be relocated north into the El Dorado Trail, out of Hangtown Creek. The existing Trunk would be intercepted along Locust Avenue, re-routed into the paved pedestrian/bicycle path, and connected to the existing 24-inch sewer east of Clay Street.

Building laterals would be disconnected from the existing 6-inch collector line and reconnected to a proposed 6-inch fly line to be installed on concrete piers along the Creek bed. The 6-inch fly line would be connected to the 16-inch trunk in El Dorado Trail through two 8-inch and one 18-inch creek crossings. Pipeline crossings would be constructed below the Creek bottom and would be encased in concrete.



LEGEND

- EXISTING SANITARY SEWER
- EXISTING SEWER LATERALS
- EXISTING SEWER MANHOLE
- EXISTING BUILDING CONNECTION TO LATERAL

Dewberry | drake haglan

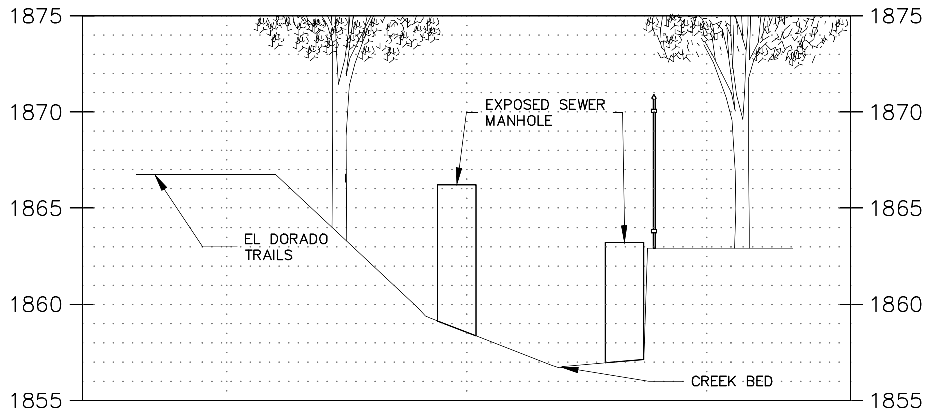
Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

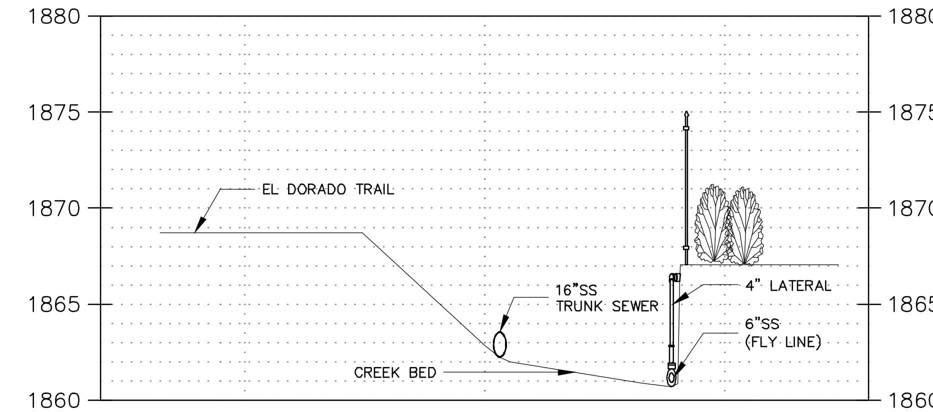
Figure 1. Existing Trunk Sewer and Service Laterals

12/22/2020

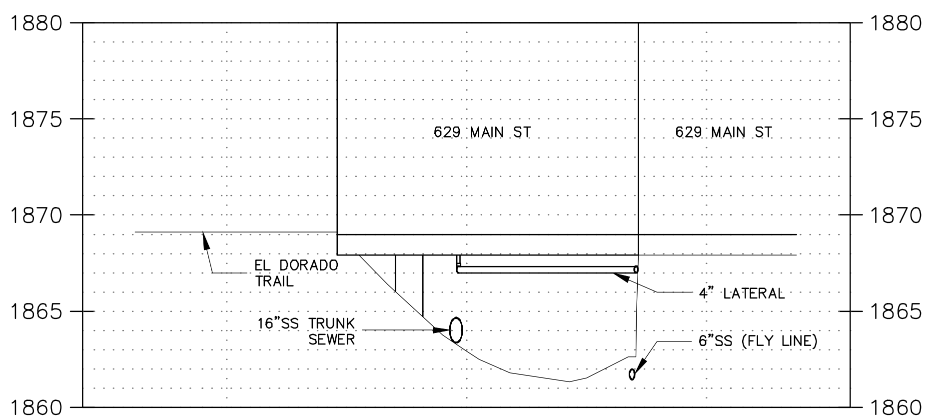
Scale: 1"=80'



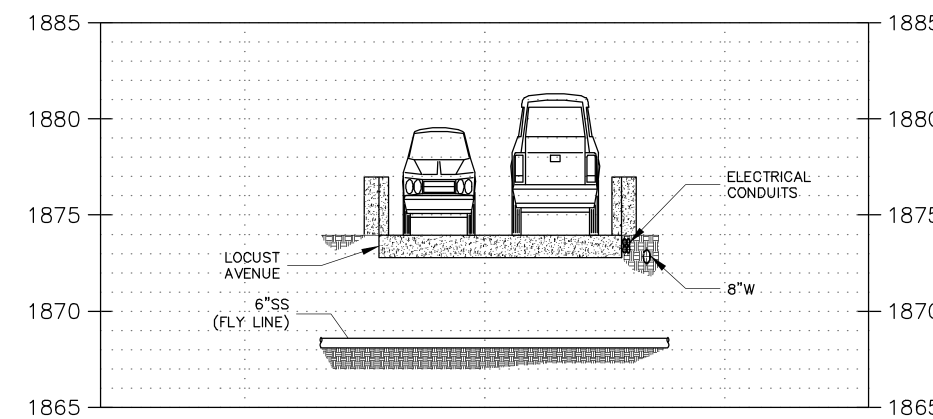
SECTION A FIG.1
SCALE: 1"=10'V
1"=20'H



SECTION B FIG.1
SCALE: 1"=10'V
1"=20'H



SECTION C FIG.1
SCALE: 1"=10'V
1"=20'H



SECTION D FIG.1
SCALE: 1"=10'V
1"=20'H

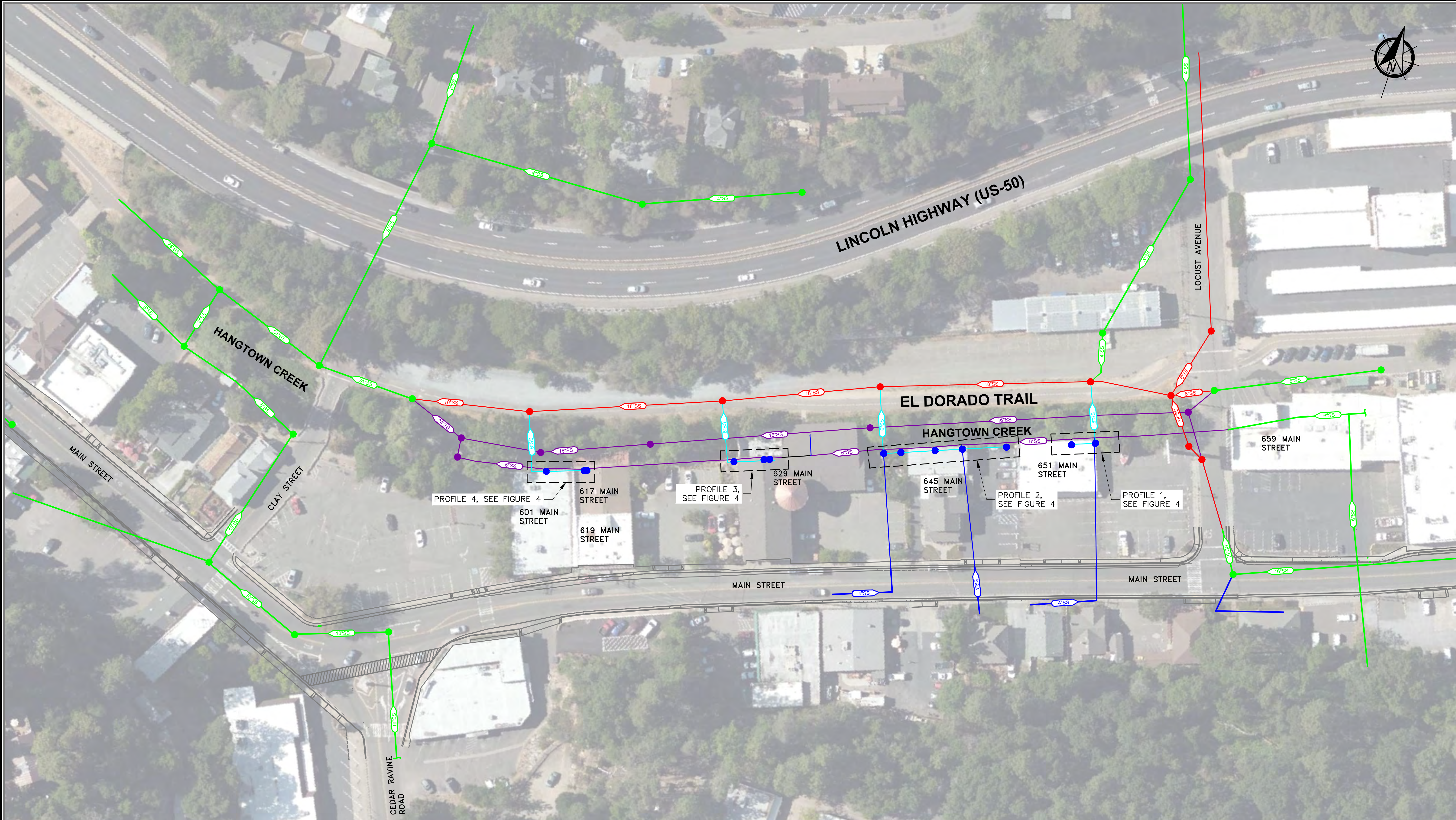
Dewberry | drake haglan

Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 2. Existing Trunk Sewer and Service Laterals Sections

12/9/2020



LEGEND

- EXISTING SANITARY SEWER
- EXISTING SEWER LATERALS
- EXISTING SANITARY SEWER TO BE REROUTED AND REMOVED
- PROPOSED TRUNK SEWER RELOCATION
- PROPOSED SEWER LATERALS
- EXISTING SEWER MANHOLE
- EXISTING BUILDING CONNECTION TO LATERAL
- PROPOSED SEWER MANHOLE
- EXISTING SEWER MANHOLE TO REMOVED

Dewberry | drake haglan

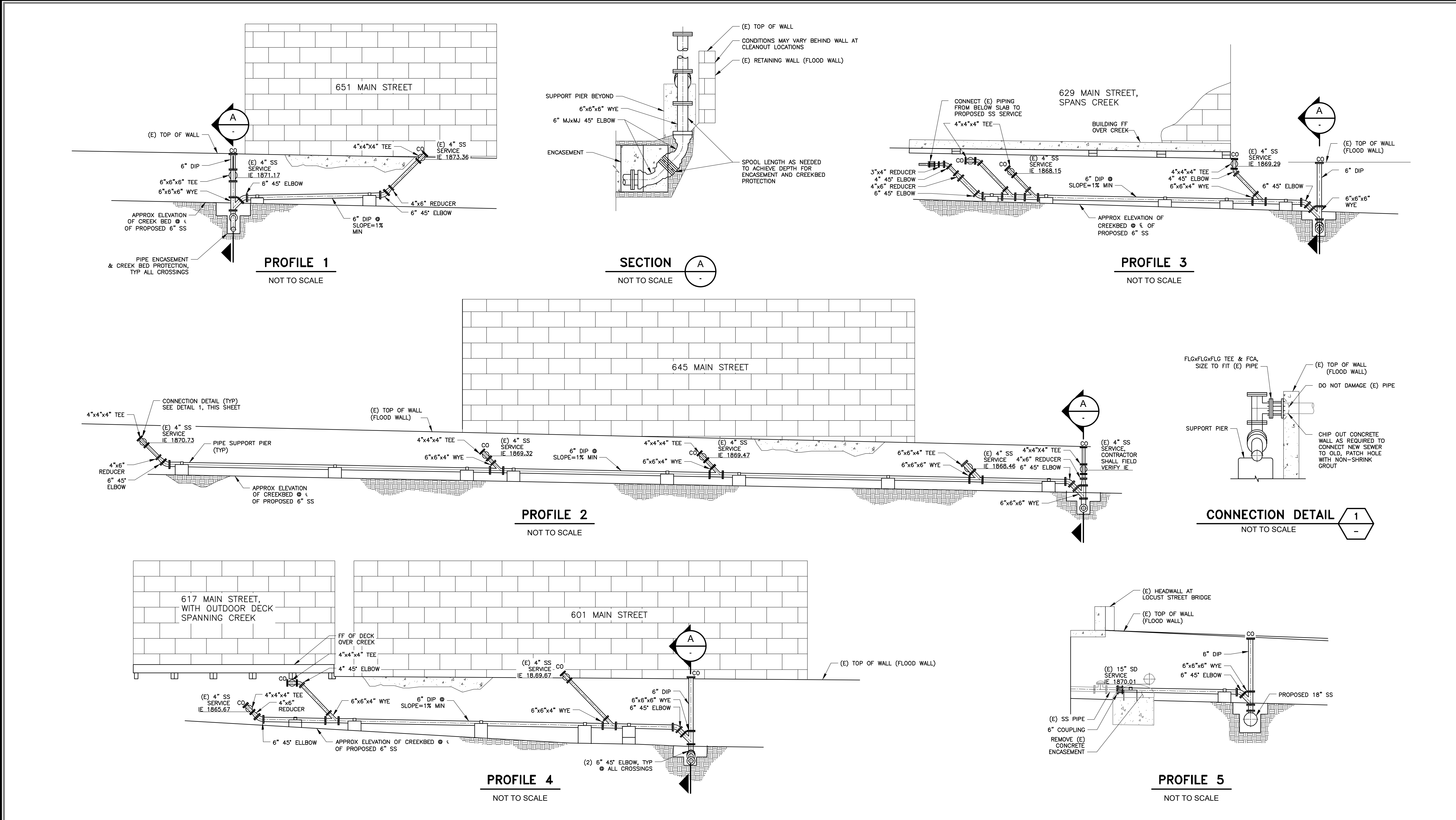
Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 3. Proposed Trunk Sewer & Sewer Laterals Relocation Plan (June 2014)

12/9/2020

Scale: 1"=80'



Dewberry | drake haglan

Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 4. Proposed Trunk Sewer & Sewer Laterals Profiles/ Sections (June 2014)

12/9/2020
Scale: N.T.S

1.3 Summary of Existing Utilities

Based on a review of Figure 5, a brief description of underground utilities within the Project footprint is presented below.

a. Potable water – a 6-inch loop is found within Locust Avenue, Main Street, and Clay Street serving businesses in the downtown core. The loop is fed through a connection to an 8-inch pipeline in Cedar Ravine Road.

b. Sewer – the 16-inch trunk sewer is routed from Main Street across Locust Avenue to Hangtown Creek. The 16-inch sewer continues in Hangtown Creek to a 24-inch connection to a trunk sewer in the bike path and pedestrian trail east of Clay Street. Laterals from businesses along Main Street are collected by a 6-inch sewer within Hangtown Creek and routed to a 24-inch connection to the referenced trunk sewer in the bike path/pedestrian trail. A 10-inch sewer in Cedar Ravine Road is routed through Main Street and Clay Street to an 8-inch connection to the 24-inch trunk sewer.

c. Storm Drain – the network of curb inlets, catch basins, and underground pipelines is limited in the Project area to a large box culvert and 15-inch storm drain crossing Main Street near Cedar Ravine Drive.

d. PG&E – Primary (12 kV) and secondary conductors/conduits are located mostly within the westerly area of Main Street on either side of Cedar Ravine Road.

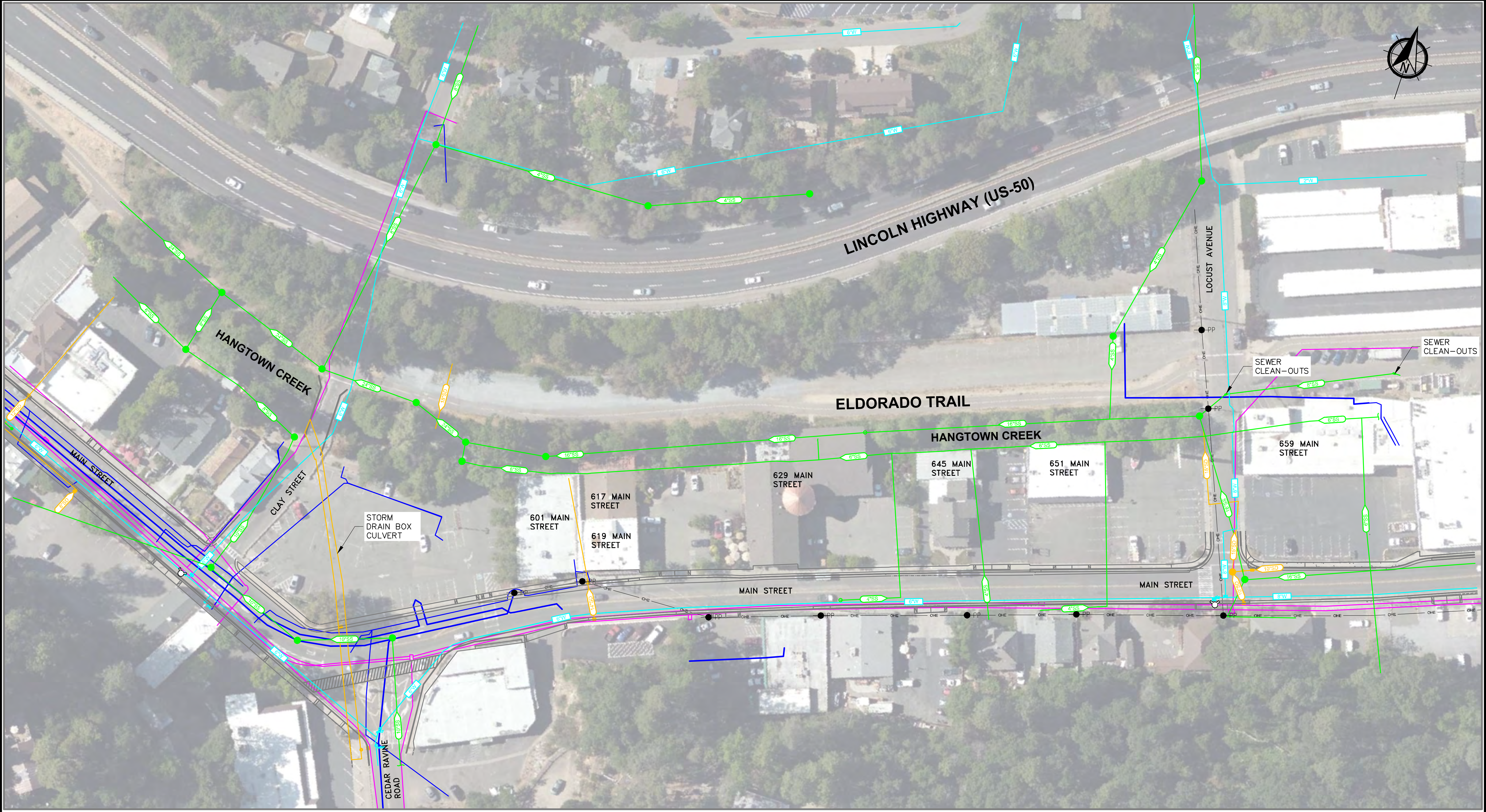
e. AT&T – An extensive network of conduits/manholes is located along the southerly side of Main Street from Locust Avenue to west of Clay Street.

The vertical and horizontal location of each of these utilities were considered when identifying a potential corridor for a trunk sewer within Main Street.

1.4 Field Investigation/Topographic Mapping

To confirm the location and connectivity of the trunk sewer network and the local wastewater collection system in the vicinity of Locust Avenue, a meeting in the field was conducted with City Public Works staff. Manholes were examined and the routes of various sewer laterals were traced to either direct connections to the 16-inch trunk sewer in Hangtown Creek or to the 6-inch collection sewer that serves business laterals along Hangtown Creek. The results of the field investigation are presented in Figure 6.

To augment the record drawing information regarding sewer and storm drains within the Project footprint, an initial topographic survey was conducted in October 2019. Rim and invert elevations were measured at multiple manholes as shown in Figure 7.



LEGEND

- SANITARY SEWER
- WATER MAIN
- STORM DRAIN
- TELEPHONE
- PG&E UNDERGROUND UTILITIES
- OHE OVERHEAD ELECTRICAL
- FIRE HYDRANT
- PP POWER POLE
- SEWER MANHOLE
- STORM DRAIN MANHOLE

Dewberry | drake haglan

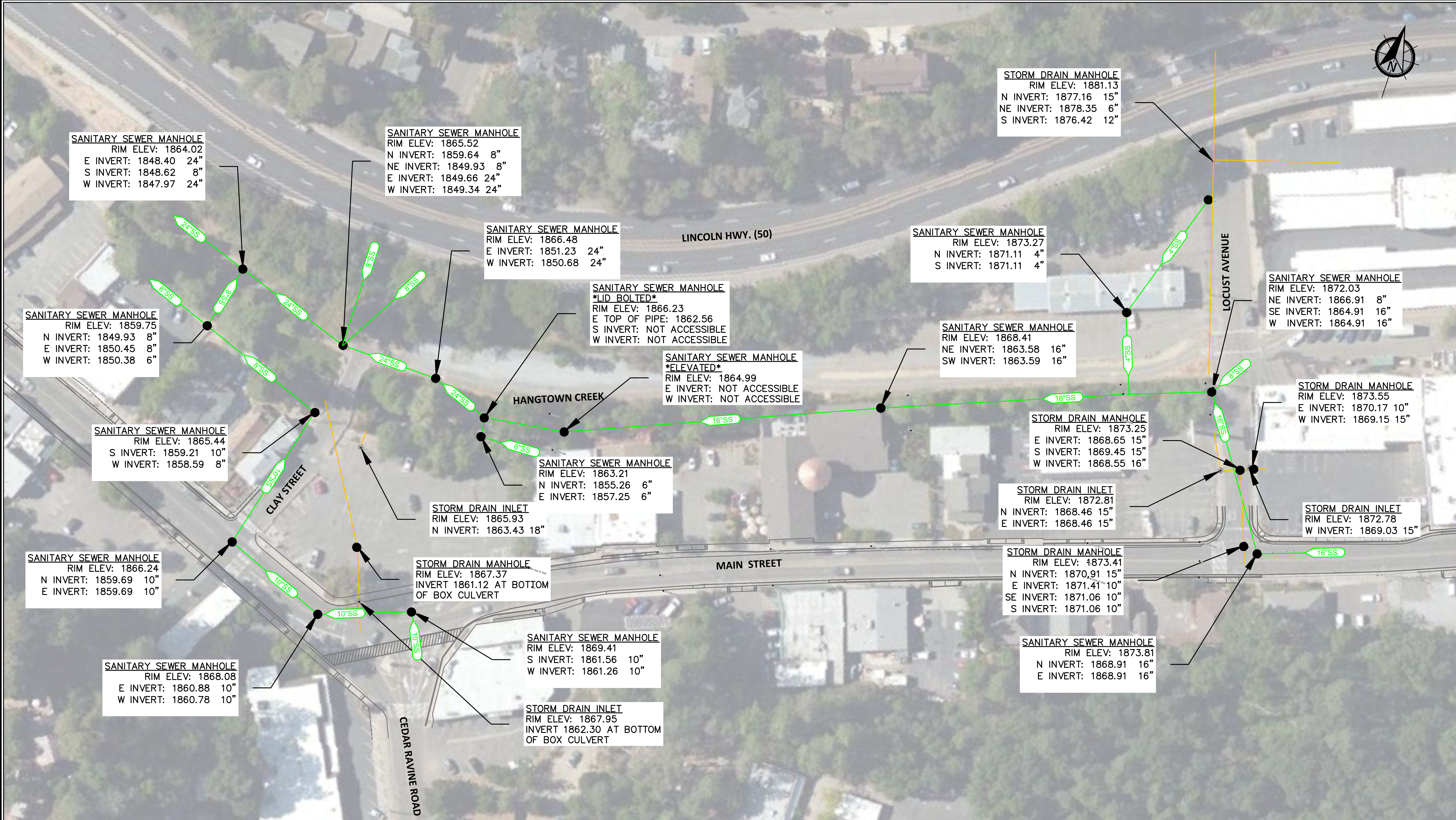
Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 5. Summary of Existing Utilities

12/22/2020

Scale: 1"=80'



LEGEND

EXISTING SANITARY SEWER

EXISTING STORM DRAIN

Hangtown Creek Sewer Relocation Project

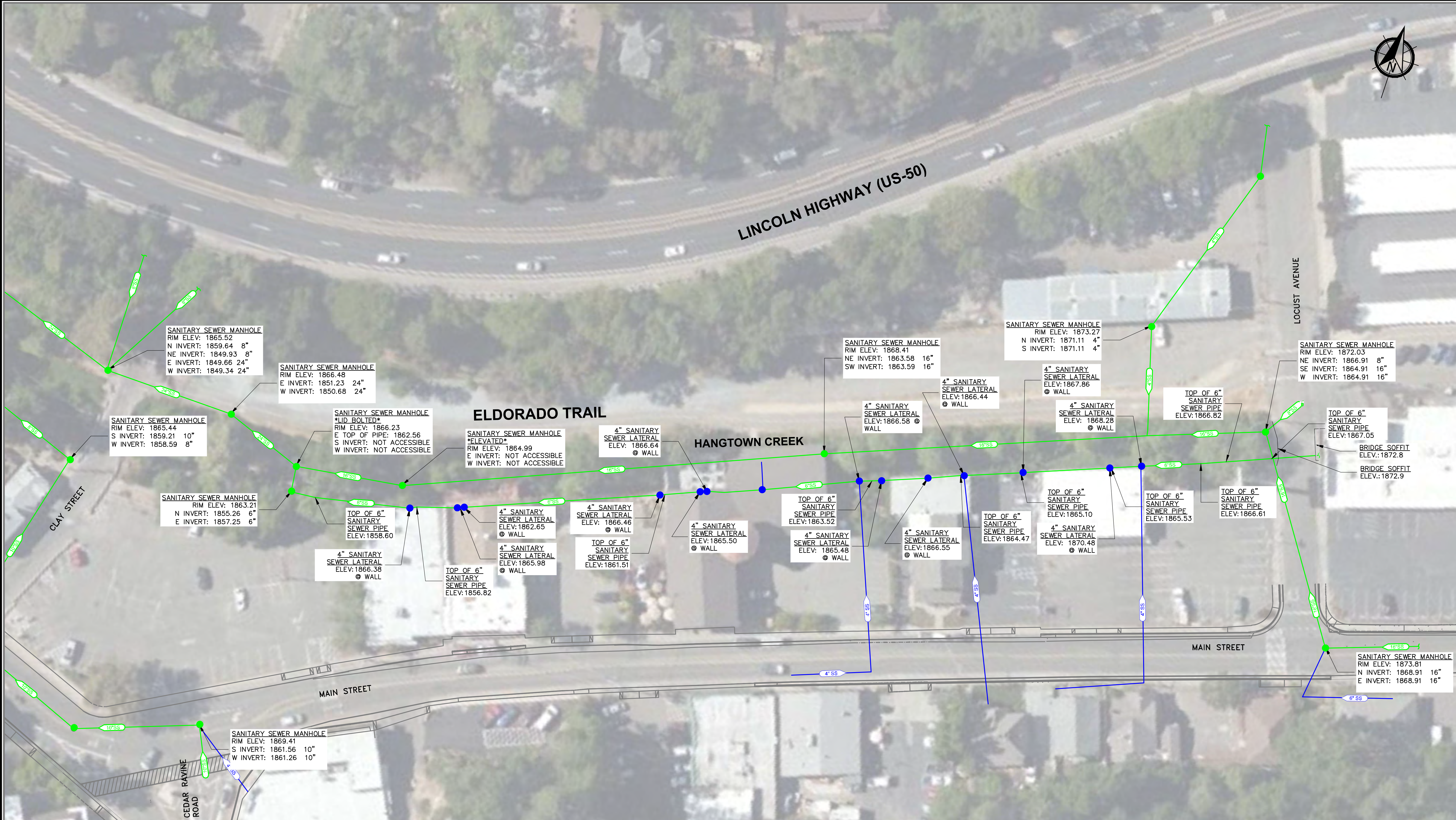
TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 6. Summary of Underground Utilities Survey Information

12/21/2020

Scale: 1"=80'

Dewberry | drake haglan



LEGEND

EXISTING SANITARY SEWER
EXISTING SANITARY LATERALS
EXISTING SEWER MANHOLE
EXISTING LATERAL CONNECTION

Dewberry | drake haglan

Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 7. Summary of Key Survey Information

12/22/2020

Scale: 1"=60'

Key takeaways from the topographic mapping and manhole survey are as follows:

a. There is approximately 20 ft of elevation difference between the invert of the 24-inch trunk sewer in the bike way/pedestrian trail and the invert of the 16-inch sewer at Main Street and Locust Avenue.

b. The difference in inverts for the 16-inch trunk sewer between Main Street/Locust Avenue and the easterly perimeter of Hangtown Creek is approximately 4 ft.

c. Inverts of laterals connecting to the 16-inch trunk sewer in Hangtown Creek are 2-7 ft above the invert of the trunk sewer at the easterly perimeter of Hangtown Creek.

Invert elevations were used to evaluate the options for re-routing laterals to a proposed trunk sewer in Main Street.

1.5 Results of Geotechnical Investigation

A geotechnical investigation was conducted by ENGEO in support of the design of the Project [5]. The final geotechnical report is included as Appendix A. As part of the geotechnical exploration, five borings were advanced to depths of 20 ft below existing ground. Existing fill, residual soils (hard sandy clay and medium density clayey sand), and hard materials were observed. Rock (phyllite) was encountered at depths ranging from 10-14 ft below existing ground as illustrated in Figure 8.

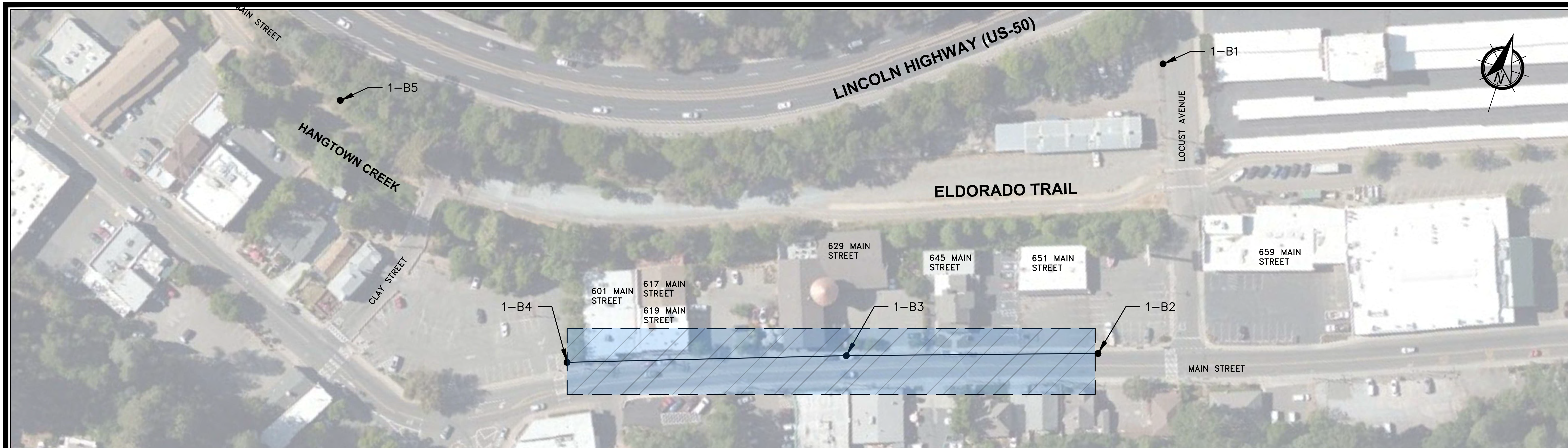
Conclusions from the geotechnical investigation include the following:

a. Conventional excavation equipment will likely be able to excavate soil deposits encountered in the borings.

b. Moderate to large excavation equipment such as CAT 235 or larger excavator will likely be able to excavate through weathered phyllite.

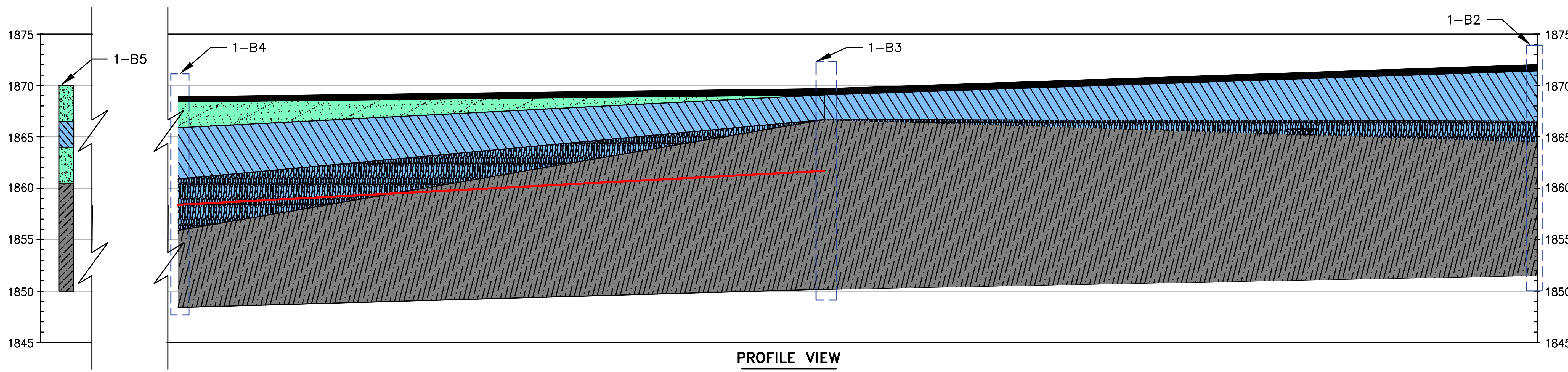
c. Although naturally occurring asbestos (NOA) materials were not observed during the subsurface exploration, the pipeline alignment falls within an area designated as "More Likely to Contain Asbestos" by El Dorado County, triggering the need for an Asbestos Dust Mitigation Plan (ADMP).

d. Temporary shoring may be required along the pipeline alignment considering the anticipated pipe invert depths. Trench stability may vary depending on specific soil conditions and should be considered by the contractor in designing temporary shoring such as trench shields.



SITE PLAN

SCALE: 1" = 80'



PROFILE VIEW

NOT TO SCALE

LEGEND

- ASPHALT CONCRETE
- CLAYEY SAND (SC)
- CLAYEY GRAVEL (SG)
- INORGANIC CLAY WITH LOW AND MEDIUM PLASTICITY (CL)
- PHYLITE
- GROUNDWATER LEVEL
- BORING LOCATION

Dewberry | drake haglan

Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 8. Geotechnical Boring Summary

12/22/2020

Scale: 1"=80'

e. Shallow groundwater will likely be encountered and temporary construction dewatering should be anticipated. Sump pumps in the excavations may be adequate for temporary dewatering, however, selection of dewatering methods should be deferred to the contractor.

The recommendations from the geotechnical investigation will be incorporated into the Project design documents.

2.0 SUMMARY OF HYDRAULIC DESIGN CRITERIA

Using the results of the manhole survey and record drawing information, the hydraulic capacity of various reaches of the existing trunk sewer within the Project footprint can be estimated. As shown in Table 1, trunk sewer capacities range from 3.4-17.3 mgd. For planning purposes for the Main Street Trunk Sewer Alternative, a minimum capacity of 3.4 mgd will be provided for the reach within Main Street east of Cedar Ravine Road. West of Cedar Ravine Road, the Main Street Trunk Sewer Alternative will be designed for a minimum capacity of 14.4 mgd.

TABLE 1
HANGTOWN CREEK SEWER RELOCATION PROJECT
ESTIMATED CAPACITY OF EXISTING 16-24 INCH TRUNK SEWERS

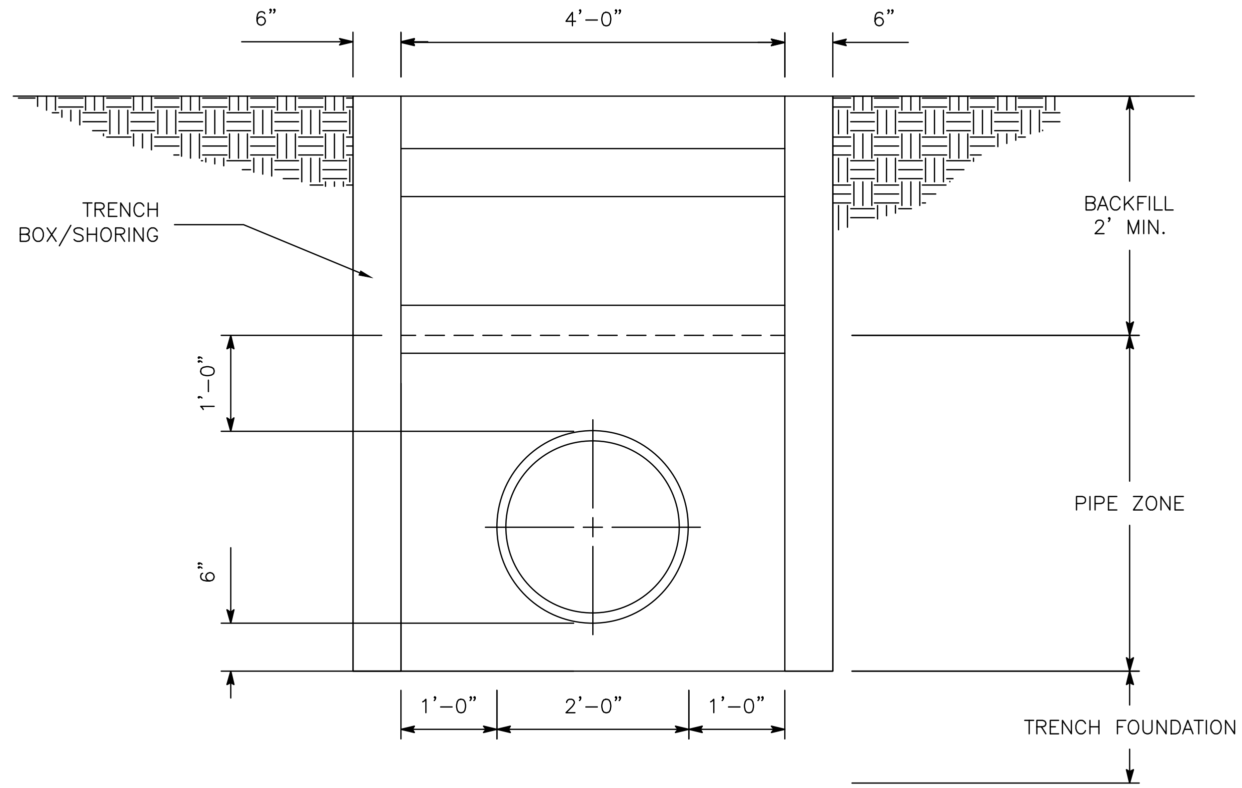
Reach	Trunk Sewer Diameter, in	Trunk Sewer Slope %	Trunk Sewer Capacity, mgd[a]
Within Hangtown Creek	16	0.4-0.5	3.4
Within Bike Path/Pedestrian Trail, from Creek Crossing to Connection with Cedar Ravine Road Sewer	24	0.9-1.4	13.8-17.3
Within Bike Path/Pedestrian Trail, Downstream of Connection with Cedar Ravine Road Sewer	24	1.0	14.4

3.0 DISCUSSION OF UTILITY CONSTRAINTS/AVAILABLE PIPELINE CORRIDOR

In developing horizontal and vertical alignment requirements for construction of the trunk sewer in Main Street, the following parameters were considered:

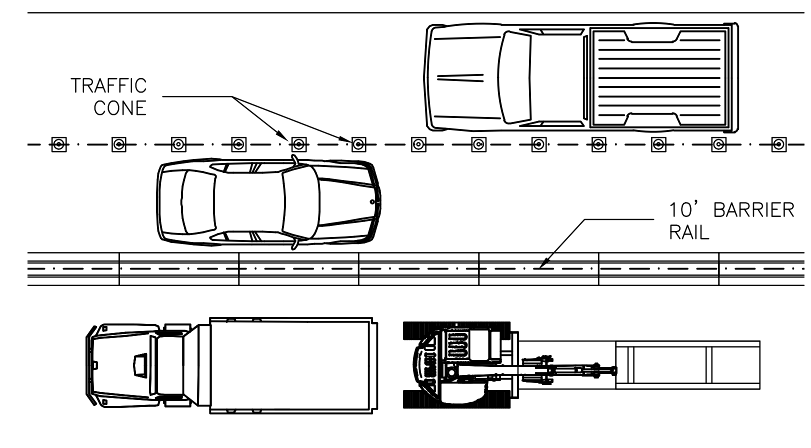
a. Invert elevations for the 16-inch trunk sewer at Locust Avenue and Main Street and the 24-inch trunk sewer north of Hangtown Creek (west of Clay Street) are EL 1868.91 ft and EL 1848.40 ft, respectively. The vertical alignment at the relocated sewer in Main Street will fall between these two elevations.

b. Because of the probable depth of the trunk sewer (10 to 15 ft) and the desire to limit construction impacts while maintaining two-way traffic, shoring of the trench excavation is anticipated. As illustrated in Figure 9, a trench width of approximately 5 ft is assumed for a 24-inch trunk sewer.



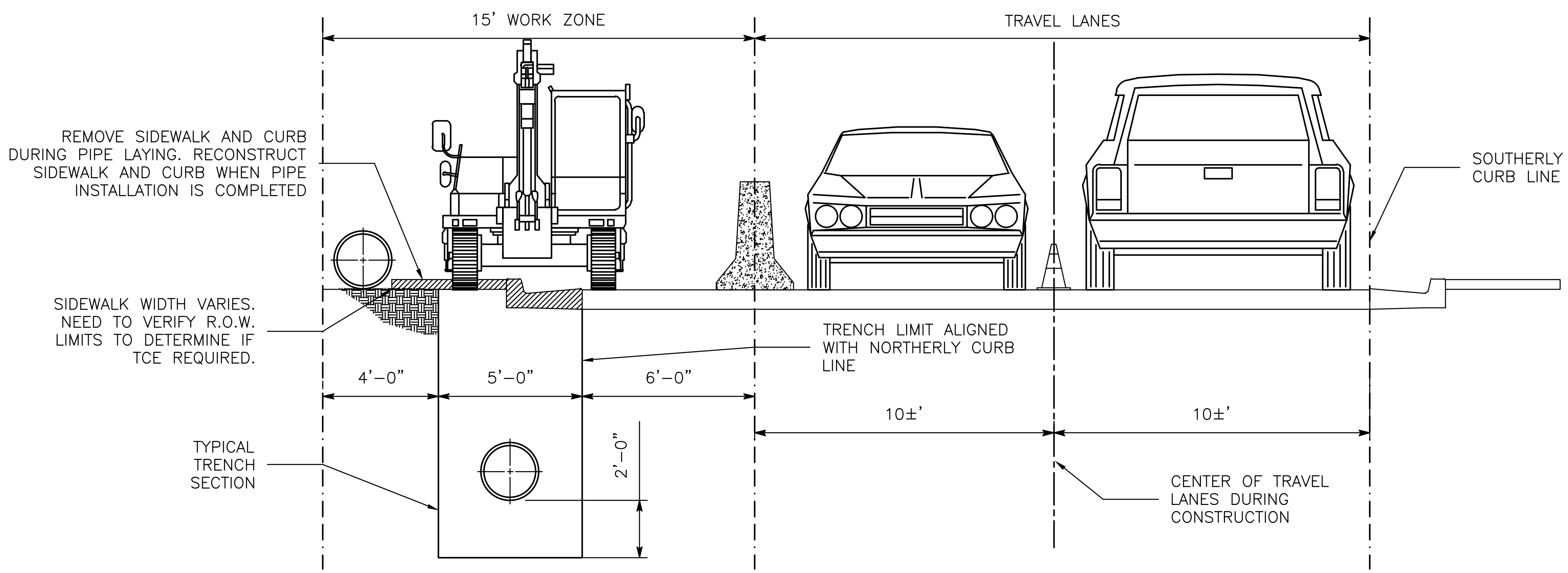
LIKELY SEWER TRENCH SECTION

SCALE: 1/2"=1'



TYPICAL CONSTRUCTION LAYOUT

SCALE: 1/2"=1'



CONSTRUCTION ZONE / TRAVEL ZONE SECTION

SCALE: 3/16"=1'

Dewberry | drake haglan

Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 9. Utility Corridor/Construction Zone Considerations

12/22/2020

c. To determine the width of the construction zone required for the trunk sewer installation, a typical setup for pipeline construction equipment and materials was developed (see Figure 9). Assuming the following equipment onsite, backhoe and dump truck, the width of the construction zone would be approximately 15 ft.

These vertical and horizontal alignment parameters will be applied to identify a possible pipeline corridor within Main Street as discussed below.

Using the horizontal and vertical parameters discussed earlier, a potential construction corridor can be identified considering the location of existing utilities within Main Street. The horizontal and vertical location of existing utilities are represented in Figure 9. As shown in the referenced figure, constructing the trunk sewer along the northerly side of Main Street below the sidewalk creates the following advantages:

a. Limits any required utility relocations to PG&E secondary conductors near Cedar Ravine Road.

b. Avoids conflicts with AT&T communication conduits and PG&E high-voltage network.

c. Facilitates re-routing of sewer laterals from businesses along the north side of Main Street.

d. Allows for maintaining two 10 ft wide lanes of traffic during construction.

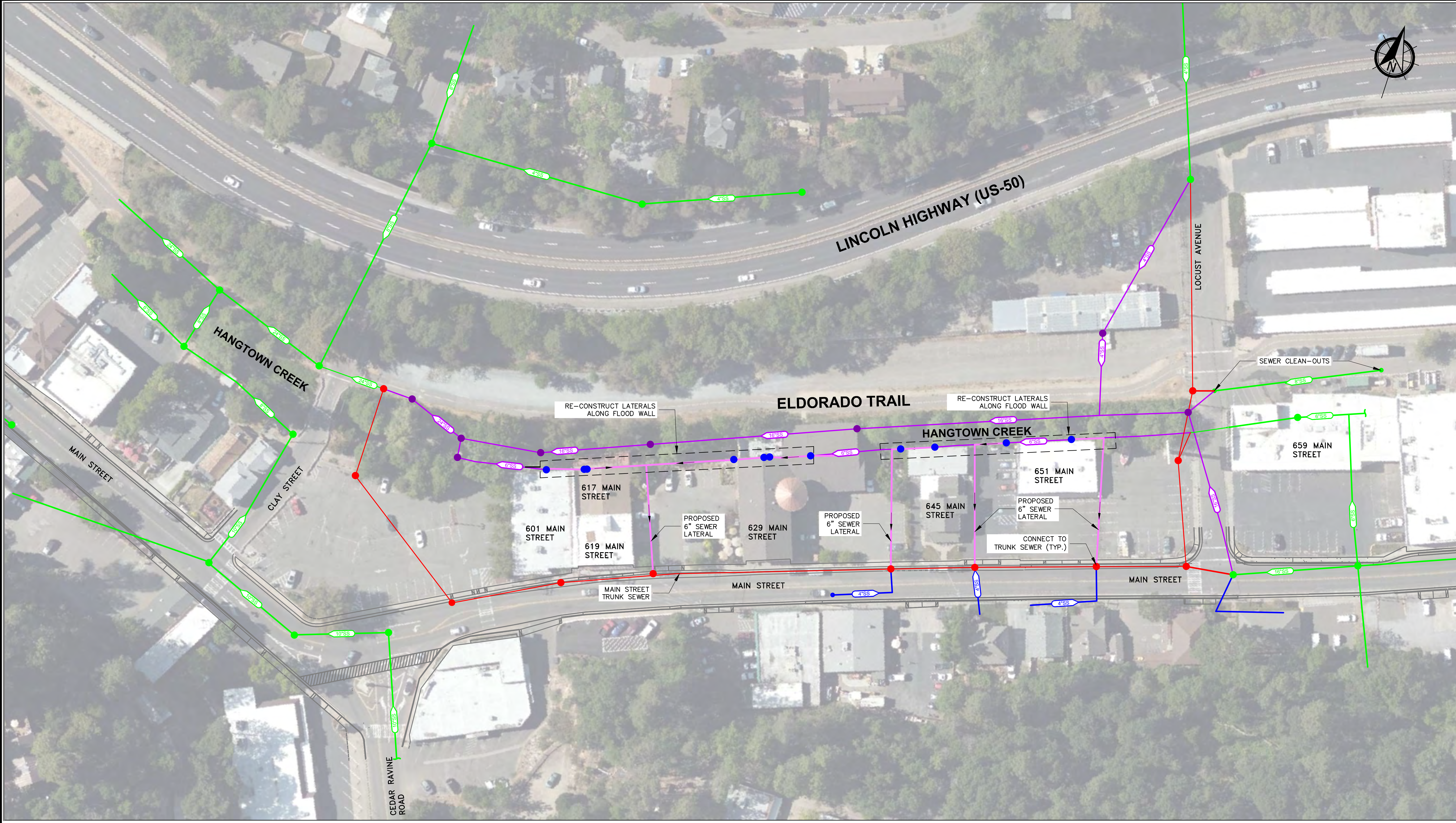
e. Minimizes requirements for any temporary construction easements (TCEs).

4.0 REVIEW OF SEWER LATERAL RE-ROUTING OPTIONS

Three options were developed for re-routing of sewer laterals from the trunk sewer in Hangtown Creek to the Main Street Alternative trunk sewer. Each option is discussed below.

4.1 Option 1 – Re-construct Laterals Along Flood Wall and Route to Main Street Trunk Sewer

The initial option to re-route the building laterals is illustrated in Figure 10. Laterals would be intercepted at the floodwall and then extended along the floodwall to connections to the 6-inch fly line. The fly line would be routed south to the Main Street Alternative for subsequent discharge to four manholes. Sewer laterals upstream of the fly line would be supported by a pipe bridge above the elevation of the existing collector sewers within Hangtown Creek. Sewer laterals would then be installed within a pipe casing for protection.



LEGEND

- EXISTING SANITARY SEWER
- EXISTING SEWER LATERALS
- EXISTING SANITARY SEWER TO BE REROUTED AND REMOVED
- PROPOSED MAIN STREET TRUNK SEWER
- PROPOSED SEWER LATERALS
- EXISTING SEWER MANHOLE
- EXISTING LATERAL CONNECTION
- PROPOSED SEWER MANHOLE
- EXISTING SEWER MANHOLE TO BE REMOVED

Dewberry | drake haglan

Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 10. Main Street Trunk Sewer Alternative Relocation Plan

Lateral 1 Option

12/22/2020

Scale: 1"=80'

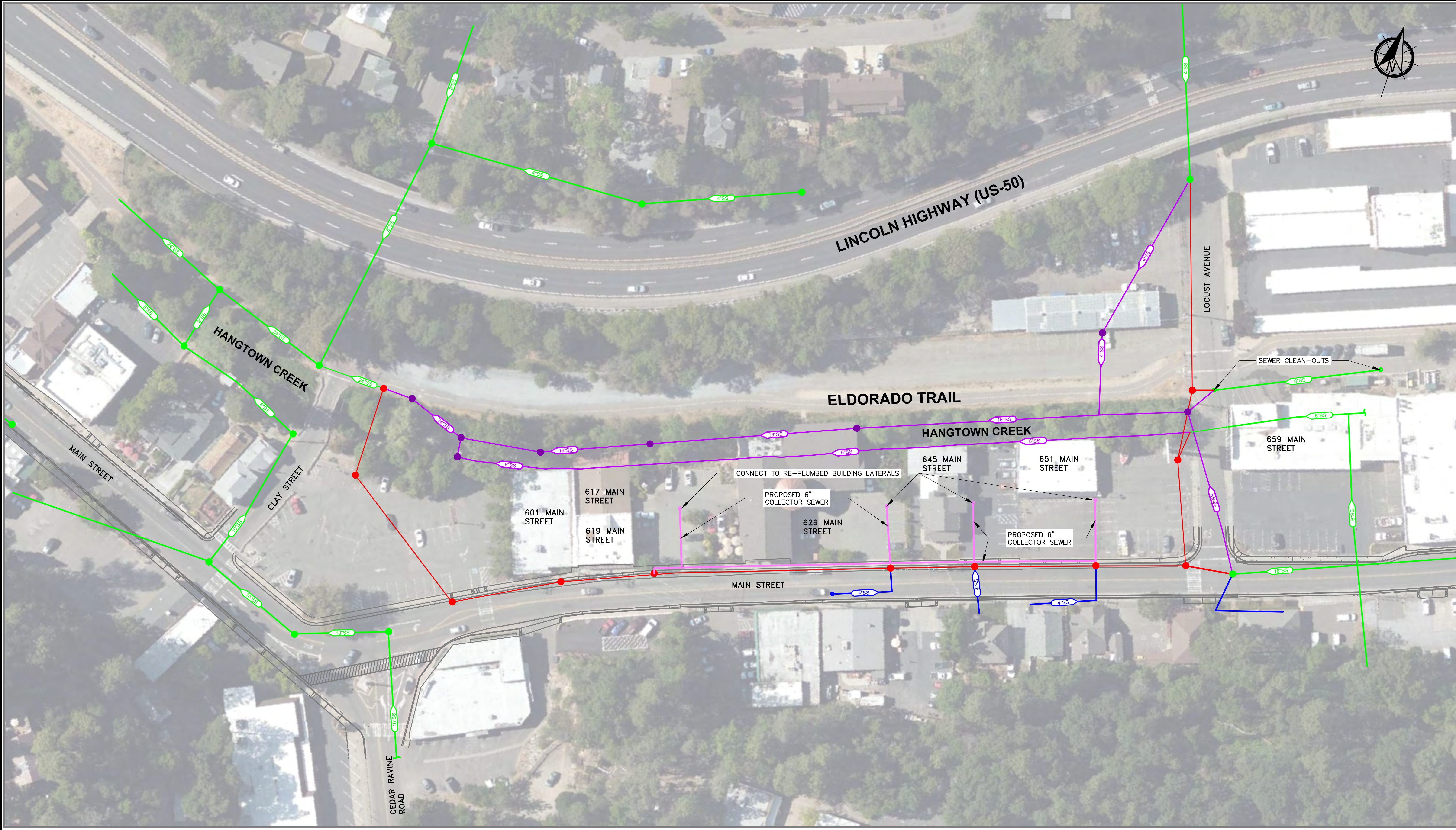
4.2 Option 2 – Re-plumb Laterals and Re-connect to Fly Line Parallel to Main Street Trunk Sewer

Option 2 assumes the various businesses will replace laterals within the building to connect to proposed laterals south of Hangtown Creek as shown in Figure 10. The proposed laterals will be routed to a 6-inch fly line that would parallel the Main Street Alternative Trunk until a connection east of the intersection of Cedar Creek Road and Main Street as presented in Figure 11. The fly line would have a minimum cover of 3 ft and would be installed beneath the sidewalk along the northerly side of Main Street.

4.3 Option 3 – Reverse Laterals at Flood Wall and Route to Main Street Trunk Sewer

Intercepting the building laterals at the flood wall and revising the alignment across paved areas between the buildings to connections to the Main Street Alternative are shown in Figure 12 for Option 3. Because the building laterals sometimes occur mid-building, reversing the direction of the laterals requires a short length of pipe along the flood wall prior to routing south to Main Street. To protect the lateral along the flood wall, a steel casing would be provided. Depending on the location and condition of the flood wall, the lateral could be supported by: 1) reconstructing the top of the wall to create an "L" shaped structural component for attachment of a pipe bracket; 2) hanging the pipe from the soffit of any overhanging building deck; 3) drilling through the flood wall and constructing a horizontal anchor for attachment of the pipe support; or 4) modifying an existing pipe support.

Based on a comparison of economic and non-economic factors described in TM 3.0 [4], Option 3 was recommended for inclusion in the Main Street Alternative. A summary of the comparison is included in Appendix B.



LEGEND

EXISTING SANITARY SEWER	PROPOSED COLLECTOR SEWER
EXISTING SEWER LATERALS	EXISTING SEWER MANHOLE
EXISTING SANITARY SEWER TO BE REROUTED AND REMOVED	PROPOSED SEWER MANHOLE
PROPOSED MAIN STREET TRUNK SEWER	EXISTING SEWER MANHOLE TO BE REMOVED

Dewberry | drake haglan

Hangtown Creek Sewer Relocation Project

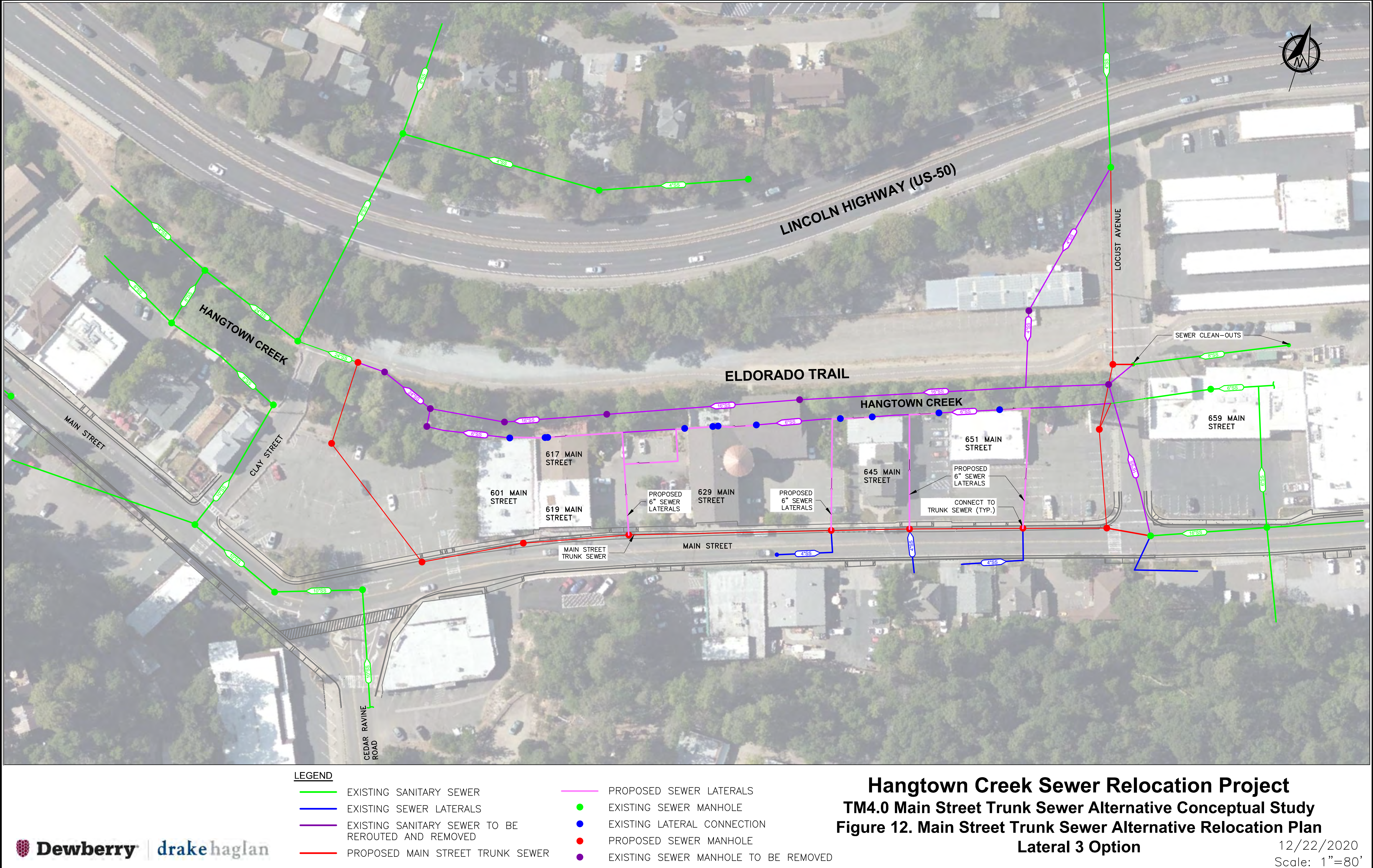
TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 11. Main Street Trunk Sewer Alternative Relocation Plan

Lateral 2 Option

12/22/2020

Scale: 1"=80'



Dewberry | drake haglan

Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 12. Main Street Trunk Sewer Alternative Relocation Plan

Lateral 3 Option

12/22/2020

Scale: 1"=80'

5.0 DESCRIPTION OF MAIN STREET TRUNK SEWER ALTERNATIVE

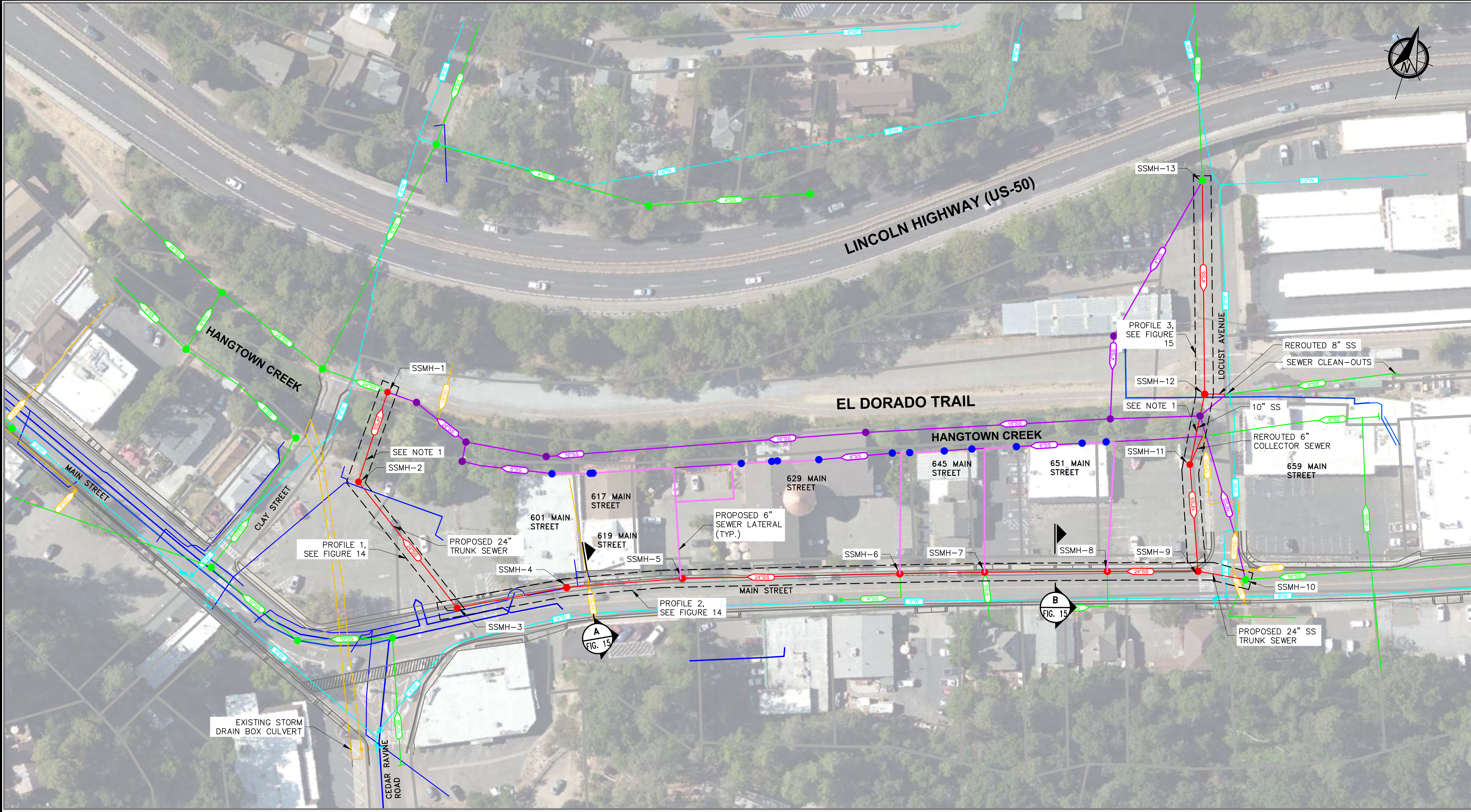
A detailed description of the Main Street Alternative is presented in the following sections including a discussion of 1) alignment; 2) profile; 3) construction sequence, and 4) traffic control. Each subject follows below.

5.1 Alignment

The trunk sewer in Main Street will be constructed from an existing manhole near the intersection of Locust Avenue and Main Street to a new manhole to be built downstream of a creek crossing, east of Clay Street. Within Main Street, the pipeline will be sited beneath the northerly curb line approximately 16 ft from the road centerline. East of the intersection of Cedar Ravine Road and Main Street, the alignment of the sewer will be shifted northwest across a paved public parking area on City-owned property. A bore and jack crossing of Hangtown Creek is anticipated east of Clay Street with a new manhole to be constructed as part of the connection to the existing 24-inch trunk sewer, north of the creek. Within Main Street, manholes will be installed based on the location of existing 4-inch and proposed 6-inch laterals serving businesses along the floodwall as well as residences south of Main Street. Sewage originating north of Hangtown Creek and east of Locust Avenue will be re-routed to a proposed 8-inch collector sewer to be installed within Locust Avenue. A bore and jack crossing of Hangtown Creek is proposed between sanitary sewer manhole (SSMH)-12 and a new SSMH to be sited immediately west of Locust Avenue and south of the floodwall within a paved area. A 12-inch collector sewer from the proposed SSMH will connect to the Main Street trunk sewer at SSMH-10. The alignment of the proposed trunk sewer and associated collector sewers/laterals are illustrated in Figure 13.

5.2 Profile

Profiles of the various components of the Main Street Alternative along with utility cross-sections are presented in Figures 14 and 15. The trunk sewer will generally be constructed at a slope of approximately .10% with depths ranging from 10-15 ft. The proposed bore and jack crossing of Hangtown Creek east of Clay Street will be designed with a minimum separation of 2 ft between the top of the pipe and the creek bottom. Based on the proposed slopes of the trunk sewer, the minimum capacity of the pipeline flowing full will be 4.6 mgd. For reference, the capacity of the existing 16-inch trunk sewer in Hangtown Creek flowing full is 3.4 mgd (see Table 1).



NOTE:

1. CREEK CROSSING TO BE ACCOMPLISHED VIA BORE AND JACK.

LEGEND

- EXISTING SANITARY SEWER
- EXISTING WATER MAIN
- EXISTING STORM DRAIN
- EXISTING SANITARY SEWER TO BE REROUTED AND REMOVED
- PROPOSED 6" SEWER LATERAL
- EXISTING PG&E CONDUIT
- PROPOSED TRUNK SEWER RELOCATION
- EXISTING SEWER MANHOLE
- EXISTING BUILDING CONNECTION TO LATERAL
- PROPOSED SEWER MANHOLE
- EXISTING SEWER MANHOLE TO BE REMOVED

Dewberry | drake haglan

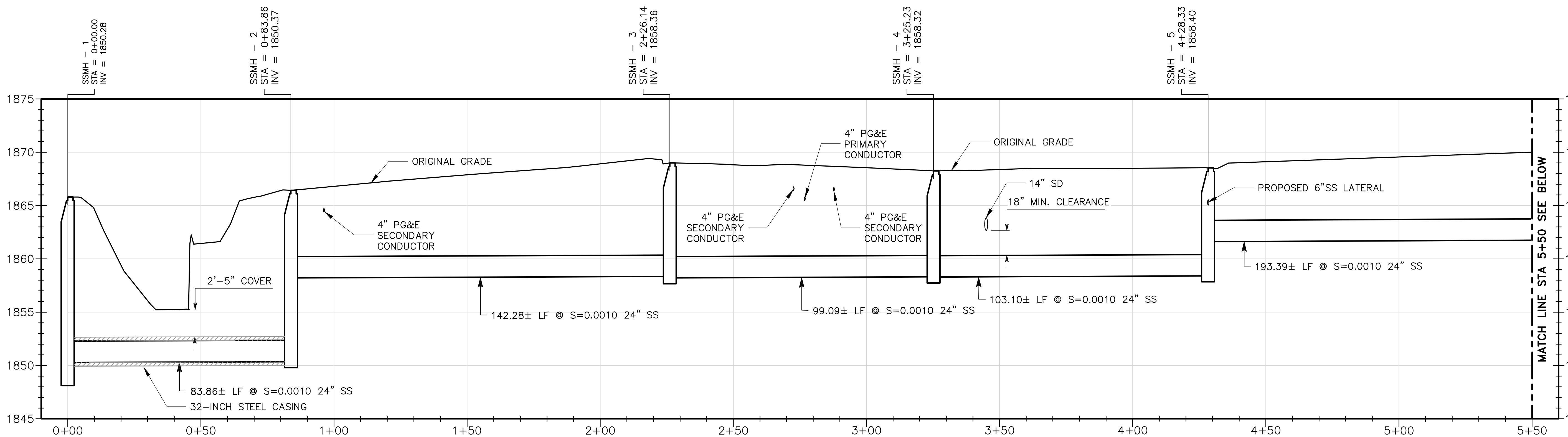
Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 13. Alignment of Main Street Trunk Sewer Alternative

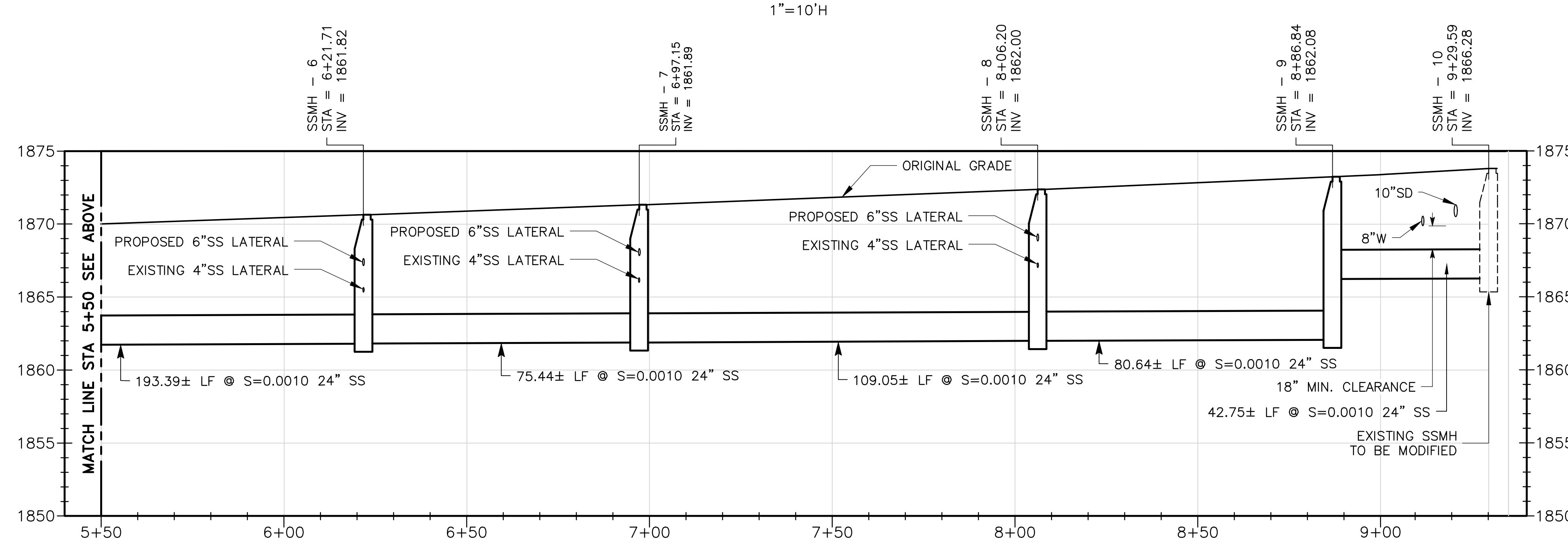
12/22/2020

Scale: 1"=80'



TRUNK SEWER PROFILE 1

SCALE: 1"=40'V
1"=10'H



TRUNK SEWER PROFILE 2

SCALE: 1"=40'V
1"=10'H

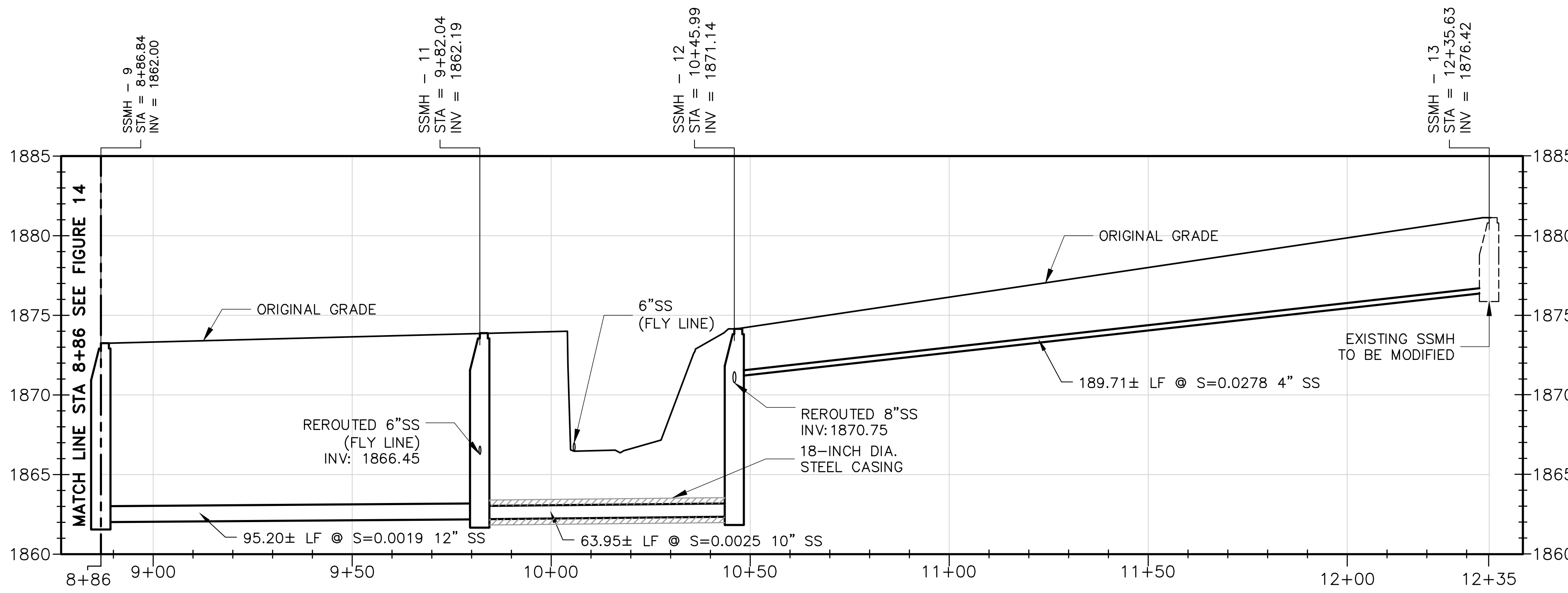
Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 14. Main Street Trunk Sewer Alternative Profile 1 & Profile 2

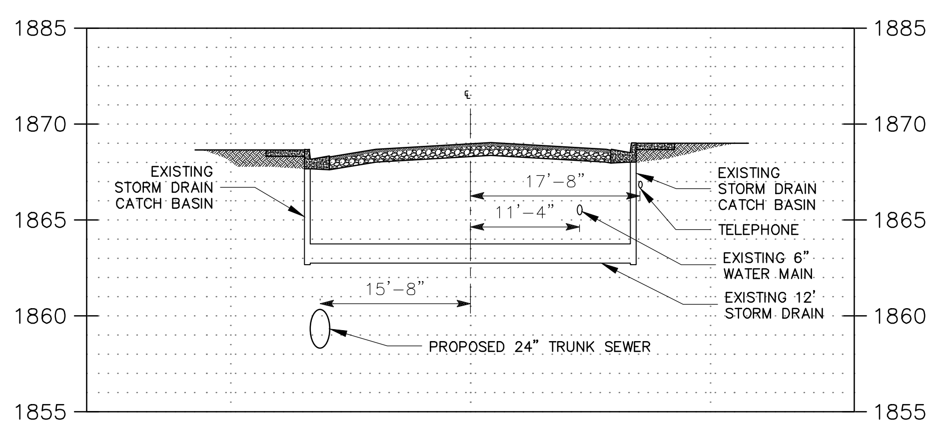
12/22/2020
Scale: As Shown

Dewberry | drakehaglan



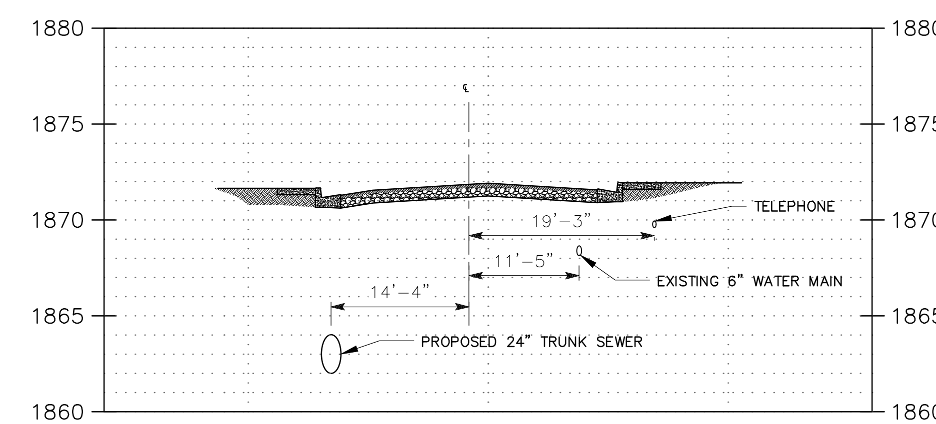
TRUNK SEWER
PROFILE 3

SCALE: 1"=40'V
1"=10'H



SECTION A FIG.13

SCALE: 1"=10'V
1"=20'H



SECTION B FIG.13

SCALE: 1"=10'V
1"=20'H

Dewberry | drake haglan

Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 15. Main Street Trunk Sewer Alternative Profile 3 and Sections

12/22/2020
Scale: As Shown

5.3 Construction Sequence

A preliminary construction sequence is illustrated in Figure 16. Key concepts incorporated within the construction sequence include the following:

a. The existing trunk sewer will remain in service throughout the construction period for the Main Street Alternative. The existing trunk sewer will not be removed from service until the Project is complete.

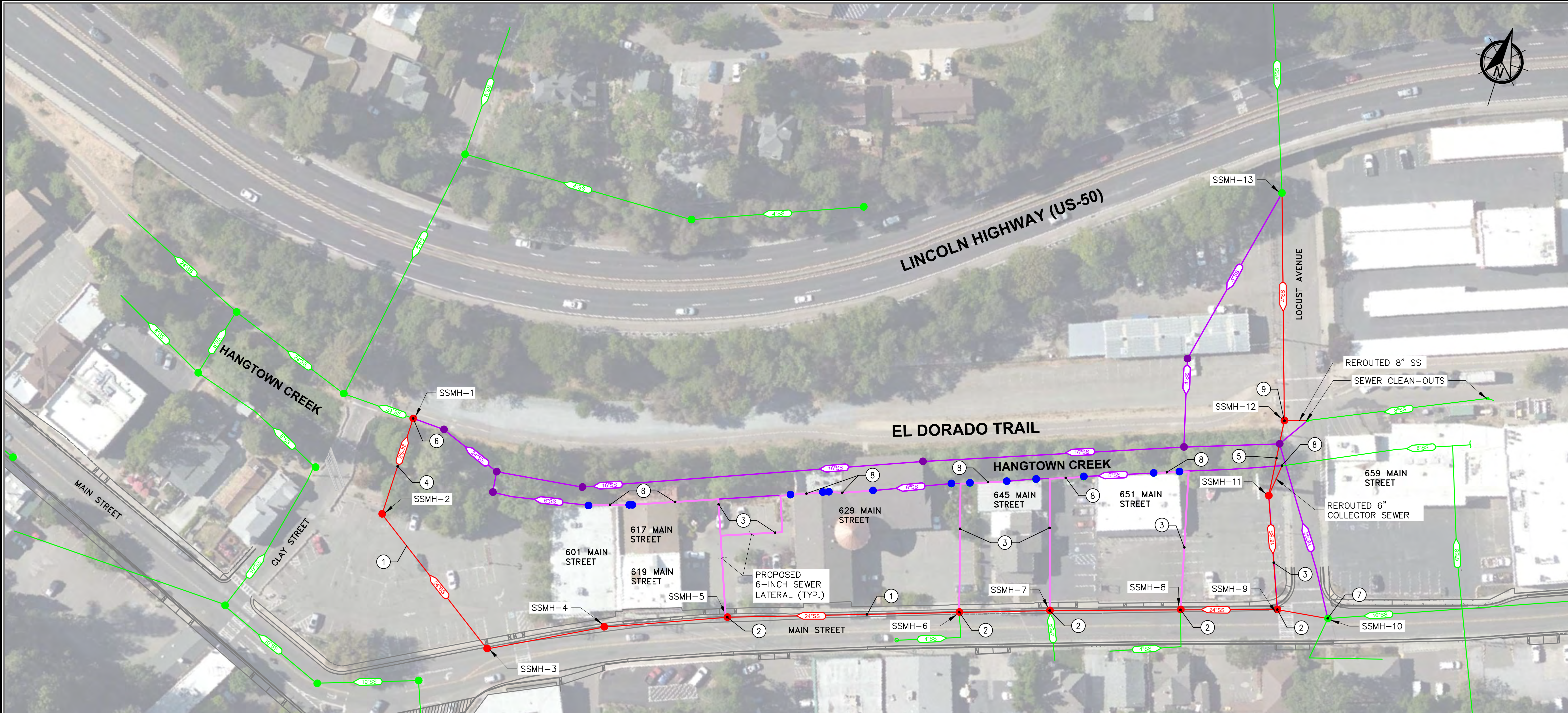
b. The proposed trunk sewer in Main Street will be constructed up to the connections to the existing trunk sewer at Locust Avenue and Clay Street. Stub outs will be provided for future lateral connections. During a shutdown of the existing pipeline, connections to the proposed sewer will be accomplished. Both the existing trunk sewer and the Main Street trunk sewer will then be operational.

c. Laterals will be re-routed incrementally beginning near Locust Avenue and progressing to the west. When the lateral re-routing is complete, a cut over to the new trunk sewer will be initiated.

d. Once all laterals have been re-routed, the connection to the existing trunk sewer at Locust Avenue will be plugged and only the Main Street trunk sewer will be operational.

5.4 Traffic Control

As illustrated in Figure 9, construction of the proposed trunk sewer in Main Street is planned along the northerly curb line between Locust Avenue and a parking area east of Clay Street. With a construction work zone width of approximately 15 ft, the westbound lane of traffic will need to shift south on a temporary basis with the eastbound lane narrowed to allow for two lanes of traffic during construction. A K-rail barrier is recommended to divide the construction zone from the traffic zone with cones used to separate the traffic lanes. A reduced speed limit will be posted through the construction zone with signage alerting motorists to potential delays. A preliminary layout of traffic control devices along Main Street from west of Clay Street to east of Locust Avenue is presented in Figures 17 and 18. Traffic control will be in accordance with the Manual of Uniform Traffic Control Devices. Construction will be scheduled to avoid periods of peak commercial activity along Main Street.



CONSTRUCTION SEQUENCE NOTES:

1. CONSTRUCT 24-INCH TRUNK SEWER BETWEEN SSMH-2 AND SSMH-10. CONNECT TO SSMH-10 DURING A SCHEDULED SHUTDOWN. PLUG CONNECTION TO 24-INCH SEWER.
2. CONSTRUCT STUB-OUTS TO PROPOSED LATERALS.
3. CONSTRUCT 6-IN LATERALS FROM FLOODWALL TO 24-INCH TRUNK SEWER MANHOLES. CONNECT TO MANHOLE STUB.
4. BORE AND JACK CREEK CROSSING BETWEEN SSMH-2 AND SSMH-1.
5. BORE AND JACK CREEK CROSSING BETWEEN SSMH-11 AND SSMH-12.
6. CONNECT TO EXISTING 24-INCH TRUNK SEWER AT SSMH-1 DURING A SCHEDULED SHUTDOWN.
7. REMOVE PLUG AND ALLOW FLOW THROUGH MAIN STREET SEWER
8. RE-ROUTE BUILDING LATERALS AND CONNECT TO 6-INCH LATERALS FROM MAIN STREET. CUT OVER TO NEW LATERALS SEQUENTIALLY BEGINNING AT SSMH-11.
9. CONSTRUCT SSMH-12, CONNECT TO CREEK CROSSING AND CAPTURE FLOW FROM SSMH-13 AND 6-INCH COLLECTOR SEWER

LEGEND

- EXISTING SANITARY SEWER
- EXISTING WATER MAIN
- EXISTING SANITARY SEWER TO BE REROUTED AND REMOVED
- PROPOSED TRUNK SEWER RELOCATION
- PROPOSED 6" SEWER LATERAL
- EXISTING SEWER MANHOLE
- EXISTING BUILDING CONNECTION TO LATERAL
- PROPOSED SEWER MANHOLE
- EXISTING SEWER MANHOLE TO BE REMOVED

Dewberry | drake haglan

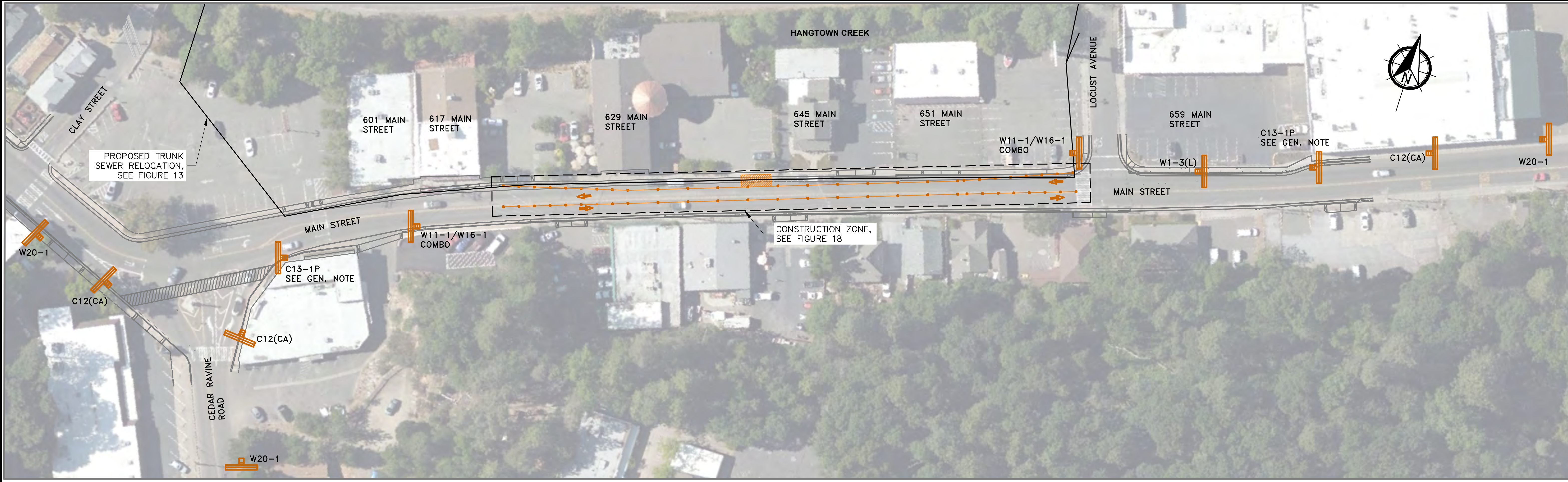
Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 16. Construction Sequence for Main Street Trunk Sewer Alternative

12/22/2020

Scale: 1"=80'



SIGNAGE KEY

W20-1	OR ROAD WORK AHEAD	ROAD WORK AHEAD SIGN
C12(CA)	OR NARROW LANE	NARROW LANE SIGN
C13-1P	OR 25 MPH	25 MPH SIGN
W1-3(L)	OR	REVERSE TURN LANE SIGN
W11-1/W16-1 COMBO	OR SHARE THE ROAD	SHARE THE ROAD SIGN

LEGEND

- PROPOSED TRUNK SEWER RELOCATION
- CONE ALIGNMENT
- WORK AREA
- TRAFFIC DIRECTION

GENERAL NOTES

1. ALL WARNING SIGNS SHALL HAVE A BLACK LEGEND AND BORDER ON AN ORANGE BACKGROUND.
2. SIGNS MAY NOT BE SUBSTITUTED.
3. SIGNS AND DEVICES MUST BE VISIBLE AT 1000'.
4. SHARE THE ROAD SIGNAGE REQUIRED WHEN OUTERMOST LANE PLUS PAVED SHOULDER IS LESS THAN 14'.
5. THE W13-1P(25) SHALL BE USED WHEN THE LANE ADJACENT TO WORK IS LESS THAN 11 FEET AND WHEN THE WORK IS NOT PROTECTED BY A FIXED BARRIER.

Dewberry | drake haglan

Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 17. Typical Traffic Control Plan For Main Street During Construction - 1

12/22/2020

Scale: 1"=80'

SIGNAGE KEY

- W20-1 OR [ROAD WORK AHEAD] — ROAD WORK AHEAD SIGN
- C12(CA) OR [NARROW LANE] — NARROW LANE SIGN
- C13-1P OR [25 MPH] — 25 MPH SIGN
- W1-3(L) OR — REVERSE TURN LANE SIGN
- W11-1/W16-1 COMBO OR [SHARE THE ROAD] — SHARE THE ROAD SIGN

LEGEND

- PROPOSED TRUNK SEWER RELOCATION
- CONE ALIGNMENT
- WORK AREA
- TRAFFIC DIRECTION

POSTED SPEED	BUFFER SPACE	MINIMUM TAPER LENGTHS									MAXIMUM CONE SPACING		SIGN SPACING	LIDG
		10' OFFSET			11' OFFSET			12' OFFSET			LONG.	TAPER & LIDG		
		L	1/2 L	1/3 L	L	1/2 L	1/3 L	L	1/2 L	1/3 L				
		MERGE	SHIFT	SHOULDER	MERGE	SHIFT	SHOULDER	MERGE	SHIFT	SHOULDER				
25	155'	104'	52'	35'	115'	57'	38'	125'	63'	42'	25'	13'	100' TO 200'	94'

GENERAL NOTES

1. ALL WARNING SIGNS SHALL HAVE A BLACK LEGEND AND BORDER ON AN ORANGE BACKGROUND.
2. SIGNS MAY NOT BE SUBSTITUTED.
3. SIGNS AND DEVICES MUST BE VISIBLE AT 1000'.
4. SHARE THE ROAD SIGNAGE REQUIRED WHEN OUTERMOST LANE PLUS PAVED SHOULDER IS LESS THAN 14'.
5. THE W13-1P(25) SHALL BE USED WHEN THE LANE ADJACENT TO WORK IS LESS THAN 11 FEET AND WHEN THE WORK IS NOT PROTECTED BY A FIXED BARRIER.
6. CONES SHOWN ON TEMPLATES ARE ILLUSTRATION PURPOSES ONLY. EXACT NUMBER OF CONES REQUIRED SHALL BE BASED ON CONE SPACING, TAPER LENGTHS, ACTUAL FIELD CONDITIONS.

Dewberry | drakehaglan

Hangtown Creek Sewer Relocation Project

TM4.0 Main Street Trunk Sewer Alternative Conceptual Study

Figure 18. Typical Traffic Control Plan For Main Street During Construction - 2

12/22/2020

Scale: 1"=40'

6.0 SUMMARY OF PROBABLE CONSTRUCTION COSTS FOR MAIN STREET TRUNK SEWER ALTERNATIVE

A summary of the probable construction costs is presented in Table 2 below. Projected costs were developed based on record bid results, outreach to local contractors, and budget estimates/quotations from vendors. Probable construction costs for Hangtown Creek Sewer Relocation Project are projected at $2.06 million including a 20 percent construction contingency.

TABLE 2
HANGTOWN CREEK SEWER RELOCATION PROJECT
SUMMARY OF PROBABLE CONSTRUCTION COSTS

Description	Probable Construction Cost, $
Traffic control	15,000
Pavement removal	40,000
Dewatering	75,000
Trench excavation	50,000
Trench shoring	40,000
Trench backfill/bedding	65,000
Lateral re-routing	90,000
Sewer lateral/collector sewers	40,000
24-inch trunk sewer	350,000
Sewer manholes	145,000
Bore and jack, two locations	750,000
Pavement/sidewalk replacement	60,000
Subtotal	*1,720,000*
Contingency, 20%	340,000
Summary of Probable Construction Costs	**2,060,000**

7.0 DISCUSSION OF ADVANTAGES/DISADVANTAGES OF MAIN STREET TRUNK SEWER ALTERNATIVE

Advantages and disadvantages of the Main Street Alternative vs. the 2014 Draft Relocation Plan are summarized in Table 3 below.

TABLE 3
HANGTOWN CREEK SEWER RELOCATION PROJECT
SUMMARY OF ADVANTAGES AND DISADVANTAGES OF MAIN STREET ALTERNATIVE VERSUS 2014 DRAFT RELOCATION PLAN

Advantages	Disadvantages
• Upon completion, minimal facilities remain within the creek footprint. • Greater accessibility to building sewer laterals. • Construction less susceptible to impacts generated by wet weather. • Less creek crossings required for lateral re-routing. • Can be sequenced to minimize interruptions to commercial sewer service.	• Traffic control required along Main Street during construction. • Greater cost if trunk sewer requires future repair with location under sidewalk/curb vs located in pedestrian trail.

Based on a review of the summary of advantages and disadvantages, the Main Street Alternative represents a feasible option for the City.

8.0 REFERENCES

[1] City of Placerville Hangtown Creek Sewer Main Relocation Project, Project No. 41202, construction drawings prepared by Domenichelli & Associates, June 2014.

[2] *City of Placerville Hangtown Creek Relocation Project, Technical Memorandum 1.0, Existing Conditions* prepared by Dewberry | Drake Haglan, November 2019.

[3] *City of Placerville Hangtown Creek Sewer Relocation Project Technical Memorandum 2.0 Horizontal and Vertical Alignment for Trunk Sewer*, prepared by Dewberry | Drake Haglan, December 2019.

[4] *City of Placerville Hangtown Creek Sewer Relocation Project Technical Memorandum 3.0 Re-Routing of Sewer Laterals*, prepared by Dewberry | Drake Haglan, December 2020.

[5] Hangtown Creek Sewer Main Relocation Project, Placerville, California, Geotechnical Exploration, prepared by ENGEO Incorporated, 15 November 2019.

Appendix A

Geotechnical Report

HANGTOWN CREEK SEWER MAIN RELOCATION PROJECT
PLACERVILLE, CALIFORNIA

GEOTECHNICAL EXPLORATION

SUBMITTED TO
Mr. Dave Richard
Principal Engineer
Drake Haglan and Associates
11060 White Rock Road, Suite 200
Rancho Cordova, CA 95670

PREPARED BY
ENGEO Incorporated

November 15, 2019

PROJECT NO.
16529.000.000

ENGEO
Expect Excellence

ENGEO
Expect Excellence

GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES

Project No.
16529.000.000

November 15, 2019

Mr. Dave Richard
Principal Engineer
Drake Haglan and Associates
11060 White Rock Road, Suite 200
Rancho Cordova, CA 95670

Subject: Hangtown Creek Sewer Main Relocation Project
Locust Avenue
Placerville, California

GEOTECHNICAL EXPLORATION

Dear Mr. Richard:

ENGEO prepared this geotechnical report for Drake Haglan and Associates as outlined in our agreement dated August 22, 2019. We characterized the subsurface conditions at the site to provide the enclosed geotechnical recommendations for design.

Our experience and that of our profession clearly indicate that the risk of costly design, construction, and maintenance problems can be significantly lowered by retaining the design geotechnical engineering firm to review the project plans and specifications and provide geotechnical observation and testing services during construction. Please let us know when working drawings are nearing completion, and we will be glad to discuss these additional services with you.

If you have any questions or comments regarding this report, please call and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

Paul Cottingham, CEG

Jonathan Boland, GE

REGISTERED PROFESSIONAL ENGINEER
JONATHAN BOLAND
No. 2763
GEOTECHNICAL
STATE OF CALIFORNIA

Nicholas Broussard, GE
pc/jb/jf

2213 Plaza Drive • Rocklin, CA 95765 • (916) 786-8883 • Fax (888) 279-2698
www.engeo.com

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

ENGEO prepared this geotechnical report for design of the Hangtown Creek Sewer Main Relocation Project in Placerville, California.

We prepared this report to provide baseline geotechnical data and to characterize the subsurface conditions for design of the sanitary sewer relocation project, as outlined in our agreement dated August 22, 2019. Drake Haglan and Associates authorized ENGEO to conduct the following scope of services:

- Review geologic maps and identify geologic hazards.
- Perform subsurface exploration and laboratory testing to evaluate the subsurface conditions along the project alignment.
- Engineering analysis to provide recommendations for design.
- Preparation of a geotechnical report.

In preparation of this report, we discussed the project with you and reviewed the following documents:

1. Hangtown Creek Sewer Main Relocation Project, Along Main St. (From Clay Street to Locust Avenue), Project Overview, prepared by Drake Haglan and Associates, dated April 16, 2019.
2. As Built Sanitary Sewer Plan and Profile, Caltrans 03-ED-49, 50 KP 23.7, 26.9-29.1, Sheet No. 152, prepared by Dokken Engineering, dated February 15, 2012.

This report was prepared for the exclusive use of our client and their consultants for design of this project. In the event that any changes are made in the character, design or layout of the sewer relocation project, we must be contacted to review the conclusions and recommendations contained in this report to evaluate whether modifications are recommended. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without our express written consent.

1.2 PROJECT LOCATION AND DESCRIPTION

Figure 1 displays a Site Vicinity Map. The sewer main relocation project is located on Main Street, Locust Street, and Clay Street in Placerville, California. Figure 2 shows existing sanitary sewer alignments, proposed new sewer pipelines, and our exploratory locations.

As depicted in the referenced Project Overview, the project involves the relocation and replacement of existing sewer pipelines with new facilities (Figure 2). Pipeline depths are expected to vary; however, the proposed replacement line tie-in point with the existing sewer will be approximately 16 feet below the existing ground surface.

The existing sanitary sewer lines to be demolished are indicated on Figure 2 and consist of:

- A 16- to 24-inch-diameter line north of Main Street and adjacent to Hangtown Creek, approximately from Locust Avenue to Clay Street.

- A 16-inch-diameter line beneath Locust Avenue from Main Street to El Dorado Trail.

- A 4-inch-diameter line from Hangtown Creek north to Locust Avenue, approximately 50 feet south of US Highway 50.

The project is to include the installation of approximately 2,100 linear feet of new 4- to 24-inch-diameter sanitary sewer lines. The new pipelines will consist of:

- A 4-inch-diameter sewer beneath Locust Avenue from approximately 50 feet south of US Highway 50 to Main Street (and crossing Hangtown Creek).

- 4-inch-diameter sewer services to structures north of Main Street.

- An 18- and 24-inch-diameter sewer beneath Main Street from Locust Avenue to Clay Street.

- A 24-inch-diameter sewer beneath Clay Street from Main Street to Hangtown Creek and extending approximately 50 feet west along Hangtown Creek.

- A 24-inch-diameter sewer crossing beneath Hangtown Creek to tie in with an existing manhole that includes a 24-inch-diameter sewer beneath El Dorado Trail.

Jack-and-bore trenchless installations are expected to be used where the pipeline alignment passes beneath Hangtown Creek west of Clay Street. The remaining portions of the alignment are anticipated to be “open-cut” trenches, which will be backfilled with engineered fill. Figure 2 shows the approximate location of the proposed alignment, the planned jack-and-bore location, as well as our exploratory boring locations.

According to elevations obtained from Google Earth (WGS 84) and the United States Geological Survey Topographic Map of the Placerville Quadrangle, 2015, site topography slopes gently towards Hangtown Creek, which flows generally from east to west across the project area. Site elevations range from Elevation 1,872 feet (Datum: WGS 84), in the northeast to Elevation 1,854 feet in the western portion of the project area.

2.0 FINDINGS

2.1 FIELD EXPLORATION

We observed the drilling of five borings at the locations shown on the Site Plan, Figure 2. We performed our field exploration on September 26, 2019, and September 27, 2019. An ENGEO representative observed the drilling and logged the subsurface conditions at each location. We retained a truck-mounted CME 75 drill rig and crew to advance the borings using both 6-inch-diameter solid-flight auger and rock-coring methods using an HQ core bit and drill rods (HQ includes a 3.77-inch outer diameter bit and 3.5-inch outer diameter rods). The borings were advanced with solid-flight auger to depths ranging from 10 to 14 feet below existing grade, at which point rock coring commenced and continued to terminal depths ranging from 19½ to

20½ feet below existing grade. The borings were permitted and backfilled in accordance with the requirements of El Dorado County.

PHOTO 2.1-1: Drilling 1-B1

PHOTO 2.1-2: Typical Rock Core

We obtained bulk soil samples from drill cuttings, retrieved disturbed soil samples at various intervals in the borings using 3-inch-OD Modified California Sampler, and obtaining continuous rock cores.

The standard penetration resistance blow counts were obtained by dropping a 140-pound hammer through a 30-inch free fall. The 2½-inch I.D. samples were obtained using a Modified California Sampler driven 18 inches and the number of blows was recorded for each 6 inches of penetration. Unless otherwise indicated, the blows per foot recorded on the boring log represent the accumulated number of blows to drive the last 1 foot of penetration; the blow counts have not been converted using any correction factors. When sampler driving was difficult, penetration was recorded only as inches penetrated for 50 hammer blows.

We used the field logs to develop the report logs in Appendix A. The logs depict subsurface conditions at the exploration locations for the date of exploration; however, subsurface conditions may vary with time.

2.2 SITE HISTORY

We reviewed topographic maps of the site dating back prior to 1891 and aerial photographs dating back to 1946. Main Street and Clay Street are mapped dating back prior to 1891 near Hangtown Creek; Locust Street first appeared on the 1947 topographic map. Cedar Ravine is also shown on the 1947 map draining northward to Hangtown Creek near Clay Street. Cedar Ravine appears to have been subsequently filled near Hangtown Creek and Clay Street.

2.3 GEOLOGY AND SEISMICITY

2.3.1 Geology

The site is located within the Sierra Nevada metamorphic belt of the Sierra Nevada Geomorphic Province. The Sierra Nevada is a nearly 400-mile-long, northwest-aligned tilted fault block, situated between Basin and Range on the east and the Great Valley on the west. The metamorphic belt is part of the prebatholithic subjacent rocks of the northern Sierra Nevada that consist of folded and faulted metasedimentary and metavolcanic rocks of Paleozoic and Mesozoic ages. As shown in Figure 3, the site is underlain by the Paleozoic Calaveras Formation. The rocks of the Calaveras Formation consist of Upper Paleozoic metamorphic rocks that include meta-volcanics, phyllite, slate, thin-bedded chert, schist, greywacke, and scattered lenses of limestone (Loyd et al. 1983, Wagner et al. 1981). The degree of weathering within the Calaveras Complex is highly variable and is dependent on fracturing and mineralogy. The geologic unit observed at the site is composed of variably fractured meta-sedimentary phyllite, which is a low-grade foliated metamorphic rock characterized by the presence of very fine-grained mica minerals.

According to the August 22, 2018, El Dorado County Asbestos Review Areas map, the project alignment is within the quarter mile buffer for the area designated to be More Likely to Contain Naturally Occurring Asbestos (NOA). We discuss this further in Section 3.2 and show the site relative to the Asbestos Review Areas map in Figure 4.

2.3.2 Seismicity

The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone and no known surface expression of active faults is believed to exist within the site. The site does lie within a seismically active region and there are several faults in the area that are considered active. The following table summarizes the distances to mapped, active regional faults and estimated magnitudes with approximately 50 miles. We used the USGS Spatial Query tool that is based on USGS 2008 National Seismic Hazard Maps used to develop the 2016 California Building Code (CBC) seismic parameters. Refer to Figure 5 for a Regional Faulting and Seismicity map that shows known USGS faults and former earthquake epicenters and magnitudes.

TABLE 2.3.2-1: Active Faults Capable of Producing Significant Ground Shaking at the Site (50-mile radius)

FAULT NAME	APPROXIMATE DISTANCE FROM SITE (MILES)	MAXIMUM MOMENT MAGNITUDE
West Tahoe	41	7.1
North Tahoe	48	6.6

* Average of Ellsworth and Hanks maximum magnitudes.

2.4 SURFACE CONDITIONS

We observed the following surface conditions at the time of our field exploration:

- Paved two-lane roadways (Main Street, Locust Street, and Clay Street) with stop signs at intersections.
- Existing mixed-use residential and commercial structures fronting on the streets.

- Concrete sidewalks and paved parking areas.
- Overhead power lines located along surface streets.
- Numerous trees and landscape areas flanking the roadways and structures.
- Hangtown Creek and associated riparian corridor crosses the project area and flows east to west.
- Paved El Dorado Trail and flanking greenbelt to the north of Hangtown Creek is oriented roughly east-west.

PHOTO 2.4-1: Typical Street Conditions, Looking West Along Main Street

PHOTO 2.4-2: Typical Parking Lot, Looking East, North of Main Street

2.5 SUBSURFACE CONDITIONS

Based on the exploratory borings, the subsurface conditions include three separate geologic units; (1) existing fill, (2) residual soil, and (3) Calaveras Formation phyllite. During the subsurface exploration, we observed the material from the borings/rock cores and did not observe evidence of NOA-containing bedrock. Below is a more detailed description of the subsurface conditions encountered in our borings.

<u>Existing Fill</u>: Fill was encountered in all of our exploratory borings and ranged in thickness from 2½ to 13 feet. The existing fill generally consisted of medium dense clayey sand and stiff clay with varying sand and gravel content. Boring 1-B4 encountered fill to approximately 13 feet below ground surface with very loose clayey gravel (blow count of 1) below the groundwater table.

<u>Residual Soil</u>: Native soil underlying existing fill generally consisted of reddish brown to dark reddish brown, very stiff to hard, sandy clay and medium dense clayey sand with minor gravel content. The clay encountered was of low plasticity with some decomposed to intensely weathered bedrock clasts.

<u>Calaveras Formation phyllite (Paleozoic)</u>: The rock we encountered in our explorations was Paleozoic-age Calaveras Formation, which contains various rock types and is highly variable in strength and weathering. We encountered aphanitic to fine-grained, olive to black phyllite, which ranged in strength from residual soil to weak. The rock was intensely to moderately weathered,

and intensely fractured along foliation joints dipping from approximately 60 degrees to approximately 85 degrees. Fractures were not healed. The rock was also prone to mechanical breaks. Core recovery during exploration was commonly less than 100%. Rock Quality Designation (RQD) was 0 in all runs. Photographs of select rock cores and field coring operations are included below.

PHOTO 2.5-1: Core from Boring 1-B1

PHOTO 2.5-2: Core from Boring 1-B2

PHOTO 2.5-3: Core from Boring 1-B3

PHOTO 2.5-4: Core from Boring 1-B5

Consult the Site Plan, Figure 2, and exploration logs for specific subsurface conditions at each location. We include our exploration logs in Appendix A. The boring logs contain the soil/rock type, color, consistency, and visual classification in general accordance with the Unified Soil Classification System and International Society for Rock Mechanics (ISRM) conventions. The logs graphically depict the subsurface conditions encountered at the time of the exploration.

2.6 GROUNDWATER CONDITIONS

We observed groundwater in Borings 1-B3 and 1-B4 at depths ranging from 8 to 10½ feet below existing grades. It should be noted that in some locations, we could not determine the presence of groundwater due to the circulation of drilling water as part of the rock coring operations.

Fluctuations in the level of groundwater may occur due to variations in rainfall, irrigation practice, flows in nearby creeks, and other factors not evident at the time measurements were made.

Environmental sampling and testing of groundwater was not a part of our current scope of work. However, we reviewed GeoTracker, a website maintained by the State of California Water Resources Control Board, which identifies sites that impact, or have the potential to impact, groundwater water quality. The database identified a former leaking underground storage tank site at 659 Main Street (northeast corner of Main and Locust), which is identified as Case T0601700030. The case was closed in 1991; however, in 1996, a site assessment was performed to delineate the extent of soil and groundwater contamination that resulted from the former leaking tank (Upgradient, 1996). The site assessment report indicated that hydrocarbon contamination was present in soil and groundwater south of the former underground storage tank with a groundwater flow gradient towards the west. The groundwater contamination, located at a reported depth of 6 feet, was in the gasoline and diesel range. Analytical laboratory test results on the groundwater sampled obtained from the boring closest to Locust Avenue, SB-6, was non-detect for benzene, toluene, Ethyl-benzene, total Xylenes, TPHg, and TPHd. (Upgradient, 1996). Based on our review of the database, it is our opinion that there are no active or open cases in the immediate vicinity of the alignment.

2.7 LABORATORY TESTING

We performed laboratory tests on selected soil and rock samples to evaluate some of their engineering properties. For this project, we performed moisture content, sieve analysis, unconfined compression, plasticity index, resistance value, and limited soil corrosion potential testing. Moisture contents are recorded on the boring logs in Appendix A; other laboratory data is included in Appendix B.

3.0 CONCLUSIONS

From a geotechnical engineering viewpoint, in our opinion, the proposed project may be designed as planned, provided the geotechnical recommendations in this report are properly incorporated into the design plans and specifications.

The primary geotechnical issues related to the installation of the proposed sewer lines are excavatability, Naturally Occurring Asbestos (NOA), trench stability, shallow groundwater, and bore-and-jack conditions at the Hangtown Creek crossing.

3.1 EXCAVATABILITY

Based on the subsurface conditions observed in our borings, we evaluated the site for excavatability considerations during construction. Due to the degree of weathering and strength of the rock units encountered, it is our opinion that excavations for the proposed depths of the sewer lines will be achievable with moderate effort using conventional excavation equipment. Based upon our observations and experience, we provide the following conclusions regarding excavation resistance at the site:

1. Conventional excavation equipment will likely be able to excavate the soil deposits.

2. Moderate to large excavation equipment such as a CAT 235 or larger excavator will likely be able to excavate through the weathered phyllite.

We provide the above excavatability information as baseline data for the project and for general planning purposes.

3.2 NATURALLY OCCURRING ASBESTOS

We do not anticipate NOA within the rock type encountered (phillite) and we did not observe NOA-containing materials during our subsurface exploration. However, the site is mapped within an area designated as “More Likely to Contain Asbestos” by El Dorado County. Based on this designation, the project alignment will be subject to an Asbestos Dust Mitigation Plan (ADMP) during project excavations, as required by El Dorado County Air Quality Management District. Details regarding County requirements for ADMPs may be found at the El Dorado County website: https://www.edcgov.us/Government/AirQualityManagement/Documents/ADMP.pdf.

El Dorado County Air Quality Management Rule 223-2 requires activities to reduce asbestos dust created from earth-moving activities. The ADMP must be prepared, submitted, approved and implemented when more than 20 cubic yards of earth will be moved at all sites identified as being in an Asbestos Review Area. The ADMP specifies measures that will be implemented to minimize the emissions of asbestos-laden dust. Though not included in the scope of this geotechnical report, we would be glad to discuss preparation of an ADMP for the construction phase of the project with you and the team when needed.

3.3 TRENCH STABILITY

Trench stability will need to be considered for design of temporary shoring. Our borings indicate that the subsurface conditions along the alignment vary and include existing fill, residual soil, and bedrock. Fill was encountered in all of our exploratory borings and ranged in thickness from 2½ to 13 feet; fill thickness, composition and consistency is expected to vary. Fill conditions in Boring 1-B4 included very loose clayey gravel (blow count of 1) below the groundwater table. Consult the exploration logs for fill descriptions at other locations. We present temporary shoring recommendations in Section 4.

3.4 SHALLOW GROUNDWATER

Shallow groundwater will likely be encountered and temporary construction dewatering should be anticipated. Groundwater can impede construction and affect excavation stability. Where trenching is anticipated below or near the groundwater, dewatering will likely be necessary.

As discussed in Section 2.6, groundwater was encountered in two of our explorations at depths of approximately 8 and 10½ feet below grade. It should be noted that in some locations, we could not determine the presence of groundwater due to the circulation of drilling water as part of the rock coring operations. Additionally, fluctuations in the level of groundwater may occur due to variations in rainfall, irrigation practice, and other factors.

Sump pumps in the excavations may be adequate for temporary dewatering; however, the selection of dewatering methods should be left to the contractor’s judgement. Depending upon environmental permitting requirements, it may or may not be possible to discharge collected groundwater to the city of Placerville storm drain system. Additional sampling and testing of the groundwater may be required to obtain the appropriate discharge permit. Though no active environmental sites are identified along the project alignment (refer to Section 2.6), the owner and contractor should be aware of the closed underground tank site located at 659 Main Street.

3.5 JACK-AND-BORE

Jack-and-bore trenchless installations are expected to be used where the pipeline alignment passes beneath Hangtown Creek west of Clay Street. Based on the subsurface conditions encountered, it is our opinion that the jack-and-bore method is feasible at this location. Weathered bedrock was encountered at a depth of 9½ feet in 1-B5, just north of Hangtown Creek. The jack-and-bore equipment selected should consider boring through the bedrock. We present recommendations for jack-and-bore installation in Section 4.2.

3.6 SOIL CORROSION POTENTIAL

We obtained a representative rock sample and submitted to a qualified analytical lab for determination of pH, minimum resistivity, sulfate content, and chloride content. The rock sample was crushed and processed through the #8 sieve. The results are included in Appendix B and summarized in the table below.

TABLE 3.6-1: Corrosivity Test Results

SAMPLE LOCATION	DEPTH (FEET)	PH[1]	MINIMUM RESISTIVITY[1] (OHMS-CM)	CHLORIDE[2] (PPM)	SULFATE[3] (PPM)
1-B1	12½	6.37	5,630	2.6	15.5

(1) Per CA DOT Test #643; (2) Per CA DOT Test #422; (3) Per CA DOT Test #417

The 2019 CBC references the 2014 American Concrete Institute Manual, ACI 318-14, Section 19.3.1 for concrete durability requirements. ACI Table 19.3.1.1 provides exposure categories and classes and Table 19.3.2.1 provides requirements for concrete in contact with soil based upon the exposure class. In accordance with these ACI tables, the soils are categorized as being within S0 sulfate exposure class. Considering a S0 sulfate exposure class, the code requires a minimum compressive strength of 2,500 psi. It should be noted, however, that the project's design requirements for concrete may result in more stringent concrete specifications.

Laboratory tests on representative soil samples from the site indicate a chloride concentration in soil of less than 50 ppm. ACI Table 19.3.1.1 provides exposure categories for corrosion protection of reinforcement and references sources of chlorides from deicing chemicals, salt, brackish water, and seawater. Typical chloride concentrations for seawater are about 19,200 ppm and for brackish water may be in the range of 500 to 5,000 ppm. Since the chloride test results from the site are substantially lower than that of seawater or brackish water, we recommend an exposure class of C0 or C1 depending on the location of the structural element (i.e. protected from moisture or exposed to moisture).

According to the National Association of Corrosion Engineers' book titled *Corrosion Basics an Introduction*, the resistivity results indicate the soils are corrosive to highly corrosive to buried metal piping (Roberg, 2006). Values tested for chloride do not pose a significant impact to metals or concrete.

If desired to investigate this further, we recommend a corrosion consultant be retained to evaluate if specific corrosion recommendations are advised for the project.

3.7 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. The common secondary seismic hazards include ground shaking, and ground lurching. Based on geologic, topographic, and subsurface data, the risk of regional subsidence or uplift, soil liquefaction, lateral spreading, landslides, tsunamis, flooding or seiches is considered low to negligible at the site, in our opinion.

Since there are no known active faults crossing the site, and it is not located within an Earthquake Fault Special Study Zone, it is our opinion that ground rupture is unlikely at the site.

An earthquake of moderate to high magnitude generated within the Northern California region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, the project should be designed using sound engineering judgement and the applicable California Building Code (CBC) requirements, as a minimum.

3.8 2019 CBC SEISMIC DESIGN PARAMETERS

The 2019 CBC utilizes design criteria set forth in the 2016 ASCE 7 Standard. Based on the subsurface conditions encountered, we characterized the site as Site Class B in accordance with the 2019 CBC. We provide the 2019 CBC seismic design parameters in the Table below, which include design spectral response acceleration parameters based on the mapped Risk-Targeted Maximum Considered Earthquake (MCER) spectral response acceleration parameters.

TABLE 3.8-1: 2019 CBC Seismic Design Parameters, Latitude: 38.729345° **Longitude:** -120.794838°

PARAMETER	VALUE
Site Class	B
Mapped MCE_R Spectral Response Acceleration at Short Periods, S_S (g)	0.44
Mapped MCE_R Spectral Response Acceleration at 1-second Period, S_1 (g)	0.21
Site Coefficient, F_A	0.9
Site Coefficient, F_V	0.8
MCE_R Spectral Response Acceleration at Short Periods, S_{MS} (g)	0.40
MCE_R Spectral Response Acceleration at 1-second Period, S_{M1} (g)	0.17
Design Spectral Response Acceleration at Short Periods, S_{DS} (g)	0.27
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	0.11
Mapped MCE Geometric Mean (MCE_G) Peak Ground Acceleration, PGA (g)	0.19
Site Coefficient, F_{PGA}	0.9
MCE_G Peak Ground Acceleration adjusted for Site Class effects, PGA_M (g)	0.17

4.0 RECOMMENDATIONS

We provide the following geotechnical recommendations for design of the project.

4.1 TRENCH BACKFILL

Utility trenches and excavations should be constructed in accordance with El Dorado County standards and recommendations provided in this report, as appropriate. Where conflict occurs, please consult with the Geotechnical Engineer for clarification.

4.1.1 Bedding and Initial Pipe Zone Backfill

To mitigate water flow into open graded granular bedding and pipe zone backfill, we recommend encapsulating the granular bedding in non-woven 4-ounce filter fabric to prevent fines migration. Additionally, to prevent water from flowing along the granular bedding, we recommend slurry cutoff plugs encapsulating the pipe and extending into the native soil or rock; the cut-off plugs should be placed approximately every 100 feet along the sewer alignment.

As an alternative to granular bedding, well-graded granular material such as Caltrans Class 2 aggregate base (AB) or controlled low strength material (CLSM) can be used. AB should be compacted to a minimum of 90 percent relative compaction. CLSM should conform with Caltrans Standard Specifications (Section 19-3.02E and 19-3.02G). The CLSM should be placed to avoid segregation of the backfill and to avoid floating or shifting of the underground utilities. Following encasement, allow adequate curing time of the slurry cement/CLSM prior to placement and compaction of additional trench backfill.

4.1.2 Intermediate Zone Backfill – Trench Zone

4.1.2.1 Acceptable Backfill Material

Onsite soil and rock is suitable as intermediate zone backfill (i.e. material placed between the pipe zone backfill and the ground surface) provided it is processed to remove concentrations of organic material, debris, and particles greater than 3 inches in maximum dimension. The maximum particle size for trench backfill is 3 inches per El Dorado County standards.

Fill within 18 inches of finished pavement subgrade should not contain significant concentrations of expansive clay and should have an Expansion Index of less than 50, as evaluated by an ENGEO field representative.

Imported fill materials should meet the above requirements and have an Expansion Index less than 50 and at least 20 percent passing the No. 200 sieve. Allow ENGEO to sample and test proposed imported fill materials at least 5 days prior to delivery to the site.

4.1.2.2 Backfill Placement and Compaction

Place and compact trench backfill as follows:

1. Trench backfill should have a maximum particle size of 3 inches.

2. Moisture condition trench backfill at least 1 percentage point above the optimum moisture content. Moisture condition backfill outside the trench.

3. Place fill in loose lifts not exceeding 8 inches in thickness;
   and

4. Compact fill to a minimum of 90 percent relative compaction (ASTM D1557). Compact the upper 6 inches below the pavement section to 95 percent relative compaction (ASTM D1557).

Jetting of backfill is not an acceptable means of compaction. We may allow thicker loose lift thicknesses based on acceptable density test results, where increased effort is applied to rocky fill, or for the first lift of fill over pipe bedding.

Where fill or subgrade materials contain more than 30 percent rock retained on a ¾-inch sieve, a performance specification should be used to evaluate compaction. For this condition, we recommend a maximum loose lift thickness of 12 inches. Moisture condition rocky fill such that the moisture content of the matrix soil (minus ¾-inch material) is at or slightly above the optimum moisture content evaluated by visual/manual methods. Compact each lift of rocky fill with at least six passes and eight passes of a Caterpillar 320 or larger excavator with a sheepsfoot wheel attachment for 90 percent and 95 percent relative compaction, respectively. We can develop other performance standards for different compaction equipment.

4.2 TEMPORARY SHORING

Temporary shoring may be required at the subject site based on the anticipated pipe invert depths. The contractor is responsible for evaluating soil/rock conditions and constructing temporary excavations in accordance with OSHA requirements. For planning purposes, we provide the following OSHA information regarding temporary slopes. In general, the soil (fill and native) encountered in our explorations would be considered “Type B” or “Type C” soil. The bedrock encountered could be considered “stable rock” or may be so jointed that a “Type A” classification is more appropriate.

TABLE 4.2-1: OSHA Technical Manual Table V:2-1. Allowable Slopes (excavations less than 20 feet) *

SOIL TYPE	CHARACTERISTICS	HEIGHT:DEPTH RATIO
Stable Rock	Rock that can be excavated with vertical sides and remain intact while exposed.	Vertical
Type A	Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot (tsf); commonly includes: clay, silty clay, sandy clay	¾:1
Type B	Cohesive soils with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf; commonly includes: angular gravel; silt; previously disturbed soils	1:1
Type C	Cohesive soils with an unconfined compressive strength of 0.5 tsf or less; commonly includes: granular soils such as gravel, sand and loamy sand, submerged soil, soil from which water is freely seeping, and submerged rock that is not stable	1½:1

*For more detail, refer to the most current OSHA Technical Manual.

The specific choice of shoring should be left to the contractor’s judgment since economic considerations and/or the individual contractor’s construction experience may determine which method is more economical and/or applicable. Excavations greater than 4 feet in depth could be temporarily shored as necessary using trench shields appropriately designed by a qualified registered engineer. Variation in hydrostatic pressures or surcharges may require an increase in design pressures and distribution. The design of the shoring should be sufficiently rigid to prevent detrimental movement of the temporary shoring and possible damage of pavements, sidewalks, adjacent utilities, or other structural improvements.

Excavated soils, construction materials or other items imposing a surcharge should be stockpiled at least 20 feet away from the edge of excavations to reduce potential adverse effect on slope or trench stability. We recommend that no vertical trench excavations be left open overnight without adequate shoring. Once shoring has been removed, the contractor should backfill the excavation to within 4 feet of the ground surface before the end of the day.

Surcharge loads from structures and vehicles should be included in shoring design if the surcharge loading is situated within 10 feet of the top of the trench or above a 1:1 line of projection extending from the bottom of the trench, whichever is farther. The surcharge should be taken as one-half of any vertical surcharge loads and should be applied as a uniform lateral load. A minimum lateral surcharge load equal to 72 psf, as prescribed in the Caltrans Trenching and Shoring Manual, should be considered for traffic loading, where applicable.

4.3 JACK-AND-BORE

The planned jack-and-bore will cross beneath Hangtown Creek west of Clay Street. Jack-and-bore methods involve advancing a pipeline using auger drilling while horizontally jacking the pipeline into place as the auger hole advances. The jacking and receiving pits may extend approximately 20 feet below grade depending on the design depth of the pipeline. Jack-and-bore design and construction should be performed by an experienced specialty contractor that can reliably maintain line and grade for the pipeline as well as avoid impacts to Hangtown Creek and nearby surface improvements.

For bore-and-jack installation, jacking and receiving shafts should be designed to resist the lateral earth pressures from adjoining soil and rock and from any surcharge loads. For design of the shaft bracing, use 50 pcf equivalent fluid density for active earth pressure and 80 pcf equivalent fluid density for at-rest earth pressure; these earth pressures assume a drained condition. Jacking forces for utility installation may be resisted by passive soil equivalent fluid pressure of 300 pcf up to a maximum value of 3,000 psf.

Dewatering, if needed, should be performed in accordance with the recommendations of Section 4.2.

4.4 PIPE DESIGN

The sewer pipe should be designed to resist loads imposed from overlying soil cover and from vehicle or construction traffic. Soil loads may be calculated using a total unit weight of 120 pounds pcf and a buoyant unit weight of 60 pcf.

The pipeline, manholes, and junction boxes should be designed for the buoyancy effects of shallow groundwater level; it is recommended that the designer consider groundwater level at this site as high as 5 feet below the ground surface. Where buoyancy effects are determined to be high, concrete collars or tie downs should be used to resist uplift.

5.0 PAVEMENT DESIGN

We obtained a representative bulk sample of the surface soil from boring 1B-2 and performed an R-value test to provide data for pavement design of the open cut trench areas. The results of the test are included in Appendix B and indicate an R-value of 69. Based on our explorations, and because pavement subgrade soil will likely vary along the roadway alignments, it is our opinion that an R-value of 35 may be applicable for design.

The El Dorado County Underground Trench Detail STD. Plan 119 shows a structural section minimum of 3 inches of asphalt concrete over 8 inches aggregate base. Using an R-value of 35, the County minimum is adequate for a Traffic Index (TI) of up to 6.0 based on Topic 633 of the Caltrans Highway Design Manual (including the asphalt factor of safety). The project Civil Engineer should confirm this TI is acceptable.

6.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report presents geotechnical recommendations for design of the improvements discussed in Section 1.3 for the Hangtown Creek Sewer Main Relocation Project, Placerville project. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations, if any. It is the responsibility of the owner to transmit the information and recommendations of this report to the appropriate organizations or people involved in design of the project, including but not limited to developers, owners, buyers, architects, engineers, and designers. The conclusions and recommendations contained in this report are solely professional opinions and are valid for a period of no more than 2 years from the date of report issuance.

We strived to perform our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed in the area; no warranty is expressed or implied. There are risks of earth movement and property damages inherent in building on or with earth materials. We are unable to eliminate all risks; therefore, we are unable to guarantee or warrant the results of our services.

This report is based upon field and other conditions discovered at the time of report preparation. We developed this report with limited subsurface exploration data. We assumed that our subsurface exploration data are representative of the actual subsurface conditions across the site. Considering possible underground variability of soil and groundwater, additional costs may be required to complete the project. We recommend that the owner establish a contingency fund to cover such costs. If unexpected conditions are encountered, ENGEO must be notified immediately to review these conditions and provide additional and/or modified recommendations, as necessary.

Our services did not include soil volume change factors, flood potential, or a geohazard exploration. In addition, our geotechnical exploration did not include work to determine the existence of possible hazardous materials. If any hazardous materials are encountered during construction, the proper regulatory officials must be notified immediately.

This document must not be subject to unauthorized reuse, that is, reusing without written authorization of ENGEO. Such authorization is essential because it requires ENGEO to evaluate the document's applicability given new circumstances, not the least of which is passage of time.

Actual field or other conditions will necessitate clarifications, adjustments, modifications or other changes to ENGEO's documents. Therefore, ENGEO must be engaged to prepare the necessary clarifications, adjustments, modifications or other changes before construction activities commence or further activity proceeds. If ENGEO's scope of services does not include on-site construction observation, or if other persons or entities are retained to provide such services, ENGEO cannot be held responsible for any or all claims arising from or resulting from the performance of such services by other persons or entities, and from any or all claims arising from or resulting from clarifications, adjustments, modifications, discrepancies or other changes necessary to reflect changed field or other conditions.

We determined the lines designating the interface between layers on the exploration logs using visual observations. The transition between the materials may be abrupt or gradual. The exploration logs contain information concerning samples recovered, indications of the presence of various materials such as clay, sand, silt, rock, existing fill, etc., and observations of groundwater encountered. The field logs also contain our interpretation of the subsurface conditions between sample locations. Therefore, the logs contain both factual and interpretative information. Our recommendations are based on the contents of the final logs, which represent our interpretation of the field logs.

SELECTED REFERENCES

California Building Standards Commission, (2019), California Building Code 2019, Volumes 1 and 2. Sacramento, California.

Dokken Engineering, As Built Sanitary Sewer Plan and Profile, Caltrans 03-ED-49,50 KP 23.7, 26.9-29.1, Sheet No. 152, dated February 15, 2012, Project No. 03-3555U4.

Drake Haglan and Associates, Hangtown Creek Sewer Main Relocation Project, Along Main St. (From Clay St. to Locust Ave.), Project Overview, dated April 16, 2019.

El Dorado County, Asbestos Review Areas (Map), Western Slope, County of El Dorado, State of California, January 22, 2015.

Loyd, R.C., Anderson, T.P., and Bushnell, M.M., 1983, Mineral Land Classification of the Placerville 15' Quadrangle, El Dorado and Amador Counties, California, California Department of Conservation Division of Mines and Geology, Open-File Report 83-29.

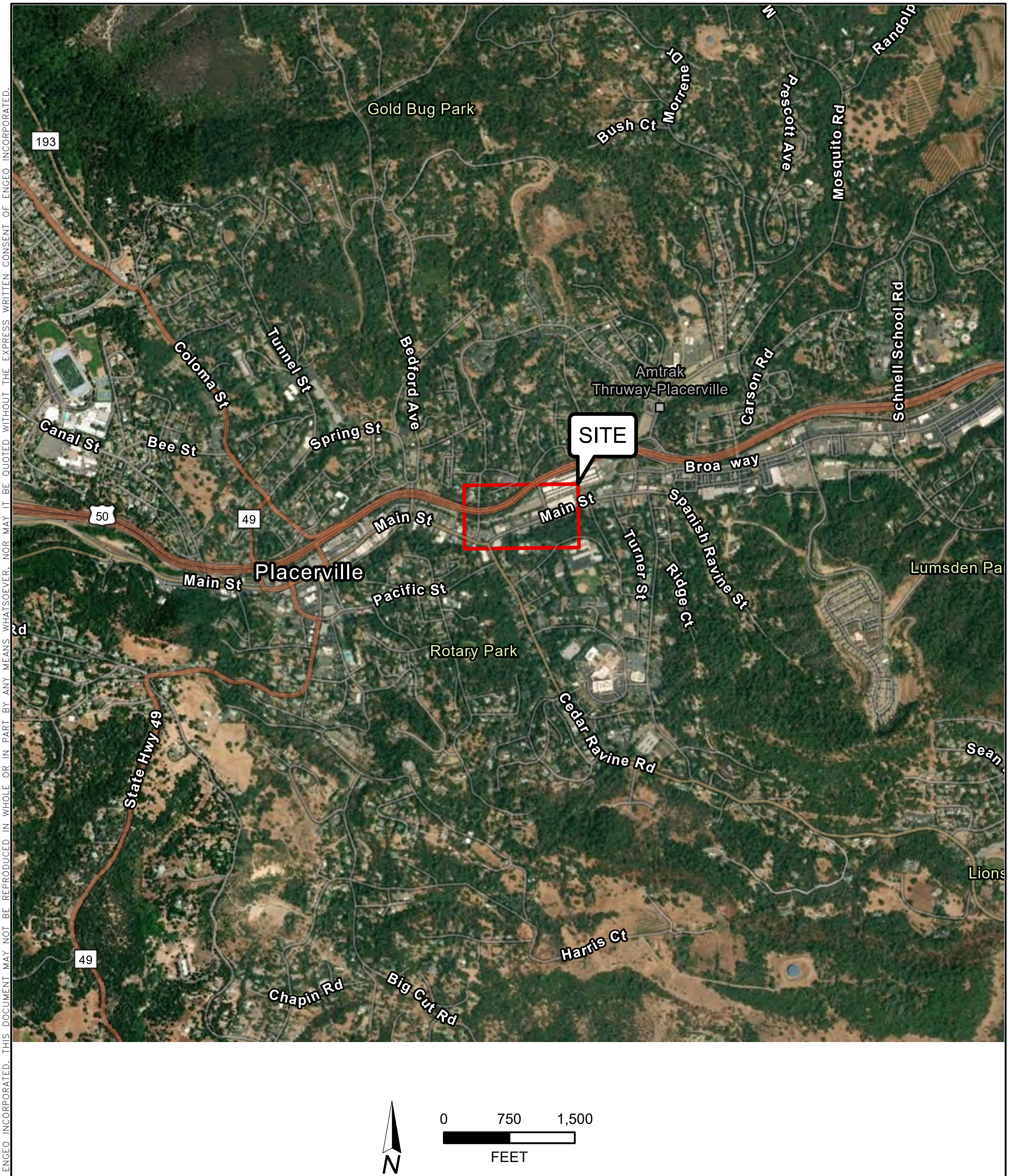
United States Geological Survey, 2018, Topographic Map of the Placerville Quadrangle, California – El Dorado County, 7.5-Minute Series, scale 1:24,000.

Upgradient Environmental Consultants, 1996; Site Assessment Report, Stencil's Toyota, 659 Main Street, Placerville, California; August 30, 1996.

Wagner, D.L., Jennings, C.W., Bedrossian, T.L., and Bortugno, E.J., 1981, Geologic Map of the Sacramento Quadrangle, California, California Division of Mines and Geology, Regional Geologic Map Series Map No. 1A, scale 1:250,000.

State Water Resources Control Board – Geotracker Website: Case Number T0601700030. https://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0601700030

FIGURES

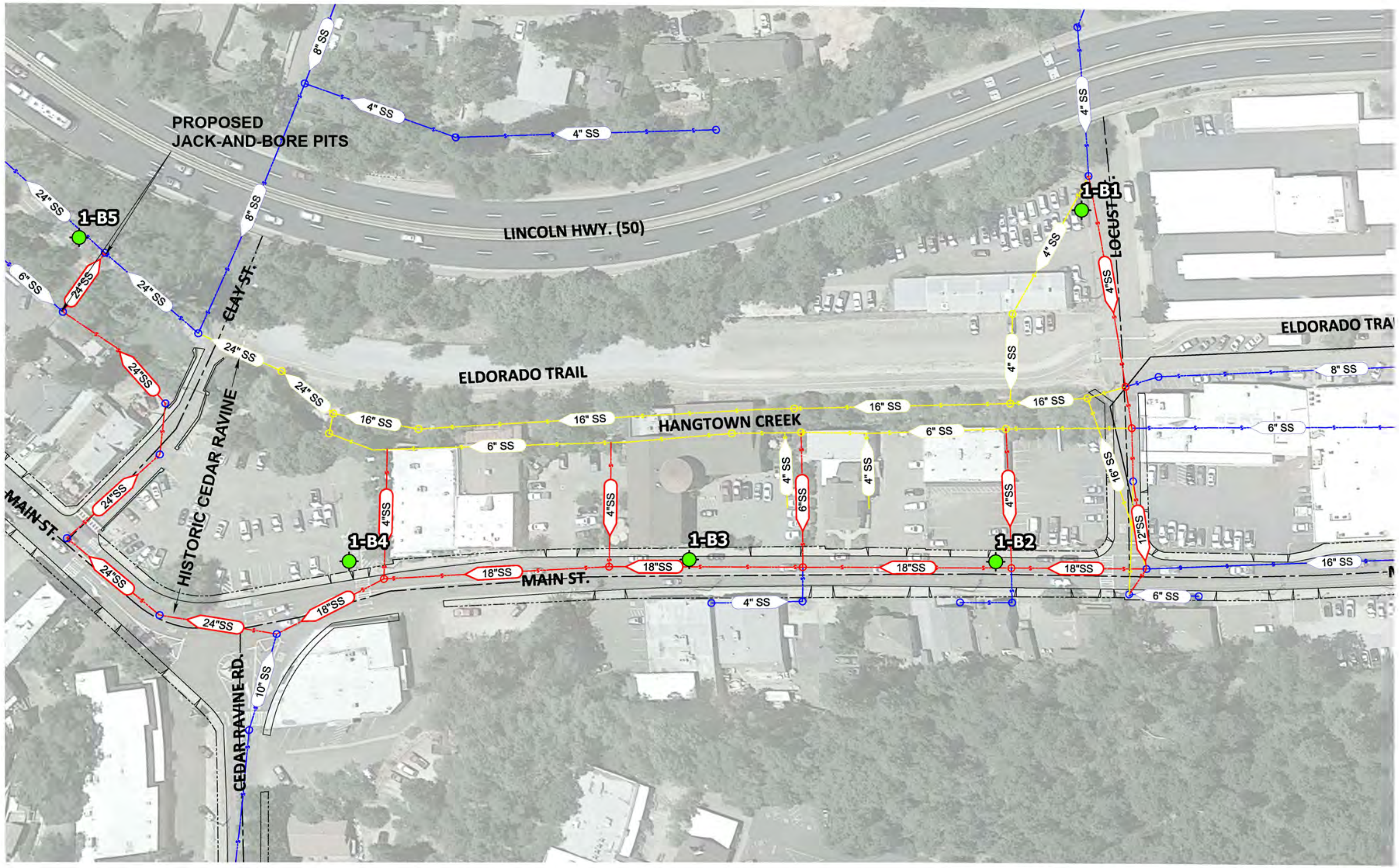


BASEMAP SOURCE: ESRI MAPPING SERVICE 2018

ENGEO Expect Excellence	VICINITY MAP HANGTOWN CREEK SEWER MAIN RELOCATION PROJECT PLACERVILLE, CALIFORNIA	PROJECT NO.: 16529.000.000 SCALE: AS SHOWN DRAWN BY: QRL CHECKED BY: JCB	FIGURE NO. 1

PATH: G:\DRAFTING\PROJECTS_16000 TO 17999\16529\16529000000\GEOTECHINAL\GEX\HANGTOWN CREEK SEWER MAIN RELOCATION PROJECT.APRX
USER: QLIANG

ORIGINAL FIGURE PRINTED IN COLOR



BASE MAP SOURCE:
DRAKE HAGLAN

N

0 50 100
FEET

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

- EXISTING SANITARY SEWER
- SANITARY SEWER TO BE DEMOLISHED
- PROPOSED SANITARY SEWER
- BORING (ENGEO, 2019)

ENGEO
Expect Excellence

SITE PLAN
HANGTOWN CREEK SEWER MAIN RELOCATION PROJECT
PLACERVILLE, CALIFORNIA

PROJECT NO.: 16529.000.000	
SCALE: AS SHOWN	
DRAWN BY: QRL	CHECKED BY: JCB

FIGURE NO.
2

PATH: WEB-GENERATED

ORIGINAL FIGURE PRINTED IN COLOR

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

Tm	MEHRTEN FORMATION
Tvs	VALLEY SPRINGS FORMATION
Tg	"AURIFEROUS" GRAVELS
Jm	MARIPOSA FORMATION
Jlr	LONGTOWN RIDGE FORMATION
Pzcc	CALAVERAS COMPLEX

N

0 2,500 5,000

FEET

BASEMAP SOURCE: WAGNER ET AL. 1981

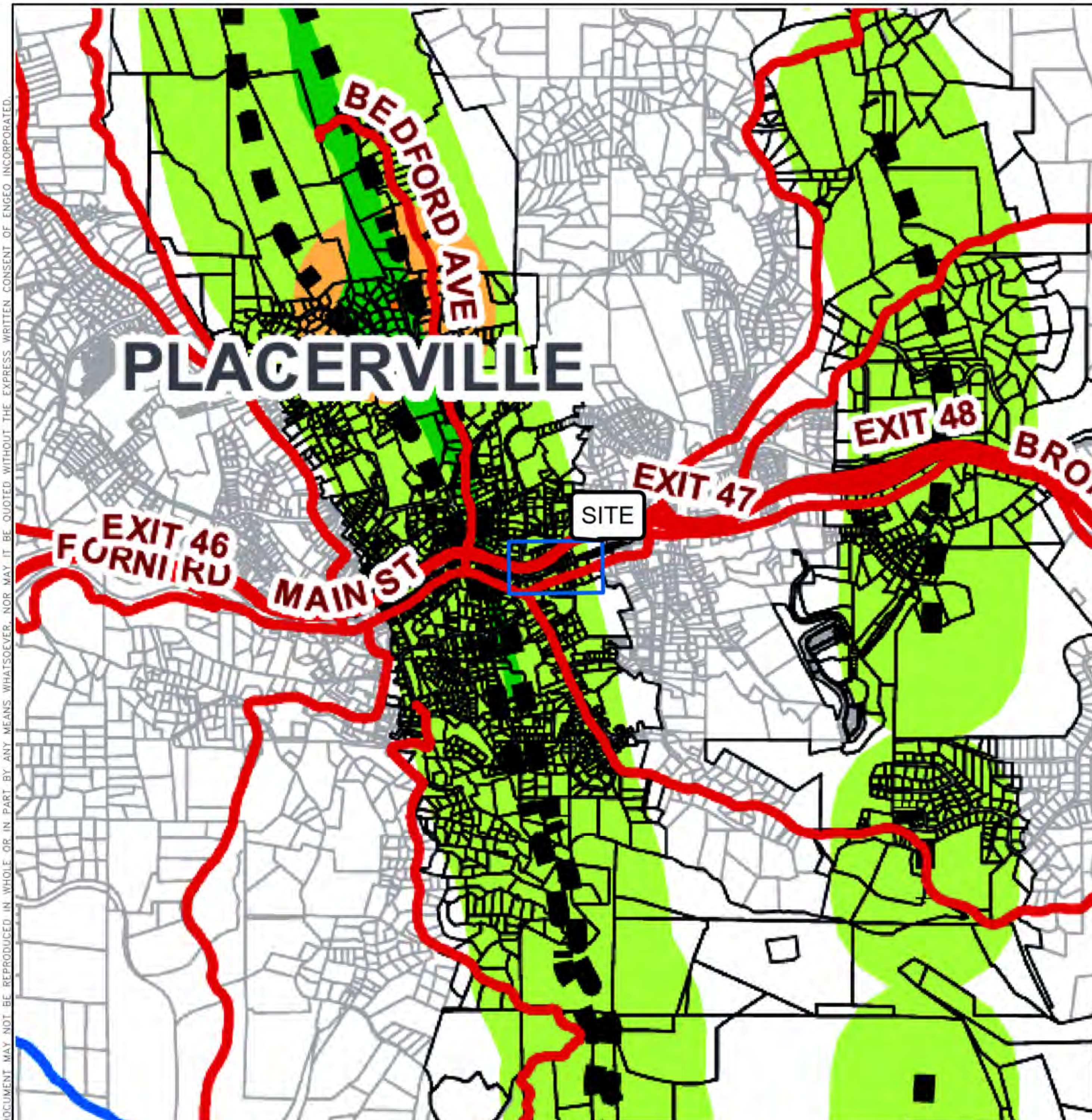
ENGEO
Expect Excellence

REGIONAL GEOLOGIC MAP
HANGTOWN CREEK SEWER MAIN RELOCATION PROJECT
PLACERVILLE, CALIFORNIA

PROJECT NO. : 16529.000.000	FIGURE NO. 3
SCALE: AS SHOWN	
DRAWN BY: QRL	CHECKED BY: JCB

PATH: G:\DRAFTING\PROJECTS_16000 TO 17999\16529\16529000000\GEOTECHINAL\GEX\HANGTOWN CREEK SEWER MAIN RELOCATION PROJECT.APRX
USER: QLIANG

ORIGINAL FIGURE PRINTED IN COLOR



More Likely To Contain Asbestos (Dept of Conservation Mines & Geology OPEN-FILE REPORT 2000-002)
Quarter Mile Buffer for More Likely To Contain Asbestos or Fault Line
Fault Line (Dept of Conservation Mines & Geology OPEN-FILE REPORT 2000-002)
Parcel Base
Major Roads
Rivers & Creeks

N

0 1,000 2,000
FEET

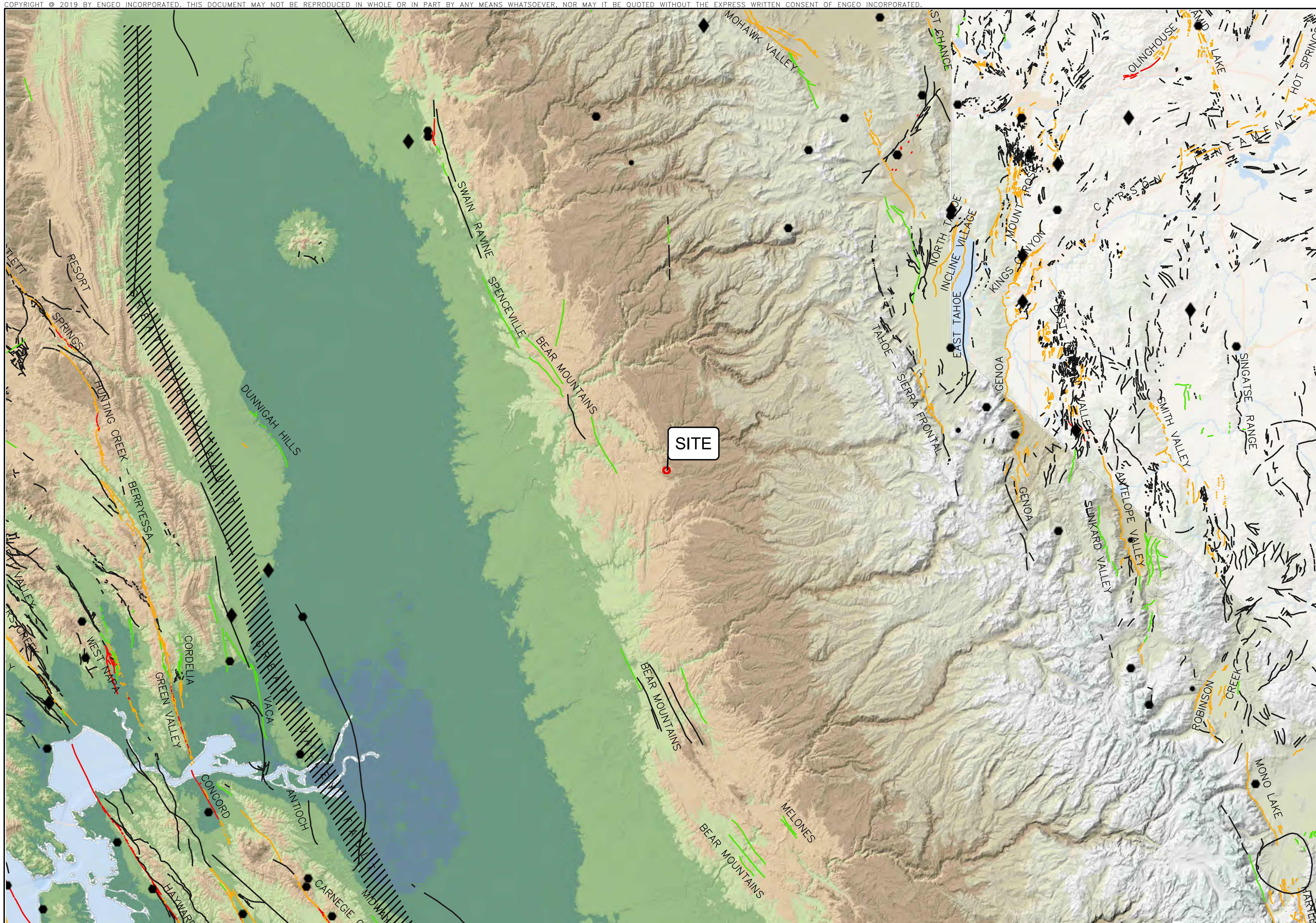
BASEMAP SOURCE: EL DORADO COUNTY SURVEYOR/G.I.S. DIVISION

ENGEO
Expect Excellence

ASBESTOS ZONING MAP HANGTOWN CREEK SEWER MAIN RELOCATION PROJECT PLACERVILLE, CALIFORNIA	PROJECT NO.: 16529.000.000		FIGURE NO. 4
	SCALE: AS SHOWN		
	DRAWN BY: QRL	CHECKED BY: JCB	

PATH: G:\DRAFTING\PROJECTS_16000 TO 17999\16529\16529000000\GEOTECHINAL\GEX\HANGTOWN CREEK SEWER MAIN RELOCATION PROJECT.APRX
USER: QLIANG

ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

EARTHQUAKE

- MAGNITUDE 7+
- MAGNITUDE 6-7
- MAGNITUDE 5-6

USGS QUATERNARY FAULTS

- HISTORICAL
- LATEST QUATERNARY
- LATE QUATERNARY
- UNDIFFERENTIATED QUATERNARY
- HISTORIC BLIND THRUST FAULT ZONE

BASE MAP SOURCE
ESRI, GARMIN, GEBCO, NOAA NGDC, AND OTHER CONTRIBUTORS
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATA SET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, 2018
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800-PRESENT)

ENGEO
Expect Excellence

REGIONAL FAULTING AND SEISMICITY
HANGTOWN CREEK SEWER MAIN RELOCATION PROJECT
PLACERVILLE, CALIFORNIA

PROJECT NO.: 16529.000.000	FIGURE NO. 5
SCALE: AS SHOWN	
DRAWN BY: QRL	CHECKED BY: JCB

PATH: G:\DRAFTING\PROJECTS_16000 TO 17999\16529\16529000000\GEOTECHINAL\GEX\HANGTOWN CREEK SEWER MAIN RELOCATION PROJECT.APRX
USER: QLIANG

ORIGINAL FIGURE PRINTED IN COLOR

APPENDIX A

BORING LOG KEY
EXPLORATION LOGS

KEY TO BORING LOGS

MAJOR TYPES			DESCRIPTION
COARSE-GRAINED SOILS MORE THAN HALF OF MAT'L LARGER THAN #200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LESS THAN 5% FINES	GW - Well graded gravels or gravel-sand mixtures
			GP - Poorly graded gravels or gravel-sand mixtures
		GRAVELS WITH OVER 12 % FINES	GM - Silty gravels, gravel-sand and silt mixtures
			GC - Clayey gravels, gravel-sand and clay mixtures
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 5% FINES	SW - Well graded sands, or gravelly sand mixtures
			SP - Poorly graded sands or gravelly sand mixtures
		SANDS WITH OVER 12 % FINES	SM - Silty sand, sand-silt mixtures
			SC - Clayey sand, sand-clay mixtures
FINE-GRAINED SOILS MORE THAN HALF OF MAT'L SMALLER THAN #200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50 % OR LESS		ML - Inorganic silt with low to medium plasticity
			CL - Inorganic clay with low to medium plasticity
			OL - Low plasticity organic silts and clays
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 %		MH - Elastic silt with high plasticity
			CH - Fat clay with high plasticity
			OH - Highly plastic organic silts and clays
	HIGHLY ORGANIC SOILS		PT - Peat and other highly organic soils

For fine-grained soils with 15 to 29% retained on the #200 sieve, the words "with sand" or "with gravel" (whichever is predominant) are added to the group name.

For fine-grained soil with >30% retained on the #200 sieve, the words "sandy" or "gravelly" (whichever is predominant) are added to the group name.

GRAIN SIZES

U.S. STANDARD SERIES SIEVE SIZE: 200, 40, 10, 4 — CLEAR SQUARE SIEVE OPENINGS: 3/4 ", 3", 12"

SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT (S.P.T.)
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	STRENGTH*
VERY SOFT	0-1/4
SOFT	1/4-1/2
MEDIUM STIFF	1/2-1
STIFF	1-2
VERY STIFF	2-4
HARD	OVER 4

MOISTURE CONDITION

DRY	Dusty, dry to touch
MOIST	Damp but no visible water
WET	Visible freewater

SAMPLER SYMBOLS

- Modified California (3" O.D.) sampler
- California (2.5" O.D.) sampler
- S.P.T. - Split spoon sampler
- Shelby Tube
- Dames and Moore Piston
- Continuous Core
- Bag Samples
- Grab Samples
- NR No Recovery

LINE TYPES

- Solid - Layer Break
- Dashed - Gradational or approximate layer break

GROUND-WATER SYMBOLS

- Groundwater level during drilling
- Stabilized groundwater level

(S.P.T.) Number of blows of 140 lb. hammer falling 30" to drive a 2-inch O.D. (1-3/8 inch I.D.) sampler

* Unconfined compressive strength in tons/sq. ft., asterisk on log means determined by pocket penetrometer

ENGEO Expect Excellence

LOG OF BORING 1-B1

ENGEO
Expect Excellence

LATITUDE: 38.730417 LONGITUDE: -120.794048

Geotechnical Exploration
Hangtown Creek Sewer
Placerville, CA
16529.000.000

DATE DRILLED: 9/24/2019
HOLE DEPTH: Approx. 20 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (WGS84): Approx. 1871 ft.

LOGGED / REVIEWED BY: T. Chatters / PC
DRILLING CONTRACTOR: H1 Drilling Company
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	DESCRIPTION	Blow Count/Foot	Atterberg Limits: Liquid Limit	Plastic Limit	Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
		Asphalt Concrete 3"								
	1870	Aggregate Base 12"								
		SANDY SILT (ML), pale olive, very stiff, moist, approximately 20% fine-grained sand [Fill]								4.0*
5	1865	CLAYEY SAND WITH GRAVEL (SC), reddish brown, dense, moist, low plasticity fines, fine- to coarse-grained sand, approximately 10% subangular fine gravel, trace coarse gravel [Native]	31				29	11.7		>4.5*
		grades to very dense	50/2					7.7		
10		Switched from solid flight auger to HQ core								
	1860	PHYLLITE, black, weak (R2), closely fractured, high angle laminated foliation, moderately weathered (WM) [RQD = 0, Recovery = 52%]								
		grades to olive mottled with brown, very weak (R1) to weak (R2), very closely to closely fractured, highly weathered.								
15	1855	grades to grayish black, weak (R2) to moderately strong (R3), closely fractured, moderately weathered (WM) [RQD =0, Recovery = 100%]								
20		Bottom of boring at 20 feet. No groundwater encountered in solid flight auger drill depth. Switched from solid flight auger to HQ core at 10 feet.								

ENGEO
Expect Excellence

LOG OF BORING 1-B2

LATITUDE: 38.729567 LONGITUDE: -120.793961

Geotechnical Exploration
Hangtown Creek Sewer
Placerville, CA
16529.000.000

DATE DRILLED: 9/24/2019
HOLE DEPTH: Approx. 20½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (WGS84): Approx. 1862 ft.

LOGGED / REVIEWED BY: T. Chatters / PC
DRILLING CONTRACTOR: H1 Drilling Company
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	DESCRIPTION	Blow Count/Foot	Liquid Limit	Plastic Limit	Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
		Asphalt Concrete 8"								
	1860	SANDY CLAY WITH GRAVEL (CL), reddish, medium dense, moist, low plasticity, fine- to medium-grained sand, subangular fine gravel, trace cobbles [Fill]						12.8		
		grades to fine- to coarse-grained sand								
5		CLAYEY GRAVEL (GC), gray, loose, moist, fine- to medium-grained sand, medium plasticity fines, angular gravel with wood debris [Fill]	8							2.65
	1855	PHYLLITE, grayish black, weak (R2) to moderately strong (R3), high angle laminated foliation, moderately weathered (WM), crushed to close fracture spacing [Native]								
10		Switched from solid flight auger to HQ core	50/1							
	1850	[RQD = 0, Recovery = 62%]								
15	1845	[RQD = 0, Recovery = 20%]								
20			50/3							
		Bottom of boring at 20½ feet. No groundwater encountered in solid flight auger drill depth. Switched from solid flight auger to HQ core at 10½ feet.								

LOG OF BORING 1-B3

ENGEO Expect Excellence

LATITUDE: 38.729347 LONGITUDE: -120.79484

Geotechnical Exploration
Hangtown Creek Sewer
Placerville, CA
16529.000.000

DATE DRILLED: 9/24/2019
HOLE DEPTH: Approx. 19½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (WGS84): Approx. 1858 ft.

LOGGED / REVIEWED BY: T. Chatters / PC
DRILLING CONTRACTOR: H1 Drilling Company
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			Asphalt Concrete 8"										
			SANDY CLAY WITH GRAVEL (CL), red, medium dense, moist, low plasticity, fine- to coarse-grained sand, subangular fine gravel [Fill]										
	1855		grades to greensish gray, wood pieces present										
			PHYLLITE, olive mottled with brownish red, weak (R2), crushed, high angle laminated foliation, highly weathered (WH) [Native]			28					14.1		
5													>4.5
			grades to olive brown, weak (R2), very closely to closely fractured, highly weathered (WH)		▽								
	1850	NR				50/3							
			Switched from solid flight auger to HQ core										
			[RQD = 0, Recovery = 80%]										
10													
			grades to black [RQD = 0, Recovery = 80%]										
	1845												
			grades to very light gray, moderately weathered (WM) [RQD = 0, Recovery = 100%]										
15													
			[RQD = 0, Recovery = 86%]										
	1840												
			Bottom of boring at 19½ feet. Groundwater encountered at 8 feet in solid flight auger drill depth. Switched from solid flight auger to HQ core at 8½ feet.										

LOG OF BORING 1-B4

ENGEO
Expect Excellence

LATITUDE: 38.729091 LONGITUDE: -120.79581

Geotechnical Exploration
Hangtown Creek Sewer
Placerville, CA
16529.000.000

DATE DRILLED: 9/24/2019
HOLE DEPTH: Approx. 20½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (WGS84): Approx. 1869 ft.

LOGGED / REVIEWED BY: T. Chatters / PC
DRILLING CONTRACTOR: H1 Drilling Company
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			Asphalt Concrete 6"										
			CLAYEY SAND WITH GRAVEL (SC), gray, medium dense, moist, fine- to coarse-grained sand, approximately 40% low plasticity fines, approximately 5% subangular fine gravel [Fill]										
	1865		CLAY WITH SAND (CL), dark reddish brown, medium stiff, moist, low plasticity, approximately 15% fine- to coarse-grained sand, approximately 5% subangular fine to coarse gravel [Fill]										
5			Phyllite fragment in fill			9					14.8		
	1860		CLAYEY GRAVEL (GC), gray, very loose, saturated, low plasticity fines, subangular fine gravel, wood pieces present, no structure, mud like [Fill]										
10					▽	1	10	25	NP	47	34.7		
	1855		PHYLLITE, black, weak (R2), highly weathered (WH), [Native]										
15						50/1							
	1850		[drilled from 15-20 feet in 5 minutes]										
20													
			Bottom of Boring at 20½ feet. Groundwater encountered at 10½ feet.										

ENGEO
Expect Excellence

LOG OF BORING 1-B5

LATITUDE: 38.729617 LONGITUDE: -120.796889

Geotechnical Exploration
Hangtown Creek Sewer
Placerville, CA
16529.000.000

DATE DRILLED: 9/24/2019
HOLE DEPTH: Approx. 20 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (WGS84): Approx. 1870 ft.

LOGGED / REVIEWED BY: T. Chatters / PC
DRILLING CONTRACTOR: H1 Drilling Company
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

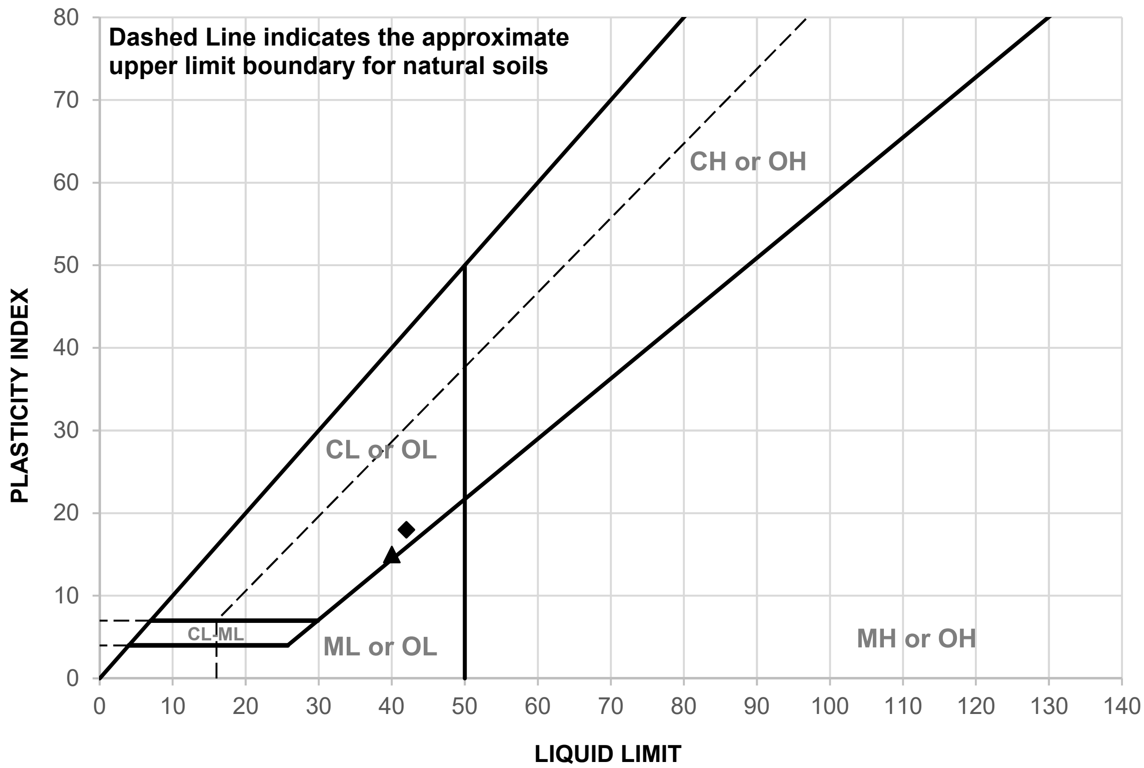
Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			CLAYEY SAND (SC), reddish brown, medium dense, low plasticity, fine- to medium-grained sand, approximately 35% fines [Fill]										
			CLAY WITH SAND (CL), reddish brown, very stiff, moist, low plasticity, approximately 15% fine-grained sand, approximately 5% subangular fine gravel [Fill]										
5	1865					33				14	5.6		3.75*
			CLAYEY SAND WITH GRAVEL (SC), light reddish brown, medium dense, low plasticity fines, fine- to coarse-grained sand, 14% fines, <5% subangular fine gravel, one 1-inch diameter quartz piece present in liner [Native]										
			increasing fines			44				27	7.1		4.0*
10	1860		PHYLLITE, olive mottled with brown, very weak (R1) to weak (R2), crushed to very closely fractured, high angle laminated foliation, highly weathered (WH)										
			Switched from solid flight auger to HQ core										
15	1855												
			[RQD = 0, Recovery = 80%]										
			[RQD = 0, Recovery = 33%]										
20	1850		Bottom of boring at 20 feet. No groundwater encountered in solid flight auger drill depth . Switched from solid flight auger to HQ core at 14 feet.										

APPENDIX B

LABORATORY TEST DATA

Liquid and Plastic Limits Test Report
Unconfined Compression Test
Particle Size Distribution Report
R-Value Test Report
Moisture Content Report
Analytical Results of Soil Corrosion

LIQUID AND PLASTIC LIMITS TEST REPORT
ASTM D4318



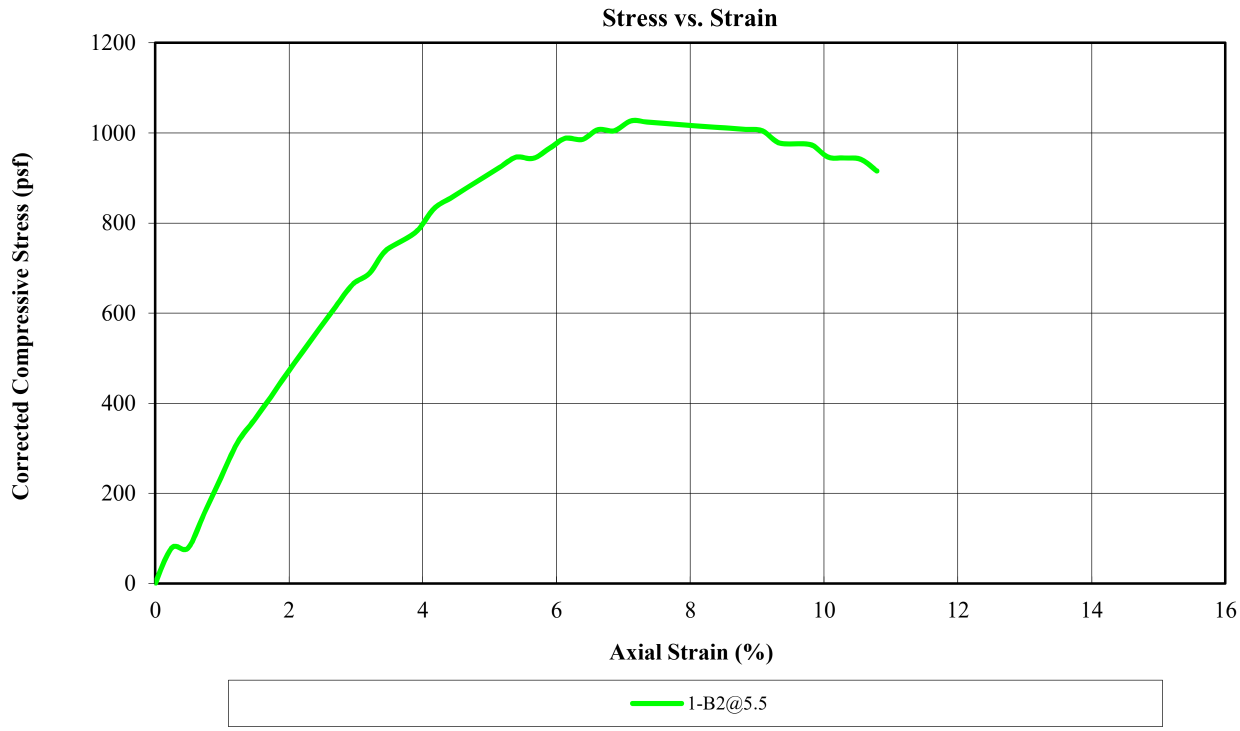
SAMPLE ID	DEPTH	MATERIAL DESCRIPTION	LL	PL	PI
1-B4	11 to 12	See exploration logs	40	25	15
1-B5	6	See exploration logs	42	24	18

SAMPLE ID	TEST METHOD	REMARKS
1-B4	PI: ASTM D4318, Wet Method	
1-B5	PI: ASTM D4318, Wet Method	

ENGEO
Expect Excellence

CLIENT: Drake Haglan and Associates
PROJECT NAME: Hangtown Creek Sewer Main Relocation
PROJECT NO: 16529.000.000 PH001
PROJECT LOCATION: Placerville, CA
REPORT DATE: 10/8/2019
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

UNCONFINED COMPRESSION TEST REPORT
ASTM D2166



	SPECIMEN
BEFORE TEST	**1-B2@5.5**
Moisture Content (%)	18.1
Dry Density (pcf)	109.9
Saturation (%)	95.2
Void Ratio	0.50
Diameter (in)	2.399
Height (in)	4.13
Height-To-Diameter Ratio	1.72
TEST DATA	
Unconfined Compressive Strength (psf)	1027
Undrained Shear Strength (psf)	513
Strain Rate (in./min.)	0.05
Specific Gravity	2.650
Strain at Failure (%)	7.11
Liquid Limit	
Plastic Limit	
Test Remarks	

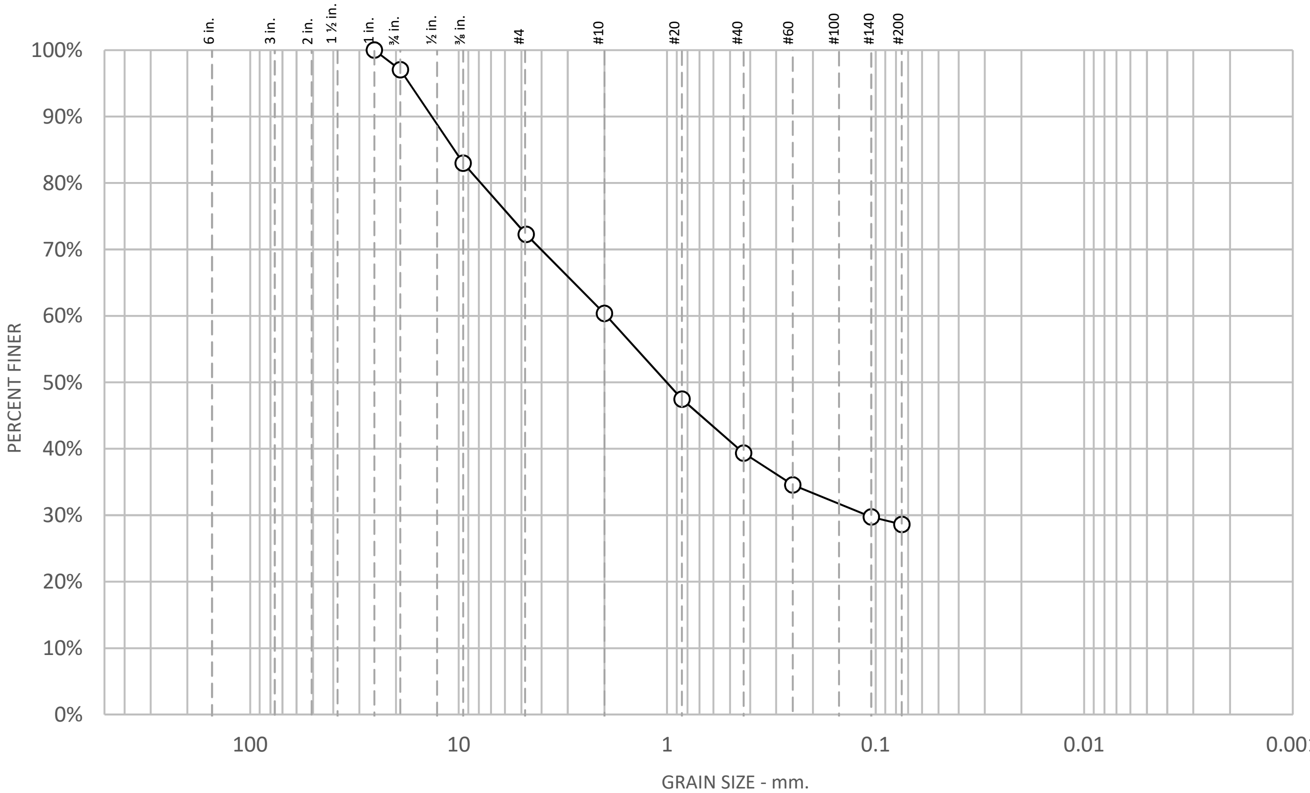
SPECIMEN	DESCRIPTION
1-B2@5.5	See exploration logs

ENGEO
Expect Excellence

PROJECT NAME: Hangtown Creek Sewer Main Relocation
PROJECT NO: 16529.000.000
CLIENT: Drake Haglan and Associates
LOCATION: Placerville, CA
PHASE NO: 001

Test Date: 10/04/19
Tested By: R. Montalvo
Reviewed By: M. Gilbert

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	3.0	24.7	11.9	21.0	10.7	28.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 in.	100.0		
¾ in.	97.0		
⅜ in.	83.0		
#4	72.3		
#10	60.4		
#20	47.5		
#40	39.3		
#60	34.6		
#140	29.8		
#200	28.6		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL = LL = PI =

Coefficients

D_{90} = 13.4640 mm D_{85} = 10.5214 mm D_{60} = 1.9523 mm
D_{50} = 1.0051 mm D_{30} = 0.1098 mm D_{15} =
D_{10} = C_u = C_c =

Classification

USCS =

Remarks

ASTM D6913, Method B

Sample Number: 1-B1 @ 4

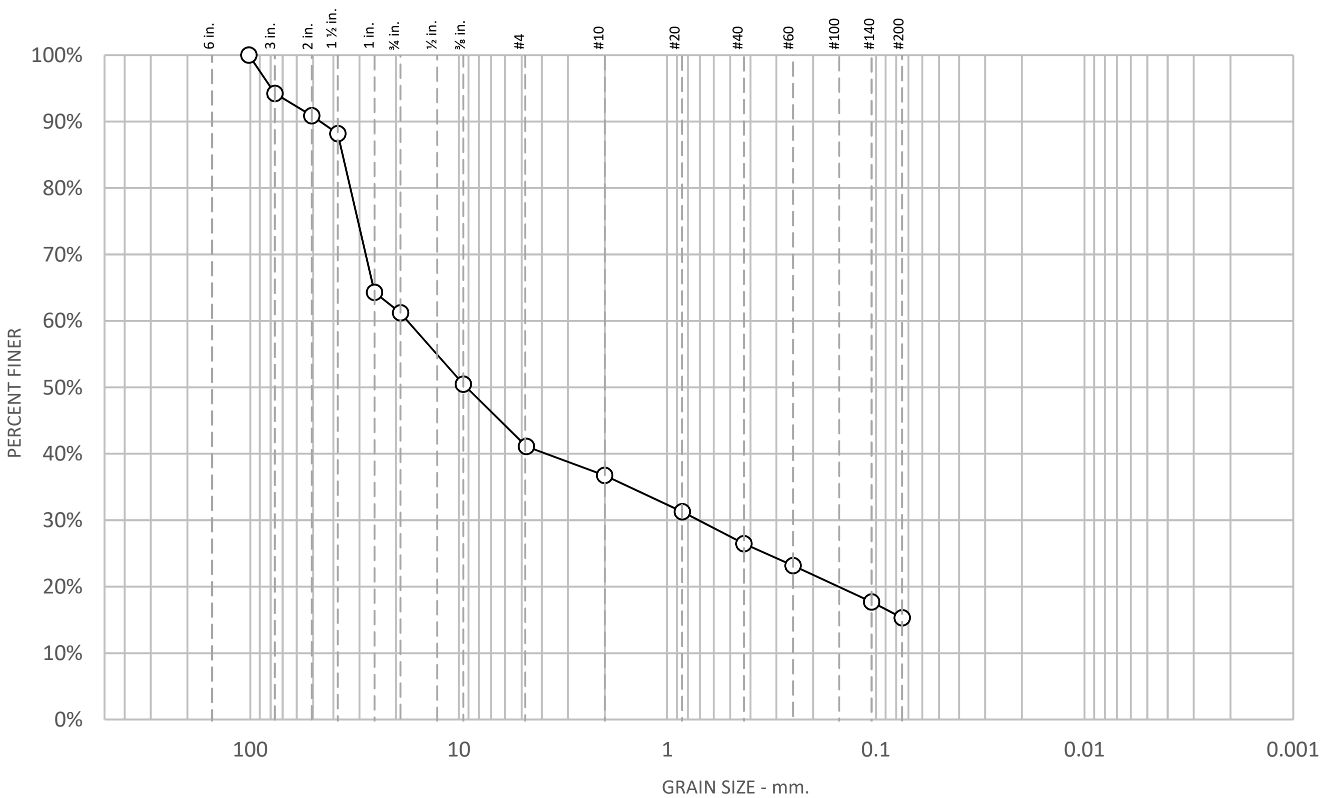
Client: Drake Haglan and Associates **Project Number:** 16529.000.000 PH001
Project: Hangtown Creek Sewer Main Relocation **Date:** 10/8/2019
Project location: Placerville, CA

ENGEO Expect Excellence

Tested By: R. Montalvo **Checked By:** M. Gilbert

Test Location: 2213 Plaza Drive, Rocklin, CA 95765

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
5.8	33.1	20.1	4.4	10.3	11.2	15.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4 in.	100.0		
3 in.	94.2		
2 in.	90.9		
1-½ in.	88.2		
1 in.	64.3		
¾ in.	61.2		
⅜ in.	50.5		
#4	41.1		
#10	36.8		
#20	31.3		
#40	26.5		
#60	23.2		
#140	17.7		
#200	15.3		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL = LL = PI =

Coefficients

D_{90} = 46.2309 mm D_{85} = 36.0909 mm D_{60} = 17.6218 mm
D_{50} = 9.2017 mm D_{30} = 0.7087 mm D_{15} =
D_{10} = C_u = C_c =

Classification

USCS =

Remarks

ASTM D6913, Method B

Sample Number: 1-B2 @ 1

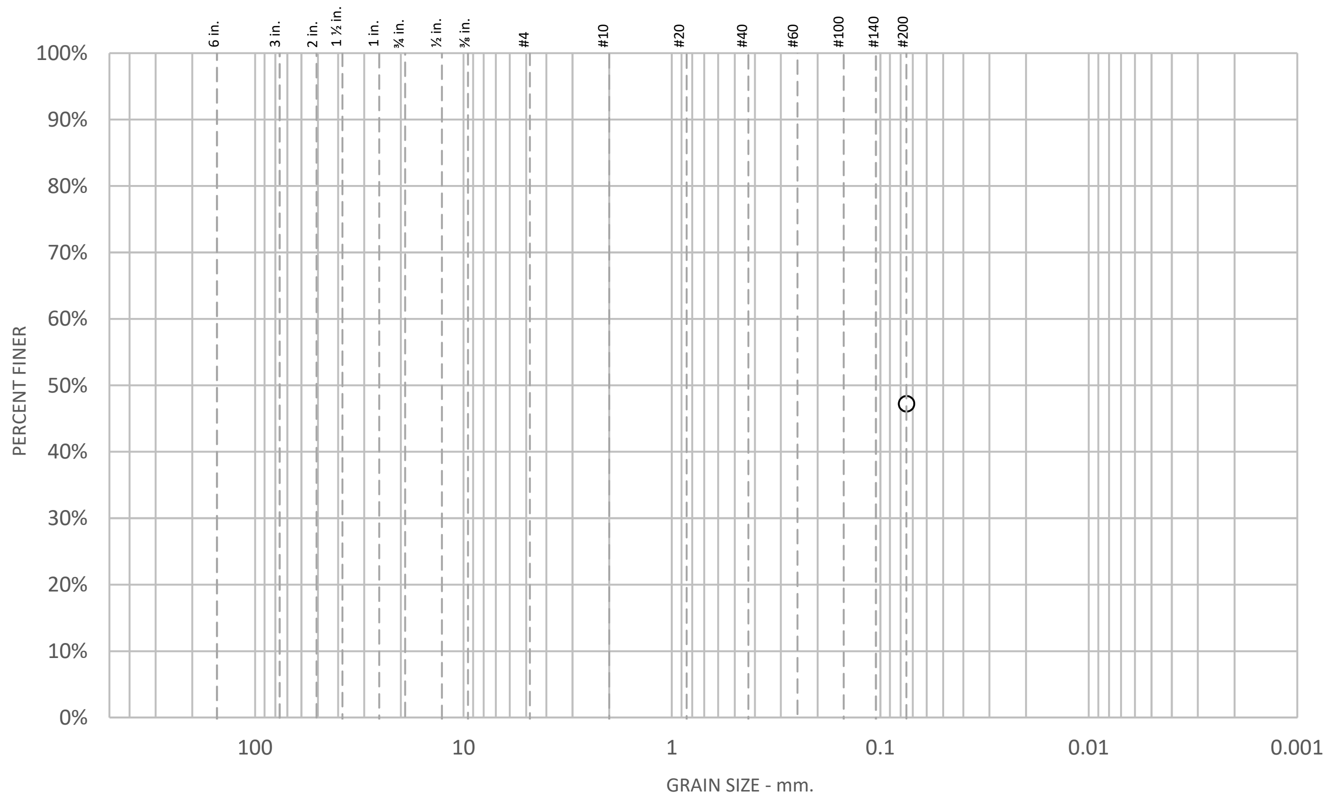
Client: Drake Haglan and Associates
Project Number: 16529.000.000 PH001
Project: Hangtown Creek Sewer Main Relocation
Date: 10/8/2019
Project location: Placerville, Ca

ENGEO Expect Excellence

Tested By: R. Montalvo
Checked By: M. Gilbert

Test Location: 2213 Plaza Drive, Rocklin, CA 95765

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						47.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	47.2		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL = 15 LL = 25 PI = 10

Coefficients

D_{90} = D_{85} = D_{60} =
D_{50} = D_{30} = D_{15} =
D_{10} = C_u = C_c =

Classification

USCS =

Remarks

PI: ASTM D4318, Wet Method ASTM D6913, Method B

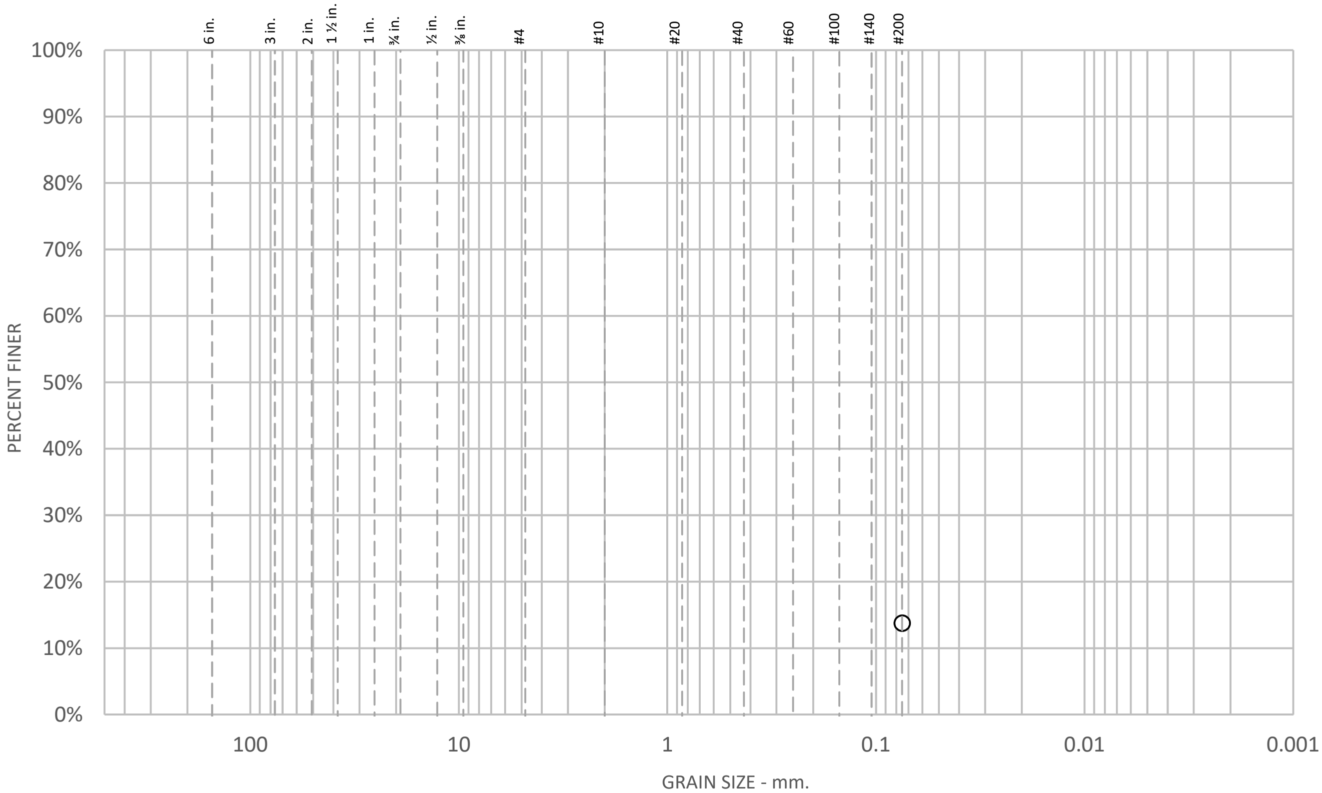
Sample Number: 1-B4 @ 11 to 12

Client: Drake Hagfan and Associates
Project Number: 16529.000.000 PH001
Project: Hangtown Creek Sewer Main Relocation
Date: 10/8/2019
Project location: Placerville, CA

Tested By: R. Montalvo **Checked By:** M. Gilbert

Test Location: 2213 Plaza Drive, Rocklin, CA 95765

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						14	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	14		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL = LL = PI =

Coefficients

D_{90} = D_{85} = D_{60} =
D_{50} = D_{30} = D_{15} =
D_{10} = C_u = C_c =

Classification

USCS =

Remarks

ASTM D1140, Method B
Soak time = 180 min
Dry sample weight = 212.3 g

Sample Number: 1-B5 @ 6

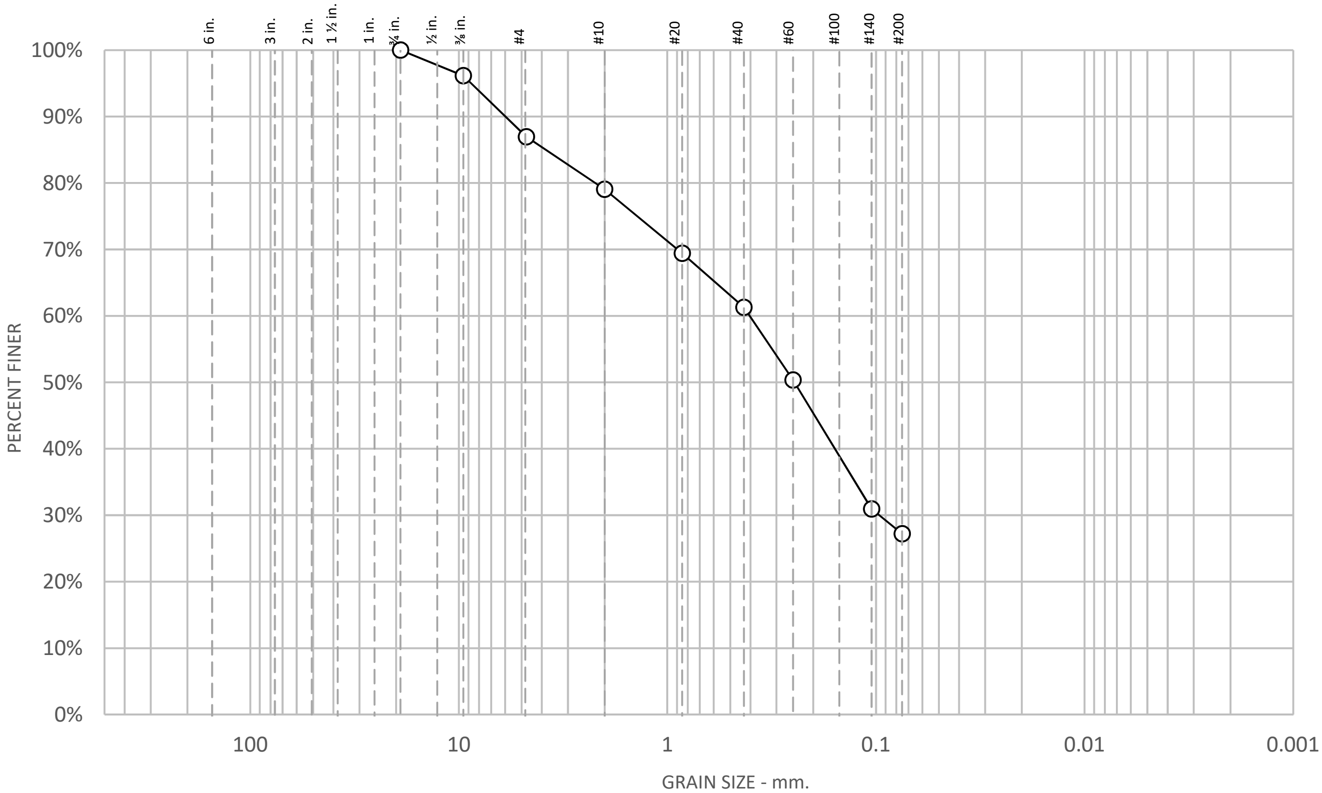
Client: Drake Haglan and Associates
Project: Hangtown Creek Sewer Main Relocation
Project location: Placerville, CA
Project Number: 16529.000.000 PH001
Date: 10/8/2019

ENGEO Expect Excellence

Tested By: R. Montalvo
Checked By: M. Gilbert

Test Location: 2213 Plaza Drive, Rocklin, CA 95765

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	0.0	13.0	7.9	17.8	34.1	27.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
¾ in.	100.0		
⅜ in.	96.1		
#4	87.0		
#10	79.1		
#20	69.4		
#40	61.3		
#60	50.3		
#140	31.0		
#200	27.2		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL = LL = PI =

Coefficients

D_{90} = 5.9793 mm D_{85} = 3.8320 mm D_{60} = 0.4036 mm
D_{50} = 0.2461 mm D_{30} = 0.0963 mm D_{15} =
D_{10} = C_u = C_c =

Classification

USCS =

Remarks

ASTM D1140, Method B
Soak time = 180 min
Dry sample weight = 516.2 g

Sample Number: 1-B5 @ 9

Client: Drake Haglan and Associates **Project Number:** 16529.000.000 PH001
Project: Hangtown Creek Sewer Main Relocation **Date:** 10/8/2019
Project location: Placerville, CA

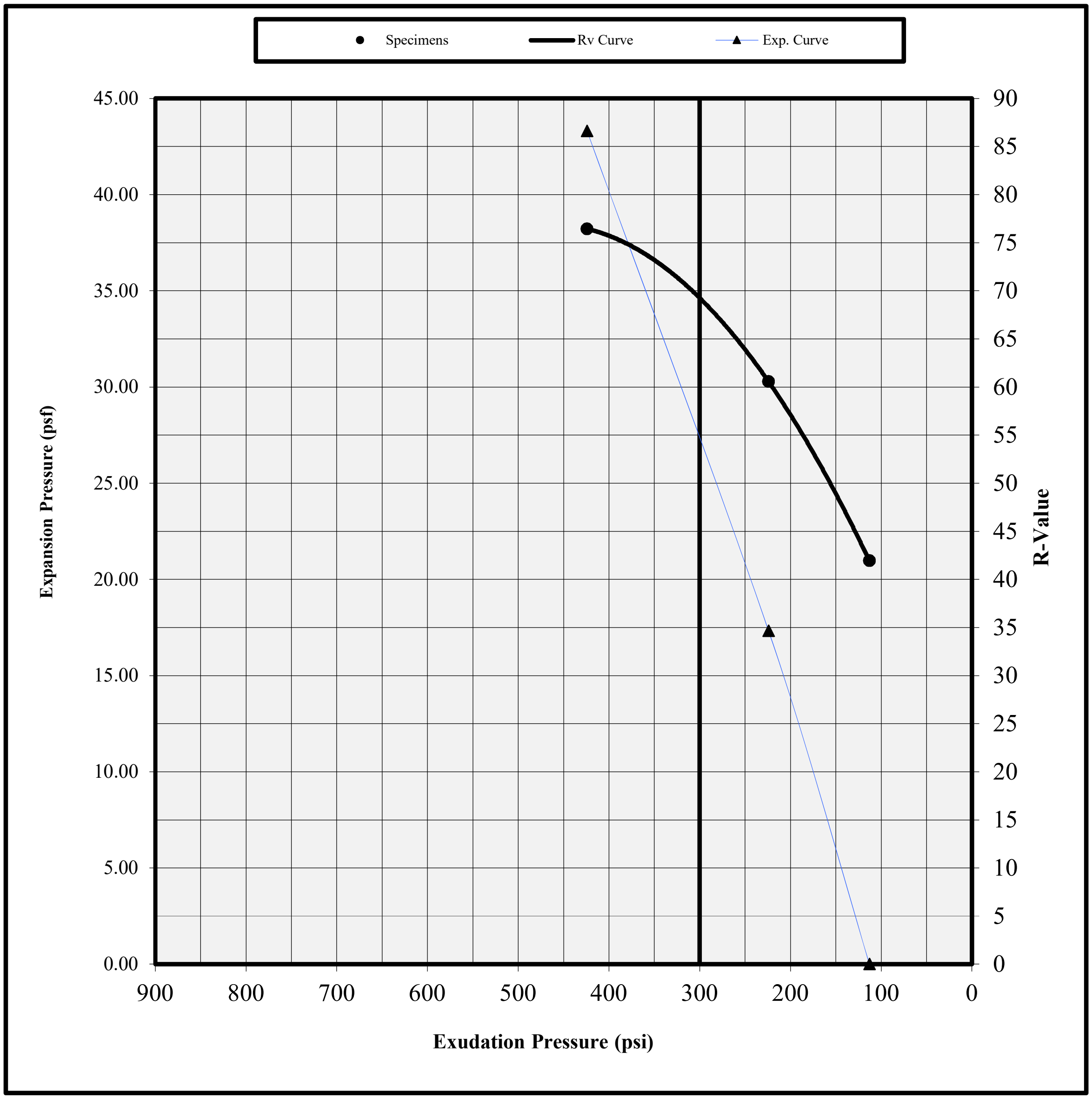
ENGEO Expect Excellence

Tested By: R. Montalvo **Checked By:** M. Gilbert

Test Location: 2213 Plaza Drive, Rocklin, CA 95765

R VALUE TEST REPORT

CTM-301



Sample ID/Location: 1-B2@1-5

Description: Brown clayey SAND with gravel

Test remarks:

Specimen	Specimen 1	Specimen 2	Specimen 3
Exudation Pressure (p.s.i.)	424	224	113
Expansion dial (0.0001")	10	4	0
Expansion Pressure (p.s.f.)	43	17	0
Resistance Value, "R"	76	61	42
% Moisture at Test	8.3	9.4	10.9
Dry Density at Test, p.c.f.	127.5	128.2	123.7
"R" Value at Exudation Pressure of 300 psi.	69		
Expansion Pressure (psf) at Exudation Pressure of 300 psi.	24		

PROJECT NAME: Hangtown Creek Sewer Main Relocation
PROJECT NUMBER: 16529.000.000
CLIENT: Drake Haglan and Associates
PHASE NUMBER: 001

DATE: 10/10/19

ENGEO Expect Excellence

Tested by: R. Montalvo

Reviewed by: N. Broussard

Lab Address: 2213 Plaza Drive, Rocklin, CA 95765


16529
1-B2@5.5
UC

MOISTURE CONTENT REPORT
ASTM D2216

SAMPLE ID	1-B1	1-B1	1-B2	1-B2	1-B3	1-B4	1-B4	1-B5
DEPTH (ft.)	4	8	1	6	3.5	5.5	11-12	6
METHOD A OR B	B	B	B	B	B	B	B	B
MOISTURE CONTENT (%)	11.7	7.7	12.8	17.4	14.1	14.8	34.7	5.6

SAMPLE ID	1-B5							
DEPTH (ft.)	9							
METHOD A OR B	B							
MOISTURE CONTENT (%)	7.1							

ENGEO
Expect Excellence

CLIENT: Drake Haglan and Associates
PROJECT NAME: Hangtown Creek Sewer Main Relocation
PROJECT NO: 16529.000.000
PROJECT LOCATION: Placerville
REPORT DATE: 10/8/2019
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 10/09/2019
Date Submitted 10/04/2019

To: Stephen Blakely
Engeo, Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 16529.000.000 Site ID : 1-B1@12.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 80707-168649.

EVALUATION FOR SOIL CORROSION

Soil pH	6.37		
Minimum Resistivity	5.63	ohm-cm (x1000)	
Chloride	2.6 ppm	00.00026	%
Sulfate	15.5 ppm	00.00155	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

ENGEO

Expect Excellence

Appendix B

Comparison of Trunk Sewer Relocation Alternatives

HANGTOWN CREEK SEWER RELOCATION PROJECT
EVALUATION MATRIX FOR SEWER LATERAL RE-ROUTING OPTIONS

Evaluation Criteria	Importance Factor	Option 1[a]		Option 2[b]		Option 3[c]		Comments
		Value	Weighted	Value	Weighted	Value	Weighted	
Capital cost	1.0	2	2.0	2	2.0	3	3.0	Option 3 requires the least amount of piping work.
Constructability	1.0	1	1.0	1	1.0	3	3.0	Working in creek bed (Option 1) or replumbing buildings (Option 2) represent difficult construction.
Required work in Hangtown Creek	0.7	1	0.7	5	3.5	3	2.1	No work in Hangtown Creek required for Option 2.
Reliability	0.7	1	0.7	4	2.8	3	2.1	Pipe supports constructed under Option 1 are vulnerable to damage during storm events.
Potential impacts to businesses	0.5	3	1.5	1	0.5	3	1.5	Replumbing businesses will greatly impact operations.
Access for future maintenance	0.5	1	0.5	3	1.5	2	1.0	Amount of pipe along flood wall increases the need for access to restricted areas along the creek.
TOTAL			**6.4**		**11.3**		**12.7**	

[a] Option 1 – Re-construct Laterals Along Flood Wall and Route to Main Street Trunk Sewer

[b] Option 2 – Re-plumb Laterals and Re-connect to Fly Line Parallel to Main Street Trunk Sewer

[c] Option 3 – Reverse Laterals at Flood Wall and Route to Main Street Trunk Sewer