DRAINAGE ASSESSMENT
CHOLLAS CREEK MULTIUSE PATH
DOROTHY PETWAY PARK TO HARBOR DRIVE
SAN DIEGO, CALIFORNIA

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Prepared for:
CITY OF SAN DIEGO

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Project No. 5SAN021000

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FOR
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This Drainage Report was prepared under the direction of the following registered civil engineer. The registered civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusion, and decisions are based.

_____ _____3/17/2015_____
Mike Daly, P.E. Date
Registered Civil Engineer

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1.0 Introduction

The City of San Diego is examining potential alternatives for extending a multiuse pathway from Dorothy Petway Park to East Harbor Drive. Psomas evaluated a number of potential alignments and identified what is likely the most feasible alignment given site specific constraints (see Figure 1). Significant portions of the path will be along Chollas Creek and South Las Chollas Creek, with remainder following existing roadways.

Existing right-of-way along much of the project reach is limited resulting in portions of the path being located within the channels banks of the Chollas and South Chollas creek channels. Modifications to the channels would be required to accommodate the path. The first goal of the design for reaches of the multiuse path within a drainage channel is to avoid any rise in the design storm water surface elevation (WSEL). This would be accomplished by reconfiguring the channel geometry to avoid any loss of channel conveyance. The second goal is to minimize maintenance and maximize safety of the path by establishing a profile which limits the recurrence of inundation by both storm related flooding and tidal backwater.

This report presents the methodology and results of an analysis to establish existing hydraulic conditions within Chollas Creek and South Chollas Creek, and to assess the potential impacts related to placement of the proposed path within the existing drainage channels. This includes both tidal backwater impacts and flood flows.

The overall scope of work for the effort is as follows:

- Obtain available project topographic and survey data for the existing drainage channels and numerous bridges within the project limits.

- Develop an existing conditions HEC-RAS model which includes bridges to determine exiting water surface elevations (WSELs) for the 100-year flood event as well as a number of more frequent flood events.

- Evaluate impacts of tidal backwater in the project area and establish a minimum elevation for the pathway in locations where it may be located in the drainage channel.

- Develop a proposed conditions HEC-RAS model to evaluate the recommended design, adjust the pathway profile to be above the 2-year event, and verify no significant impacts to the 100-year WSEL.

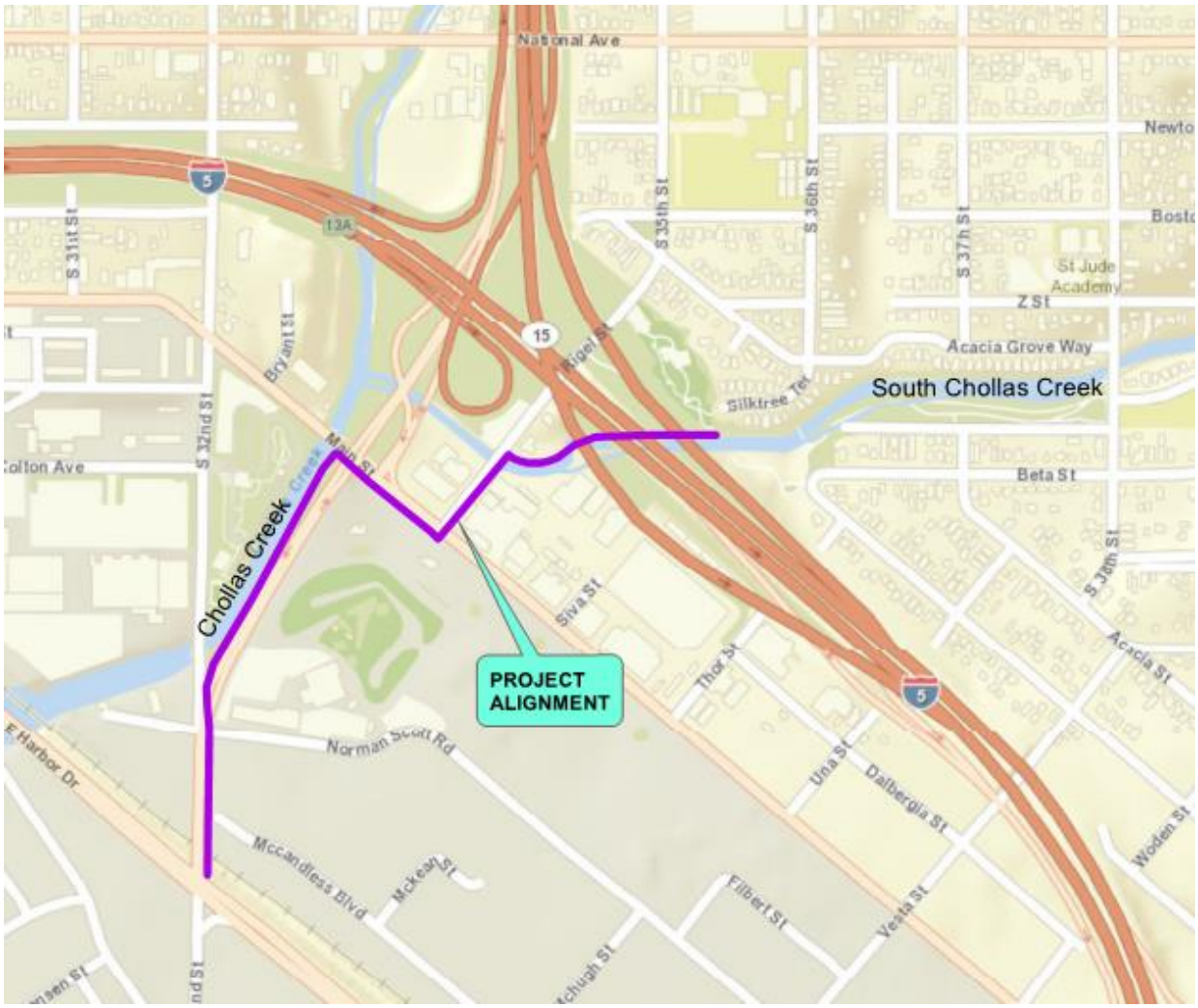


Figure 1-1
Project Location Map

2.0 Project Hydrology

No new hydrologic analysis was completed for the project. Peak discharges within Chollas Creek and South Chollas Creek were taken from the effective FEMA Flood Insurance Study (FIS). Estimated peak discharges for storm events not provided in the effective FIS were extrapolated using ratios developed through the application of USGS Regional Regression Equations developed for the project area. A summary of peak discharges is provided in Table 2-1.

Table 2-1
Summary of Peak Discharges
(in cfs)

	2-Year	5-Year	10-Year	100-Year
South Chollas Creek	1060	1643	2000	5300
Chollas Creek (d/s of confluence)	2000	3100	4200	10000

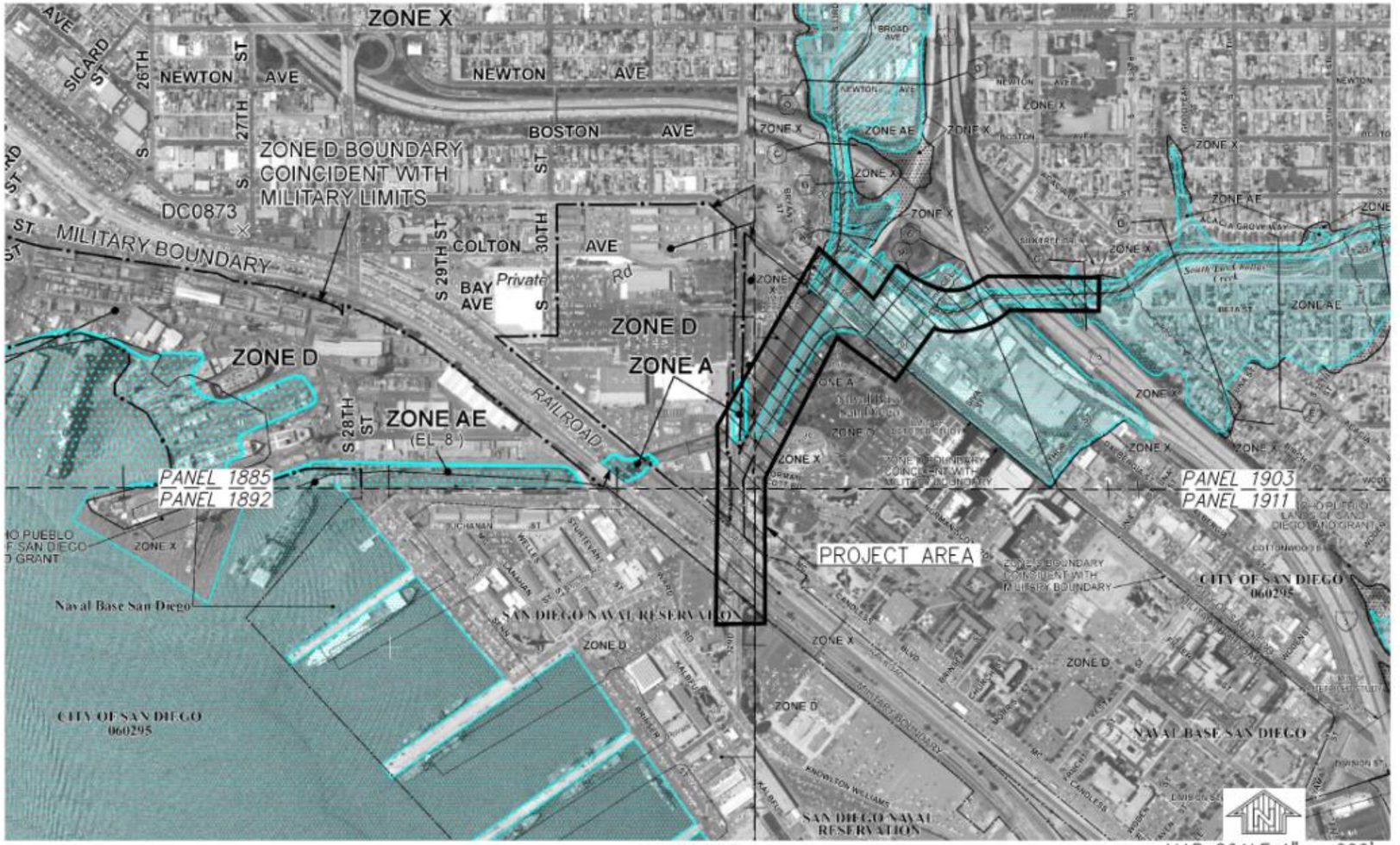
3.0 FEMA Status

Both Chollas Creek and South Chollas Creek are mapped in the effective Flood Insurance Study (FIS) for the City of San Diego. A copy of the Flood Insurance Rate Map (FIRM) panel covering the project area is provided in Figure 3-1. The current mapping includes cross-sections with Base Flood Elevations (BFEs) on both creeks to the point of their confluence. Downstream of this mapping is either Zone A which provided flooding extents but no BFEs, or Zone D which indicates only the potential for flooding over a large area.

4.0 Existing Conditions Channel Hydraulics

An existing conditions hydraulic model was created for South Chollas Creek and Chollas Creek within the study area. The model utilized the HEC-RAS computer program and available LIDAR data collected in 2005. Conditions within the project do not appear to have changed significantly and the available data is considered to be generally representative of current conditions. A description of the LIDAR data is provided in Appendix A.

Field survey was also completed to verify the accuracy of the LIDAR data as well as collect more accurate information at bridges and other key locations. The LIDAR data appeared to be of sufficient accuracy for planning purposes. However, it is recommended that detailed aerial topography and additional filed survey be completed as part of the final design effort. The extents and layout of the existing conditions HEC-RAS model are shown on Figure 4-1. Output from the existing conditions HEC-RAS file has been provided in Appendix B.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities
- 513 (EL 987) — Base Flood Elevation line and value; elevation in feet*
- Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A — A: Cross section line
- 23 — 23: Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4275000mE — 1000-meter Universal Transverse Mercator grid ticks, zone 11
- 6000000 FT — 5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 406), Lambert projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

Figure 4-1
Effective FIRM Panel

Legend

HEC-RAS Cross Section

123234 Cross Section ID

N

0 200 400 600 800 Feet

Figure 4-2
HEC-RAS Map

There are several existing bridges in the project reach which were included in the HEC-RAS model. The four bridges at I-5 (north and south mainlines and adjacent ramps) were determined to be well above the 100-year water surface elevation, easily providing more than 10 feet of clearance between the proposed path and bridge low chord, and were therefore not included in the model as bridges, although the abutment geometry is reflected in the cross-section data. Geometric data for the bridges utilized in the model (i.e. low chord, deck, abutments and piers) was based on field survey data as most of the available record drawings did not provide adequate information. The model was used to estimate the available freeboard at bridges for both tidal backwater and flooding conditions, and if extending a path under each bridge within the channel is feasible given freeboard constraints.

4.1 Tidal Backwater Impacts

Chollas Creek and South Chollas Creek are subject to inundation from tidal backwater within the entire project reach. An assessment of available tidal information was completed to establish a minimum pathway elevation within the channel which is above the Mean Higher Water at an elevation where pathway inundation would occur only infrequently. Based on NOAA tide curves, a path elevation of 4.75' above mean sea level (AMSL) would be inundated by tidal backwater an average of once every 10-years. This was confirmed through the evaluation of approximately three years of tidal data as depicted on Figure 4-2 which shows the 4.75 elevation exceeded once in that time period. This elevation does not consider inundation from flood related events which is discussed in Section 5.0. The impacts of lowering the path elevation in terms of frequency of tidal inundation can be approximated from this figure.

The feasibility of extending the pathway within the channel under each bridge given tidal backwater was evaluated based on the minimum path elevation and bridge low chord as-built data. It should be noted that at some bridges, the controlling elevation was the bottom of a utility pipe crossing the bridge below the low chord elevation. A graphical representation of design tidal backwater elevation and clearance to the low chord at each bridge has been provided in Appendix C. A summary of relevant data at each bridge has been provided in Table 4-1.

The results of the assessment indicate that it is not feasible to extend multiuse pathways under any of the bridges given estimated channel flowline elevations and tidal backwater constraints with the exception of the I-5 bridges. The minimum recommended clearance is 10 feet, with an absolute minimum of 8 feet.

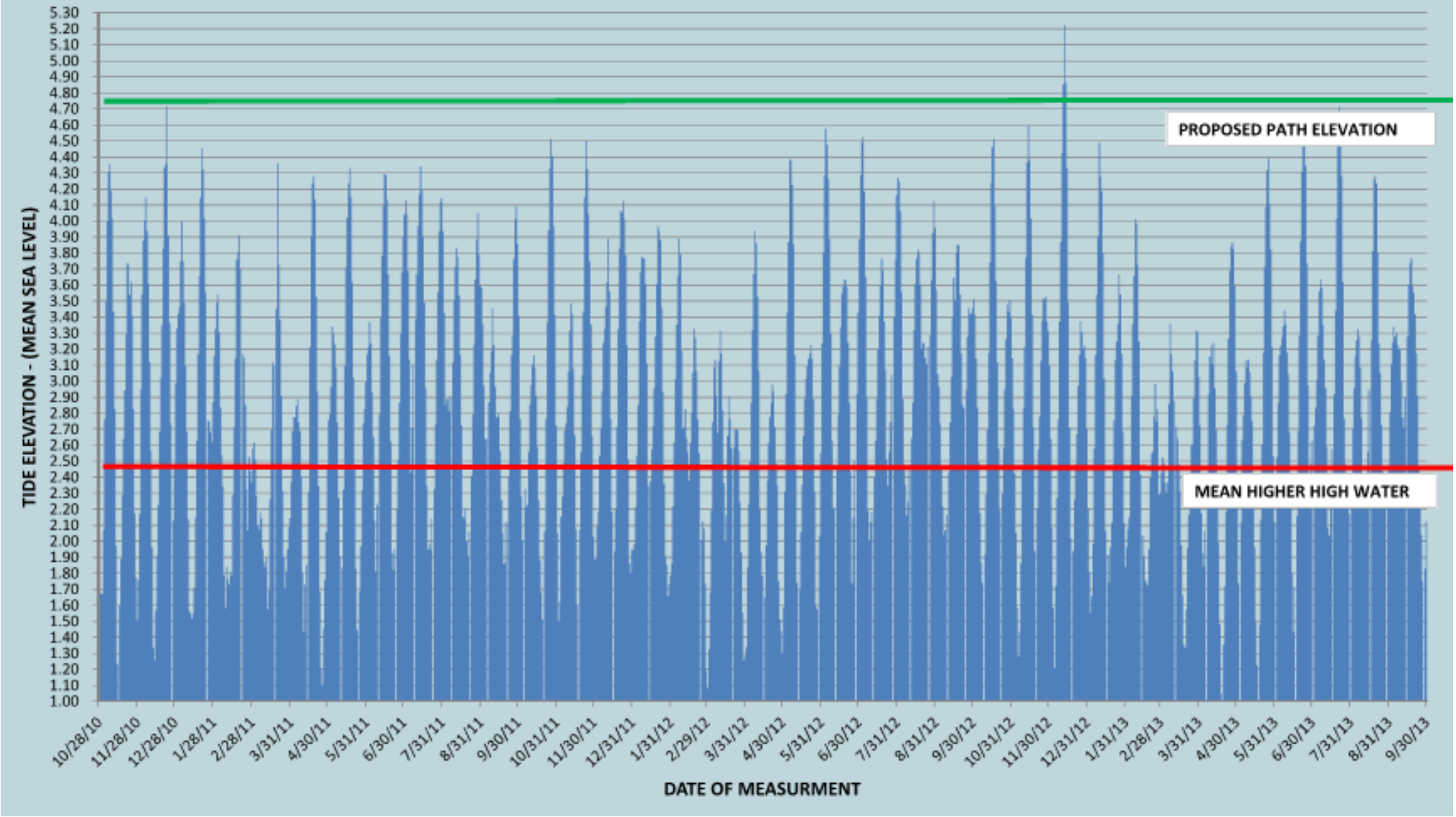


Figure 4-3
Historic Tide Data

Table 4-1
Summary of Bridge Vertical Clearance

Bridge Location	Design Tidal Backwater Elevation	Controlling Bridge Low-Chord Elevation	Path Vertical Clearance
Main Street	4.75'	10.37	5.62
32nd Street	4.75'	7.23	2.48
Rigel Street	4.75'	9.66	4.91
I-15 On-Ramp (NB)	4.75'	12.00	7.25
I-15 On-Ramp (SB)	4.75'	10.62	5.87

5.0 Proposed Conditions Channel Hydraulics

Psomas evaluated a number of potential pathway alignments based on project specific constraints including right-of-way, bridge clearance, tidal backwater, traffic issues and overall public safety. The recommended pathway alignment, as well as typical sections for each path segment, is provided on Figures 5-1 and 5-2. The proposed pathway will need to be within the existing channel along two discreet reaches as a result of limited right-of-way. The first reach is from the I-15 northbound off-ramp to Rigel Street. The second reach is from Main Street to 32nd Street.

As shown in the typical sections on Figure 5-2, the existing bank will be "benched" to accommodate the proposed pathway where it is proposed to be in the channel. Psomas delineated existing right-of-way based on available records. This information was utilized to determine the limits of potential channel reconfiguration with the goal of offsetting any conveyance losses associated with encroachment of the pathway.

A proposed conditions HEC-RAS model was developed through modification of the existing conditions cross-sections to represent the new pathway in the channel. The results of the analysis indicate no increase in water surface elevations (WSELs) greater than 0.1' in those sections where the pathway would be constructed in the channel. Table 5-1 provides a summary of water surface elevations from the HEC-RAS model. Channel cross sections and model output are provided in Appendix D.

Increases in WSEL greater than in 0.1' require a Letter of Map Revision (LOMR) through FEMA which should be avoided as it is a costly and time consuming process. No LOMR is anticipated for this project since increases are kept below the 0.10' threshold. Increases in the 100-year channel velocity for proposed conditions are insignificant with no increased erosion risk over existing conditions.

As previously discussed, the pathway in the channel should be set at a minimum elevation of 4.75' AMSL which eliminates impacts from tidal backwater. However, periodic inundation of the path would still occur at that elevation as a result of the conveyance of flood waters in the channel. The path profile was therefore raised to the maximum elevation in which the required channel modifications could be accommodated

within the available right-of-way. Based on the estimated peak discharges discussed in Section 2, the path will be inundated between a 2-year and 5-year flood event. This is shown graphically on the cross-sections in Appendix D. Due to the periodic inundation of the proposed path, the City of San Diego will install warning/restrictive devices in compliance with current standards in order to prevent access during large storm events.

6.0 Tributary Drainage

Psomas completed a planning level assessment of potential tributary drainage issues which may impact the proposed pathway project. There does not appear to be any significant offsite drainages which cross the proposed path alignment that would require special treatment in the form of culverts, scuppers or other improvements.

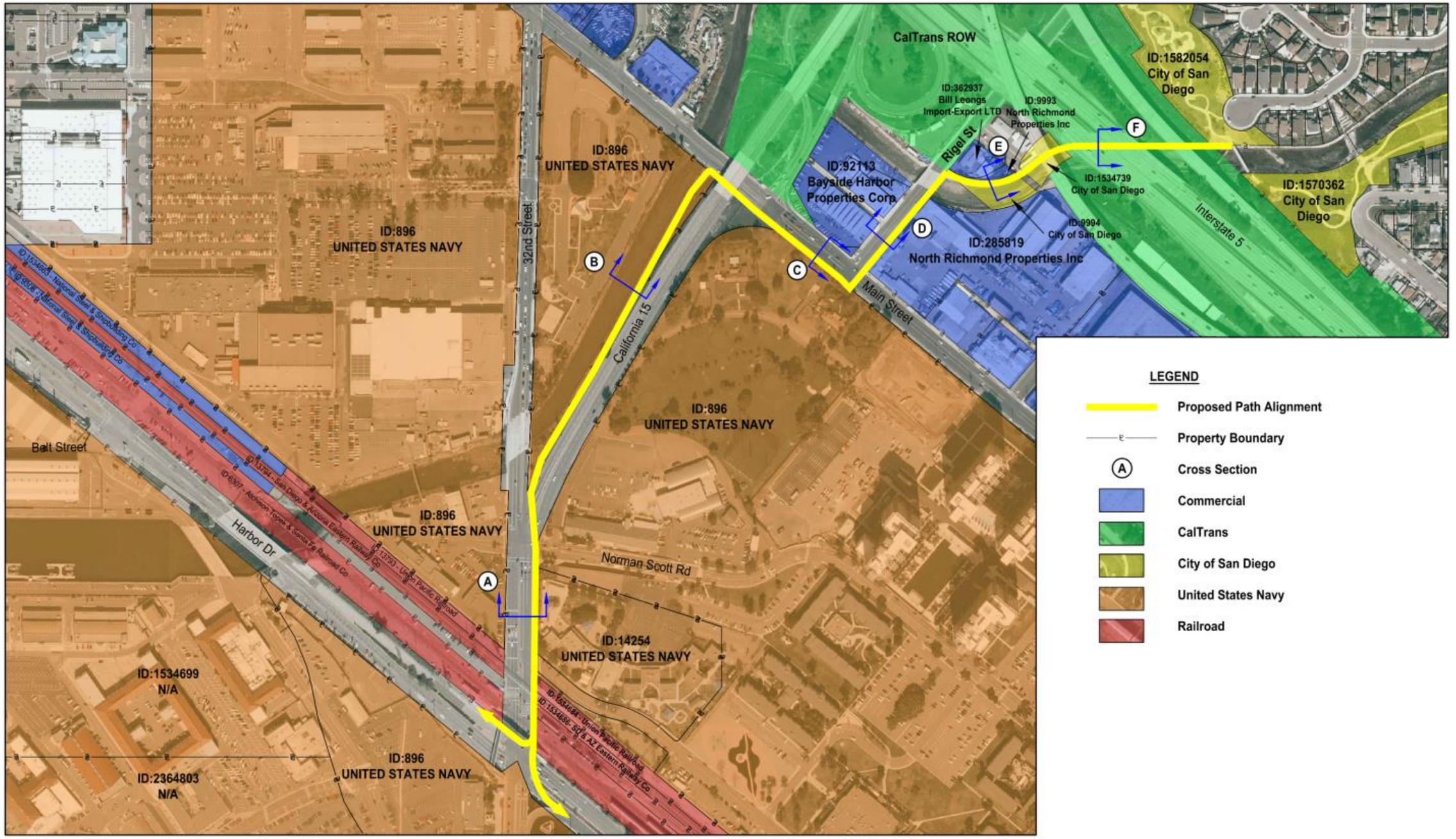
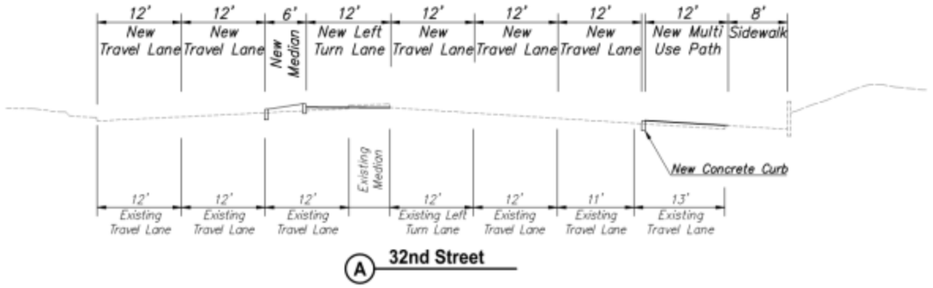
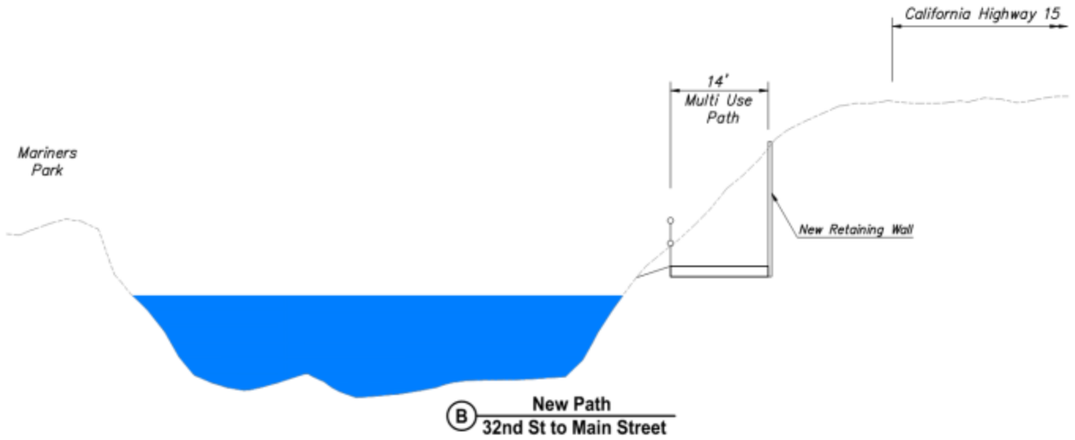


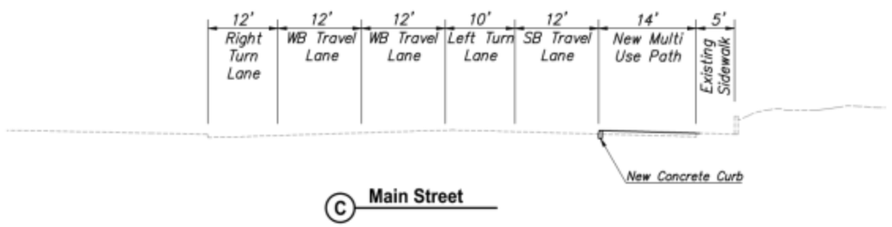
Figure 6-1
Recommended Pathway Alignment



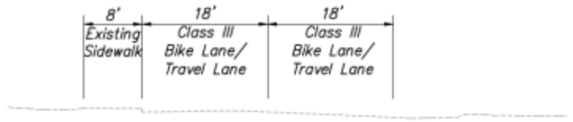
A 32nd Street



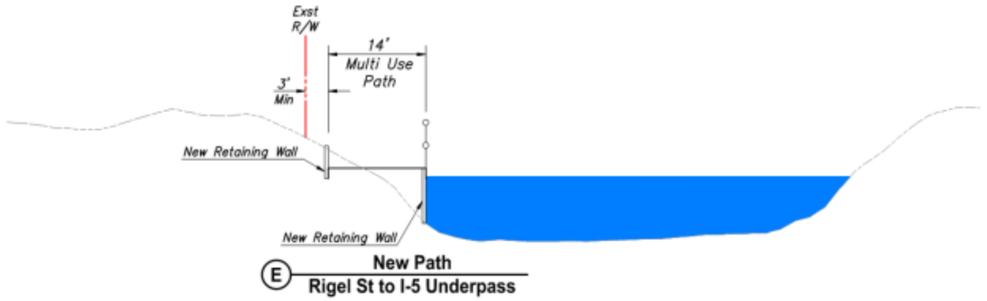
B New Path
32nd St to Main Street



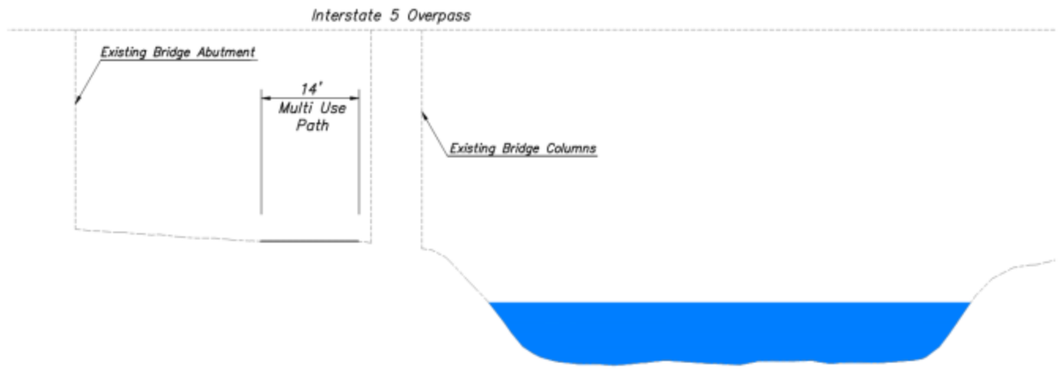
C Main Street



D Rigel Street



E New Path
Rigel St to I-5 Underpass



F Interstate 5 Overpass

Figure 6-2
Typical Sections

Table 6-1
HEC-RAS Data Summary

XSEC ID	EXISTING WSEL	PROPOSED WESEL	DIFFERENCE	EXISTING VELOCITY	PROPOSED VELOCITY	DIFFERENCE
138148	16.3	16.3	0.0	5.2	5.2	0.0
137325	16.3	16.3	0.0	5.5	5.5	0.0
137093	16.3	16.3	0.0	5.2	5.2	0.0
135044	16.3	16.3	0.0	4.0	4.0	0.0
131970	16.3	16.3	0.0	3.9	3.7	-0.1
130893	16.2	16.2	0.0	4.6	4.6	0.0
129869	16.2	16.2	0.0	3.9	3.9	0.0
128810	16.2	16.2	0.0	4.0	3.9	-0.1
127749	16.2	16.2	0.0	3.9	4.0	0.0
127109	16.1	16.1	0.0	3.8	3.8	0.0
125968	16.1	16.0	0.0	4.2	4.2	0.0
124756	15.8	15.8	0.0	5.3	5.3	0.0
123676	15.6	15.6	0.0	6.2	6.2	0.0
123234	14.8	14.7	0.0	7.6	7.6	0.0
122969	14.8	14.8	0.0	7.2	7.3	0.0
122759	14.8	14.8	0.0	6.9	6.9	0.0
121646	14.5	14.5	0.0	6.7	6.7	0.0
120242	14.7	14.7	0.0	5.1	5.1	0.0
119343	13.7	13.6	0.0	9.0	9.0	0.0
117902	13.8	13.8	0.0	7.5	7.6	0.0
117043	13.2	13.2	0.0	7.5	7.5	0.0
114816	13.0	13.0	0.0	8.0	7.6	-0.4
112362	12.5	12.6	0.1	8.8	8.3	-0.5
109183	11.9	12.0	0.1	9.7	9.2	-0.5
106608	12.1	12.1	0.0	7.8	7.8	0.0
105398	10.7	10.7	0.0	10.5	10.5	0.0
102632	10.4	10.4	0.0	9.4	9.4	0.0
102557	10.1	10.1	0.0	9.9	9.9	0.0
99882	7.2	7.2	0.0	15.0	15.0	0.0

APPENDIX A
LIDAR DATA DOCUMENTATION

APPENDIX B
EXISTING CONDITIONS
HEC-RAS OUTPUT

APPENDIX C
TIDAL BACKWATER CLEARANCE AT BRIDGES

APPENDIX D
PROPOSED CONDITIONS
HEC-RAS OUTPUT