Meeting of the Central Valley Flood Protection Board
July 22, 2011

Staff Report
Sacramento Regional Transit District
Morrison Creek Bridge

1.0 – ITEM

Consider approval of Permit No. 18166-1 (Attachment B).

2.0 – APPLICANT

Sacramento Regional Transit District, Sacramento County

3.0 – LOCATION

The project is located in south Sacramento, over Morrison Creek east of Franklin Boulevard (Morrison Creek, Sacramento County, see Attachment A).

4.0 – DESCRIPTION

Construct light rail improvements adjacent to and over Morrison Creek in conjunction with the South Sacramento Corridor Phase 2 project to include embankment, bridge (aerial structure over Morrison Creek/UPRR), abutments, bents, temporary crossing, retaining walls, soundwalls, falsework, and relocate existing levee access road adjacent to Morrison Creek.

The proposed bridge will be located above and in the vicinity of the State/federal levees and floodwalls which were built as part of the South Sacramento County Streams Project along Morrison Creek. There would be no vegetation planting for this bridge project.

5.0 – PROJECT ANALYSIS

The bridge proposed by Sacramento Regional Transit District (RT) is to be a 32- ft wide and 1,317.5- ft long box girder completely spanning Morrison Creek, its levee and the UPRR embankment. The length of spans over Morrison Creek ranges from 108 ft to 175.5 ft. The pier has a 7 ft octagonal column with 108 inches CIDH concrete piles.

Title 23 Section 128 (10) (A) states that the bottom (soffit) of a proposed bridge must be at least three feet above the design flood plane, two feet for minor streams. The proposed bridge has a minimum 18.9 feet of vertical clearance above the existing west levee and 26.7 feet of vertical clearance above UPRR embankment.
The reach of proposed project is a well engineered channel with engineered levees and side slopes. There is no bank protection needed at the bridge due to low velocities caused by the backwater effects on the Beach-Stone Lakes and the lower reach of Morrison Creek.

5.1 – Hydraulic Analysis

Originally, the runoff discharge from the Morrison Creek Stream Basin drained into the Sacramento River. When levees of east Sacramento River were constructed, the flows were diverted into Beach-Stone Lakes. The most recent flooding occurred in 1982 and 1986. Those two floods had recurrence intervals of 25 years. The Camanche Reservoir on the Mokelumne River reduces flood hazards to the western portion of the Morrison Creek. It also reduces the backwater effect of the Mokelumne and Cosumnes Rivers on the Beach-Stone Lakes and the lower reach of Morrison Creek.

The discharge of the 100-yr flood at Morrison Creek used for the bridge design analysis is taken from the information provided by the U.S. Army Corps of Engineers (USACE). The datum elevation used for study is NGVD 29. A HEC-RAS model was used to analyze the output result of hydraulic conditions with existing conditions and proposed conditions.

There are two scenarios due to the backwater effect on the Beach-Stone Lakes and the lower reach of Morrison Creek; one is the 100-yr flood event with peak stage in Beach Lakes and concurrent flows in Morrison Creek (2A scenario) and the other is the case of 100-yr flood discharge at Morrison Creek with peak flows in Morrison Creek and concurrent stage in Beach Lakes (2B scenario).

The maximum water surface elevation (WSEL) occurs due to the backwater effect at Beach Lakes during the 100-yr flood event for the 2A scenario. The concurrent discharge in Morrison Creek is 6,875 cfs. The WSEL of the existing condition is 15.30 ft and the velocity ranges from 1.35 ft/s to 1.58 ft/s near the future bridge location. The WSEL of the proposed project condition is 15.31 ft and the velocity ranges from 1.35 ft/s to 1.58 ft/s near the bridge.

The 100-yr flood discharge at Morrison Creek for 2B scenario is estimated about 8,283 cfs. The water surface elevation (WSEL) is 11.46 ft and the velocity ranges from 2.42 ft/s to 2.83 ft/s near the bridge.

The WSEL of 15.31 ft (2A scenario) is used to calculate freeboard. The levee elevation of west bank is 21.34 ft and the freeboard is 6.03 ft. The velocity of 2B scenario (2.83 ft/s) is higher than that of 2A scenario (1.58 ft/s) and it is not significant to cause any

damage for levee and bridges. There is no bank protection needed at the bridge. In addition, bank protection already exists on the levees.

The proposed Regional Transit flyover bridge passes 100-yr flood discharge. The proposed project meets the Board's standards contained in Title 23, California Code, Article 8, Section 128(a)(10)(A) which states "The bottom members (soffit) of a proposed bridge must be at least three (3) feet above the design flood plane. The required clearance may be reduced to two (2) feet on minor streams at sites where significant amounts of stream debris are unlikely".

The scour and countermeasure analyses were estimated by HEC-18 model. The total scour of bridge is comprised of three components such as long-term aggradation and degradation, contraction scour and local scour. The total scour is about 8.0 ft for design discharge.

Based on these results, the proposed project will convey 100-yr base flood without significant damage either the flood plain or surrounding property.

5.2 – Geotechnical Analysis

This project has no significant geotechnical impacts to the existing streambank or the floodway. The distance of the bridge column from the levee toe is about 18 ft at waterside which meets the Board's standards with minimum distance of ten (10) feet beyond the levee toes. Excavation occurs at locations that are not critical to the integrity of the natural stream bank or creek. All fill, excavation, and temporary structures will be completed in compliance with Permit No. 18166-1 (see Attachment B) and Title 23.

6.0 – AGENCY COMMENTS AND ENDORSEMENTS

The comments and endorsements associated with this project, from all pertinent agencies are shown below:

- The U. S. Army Corps of Engineers Section 208.10 letter has not been received but is expected to be received prior to the July 22, 2011 Board meeting which then will become Exhibit A of the permit.
- The endorsement letter of the Sacramento County was received on October, 2008.

7.0 – CEQA ANALYSIS

The Board, acting as a responsible agency under CEQA, has independently reviewed the Draft Environmental Impact Statement/Draft Environmental Impact Report (DEIS/DEIR) (September 1994), Supplemental Draft Environmental Impact

Statement/Subsequent Draft Environmental Impact Report (SDEIS/R) (SCH No. 1996052075, January 2007) and Supplemental Final Environmental Impact Statement/Subsequent Final Environmental Impact Report (SFEIS/R) (SCH No. 1996052075, September 2008) on the South Sacramento Corridor Phase 2 Project.

Sacramento Regional Transit, as the lead agency, determined that the project would not have a significant effect on the environment and adopted Resolution 08-10-0145 on October 27, 2008 (including Statement of Facts, Findings, Impacts and Mitigation Measures, Statement of Overriding Considerations and Mitigation Monitoring and Reporting Program). The Notice of Determination was filed with the State Clearinghouse on October 31, 2008. The SDEIS/R, SFEIS/R, Resolution 08-10-0145 and Mitigation Monitoring Plan may be viewed or downloaded from the Central Valley Flood Protection Board website at http://www.cvfpb.ca.gov/meetings/2011/7-22-2011.cfm. The documents are also available for review in hard copy at the Board and County offices.

Impacts that can be Mitigated
The significant impacts and the mitigation measures to reduce them to less than significant are adopted in Sacramento Regional Transit Resolution 08-10-0145, dated October 27, 2008 (which includes a Statement of Facts, Findings, Impacts and Mitigation Measures, Statement of Overriding Considerations and Mitigation Monitoring and Reporting Program). The significant impacts associated with the South Sacramento Corridor Phase 2 Project, are reduced to a less-than-significant level by mitigation measures identified in the MMRP and have been incorporated into the project.

Based on its independent review of the SDEIS/R, SFEIS/R and Sacramento Regional Transit Resolution 08-10-0145 the Board finds that for each of the significant impacts described, changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessens the significant environmental effects as identified in the SFEIS/R.

Significant Unavoidable Adverse Impacts of the Project
The following impacts of the proposed project remains significant following adoption and implementation of the mitigation measures described in the SFEIS/R:

The Locally Preferred Alternative Phase 2 (LPAP2) locates a 2,000 space parking structure just south of the main college entrance off of Bruceville Road and includes an extension of an internal CRC roadway to a new driveway on Old Calvine Road, about 500 feet west of Bruceville Road. The LPAP2 is projected to impact the intersection of Franklin Boulevard and Cosumnes River Boulevard. During the A.M. peak traffic hour, the intersection operating condition deteriorates by more than 5 seconds of delay, from 65.2 to 86.0 seconds. During the P.M. peak traffic hour, the intersection operating condition deteriorates by more than 5 seconds of delay, from 44.2 to 64.8 seconds.

The Board also finds that the specific economic, legal, social, technological or other benefits of the project outweigh the unavoidable adverse environmental effects, which are thus considered to be “acceptable.”

Statement of Overriding Considerations
Sacramento Regional Transit adopted Resolution 08-10-0145 including the Statement of Overriding Considerations. The Board concurs with this Statement.

The Board has independently considered the significant and unavoidable environmental impacts of the proposed project. The Board has also considered the benefits of the project, including expanding transit service in South Sacramento; developing and implementing transportation policies and services that reinforce local and regional land use plans and policies. The Board finds that economic, legal, social, technological, or other benefits of the proposed project outweigh the unavoidable adverse environmental effects of the project, and the adverse environmental effects are considered acceptable when these benefits of the project are considered.

The documents and other materials which constitute the record of the Central Valley Flood Board’s proceedings in this matter are in the custody of Jay Punia, Executive Officer, Central Valley Flood Protection Board, 3310 El Camino Ave., Rm. 151, Sacramento, California 95821.

8.0 – SECTION 8610.5 CONSIDERATIONS

1. Evidence that the Board admits into its record from any party, State or local public agency, or nongovernmental organization with expertise in flood or flood plain management:

   The Board will make its decision based on the evidence in the permit application and attachments, this staff report, and any other evidence presented by any individual or group.

2. The best available science that related to the scientific issues presented by the executive officer, legal counsel, the Department or other parties that raise credible scientific issues.

   The accepted industry standards for the work proposed under this permit as regulated by Title 23 have been applied to the review of this permit.

3. Effects of the decision on the entire State Plan of Flood Control:

   This project has no negative impacts on the State Plan of Flood Control. Both hydraulic and structural impacts from the project construction are negligible.

4. Effects of reasonable projected future events, including, but not limited to, changes in hydrology, climate, and development within the applicable watershed:

   Climate change issues have not been taken into account in the hydraulic analysis for this project and the water surface elevation change resulting from change in climate for the site is unknown. However, the more than 18 feet of vertical clearance of the bridge from the project levee, it is not foreseeable that sea level rise as a result of climate change would have an adverse effect to both the bridge and the project levee. There are no other foreseeable projected future events that would impact this project.

9.0 – STAFF RECOMMENDATION

Staff recommends that the Board adopt the CEQA findings, approve Permit No. 18166-1 conditioned upon receipt of a favorable U.S. Army Corps of Engineers' 208.10 comment letter and direct the Executive Officer to take necessary actions to execute the permit and to file a Notice of Determination with the State Clearinghouse.

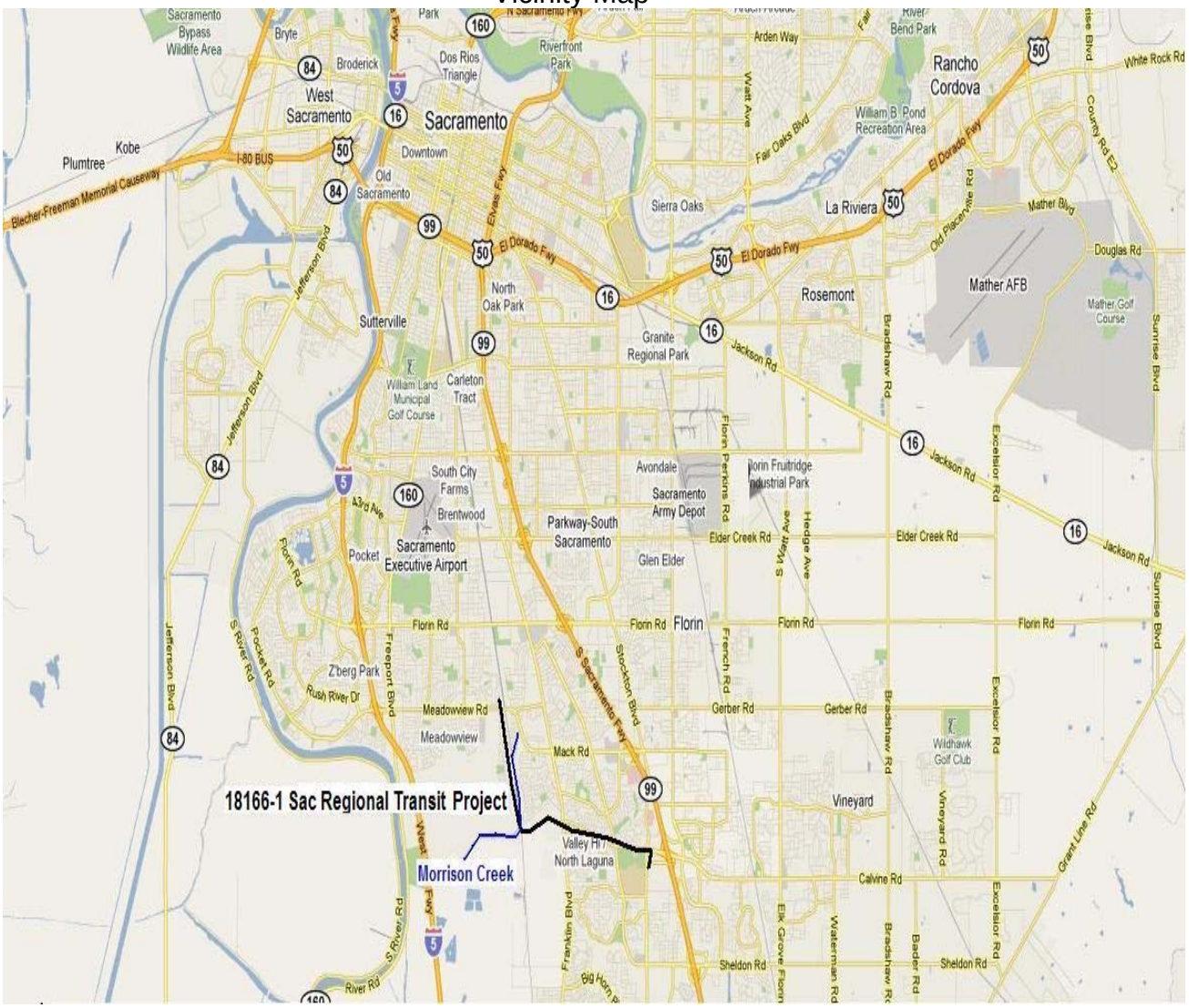
10.0 – LIST OF ATTACHMENTS

A. Location Maps and Photos
B. Draft Permit No. 18166-1
C. Regional Transit Bridge at Morrison Creek General Plan & Bridge Pier Plan
D. HEC-RAS Model Result

Design Review:	Sungho Lee
Environmental Review:	James Herota
Document Review:	David Williams, Dan Fua, Len Marino

ATTACHMENT A

Vicinity Map



ATTACHMENT A

Project Location Map

ATTACHMENT A

Sacramento Regional Transit Light Rail Project over Morrison Creek

DRAFT

STATE OF CALIFORNIA
THE RESOURCES AGENCY

THE CENTRAL VALLEY FLOOD PROTECTION BOARD

PERMIT NO. 18166-1 BD

This Permit is issued to:

Sacramento Regional Transit District
2811 O Street
Sacramento, California 95816-6410

Construct light rail improvements adjacent to and over Morrison Creek east of Franklin Boulevard in conjunction with the South Sacramento Corridor Phase 2 project; construct embankment, bridge (aerial structure over Morrison Creek/UPRR), abutments, bents, temporary crossing, retaining walls, soundwalls, falsework, and relocate existing levee access road adjacent to Morrison Creek. The project is located in Sacramento extending south from Meadowview Road to Bruceville Road (Section 8&9, T7N, R5E, MDB&M, Morrison Creek, Sacramento County).

NOTE: Special Conditions have been incorporated herein which may place limitations on and/or require modification of your proposed project as described above.

(SEAL)

Dated: _____

_____
Executive Officer

GENERAL CONDITIONS:

ONE: This permit is issued under the provisions of Sections 8700 – 8723 of the Water Code.

TWO: Only work described in the subject application is authorized hereby.

THREE: This permit does not grant a right to use or construct works on land owned by the Sacramento and San Joaquin Drainage District or on any other land.

FOUR: The approved work shall be accomplished under the direction and supervision of the State Department of Water Resources, and the permittee shall conform to all requirements of the Department and The Central Valley Flood Protection Board.

FIVE: Unless the work herein contemplated shall have been commenced within one year after issuance of this permit, the Board reserves the right to

change any conditions in this permit as may be consistent with current flood control standards and policies of The Central Valley Flood Protection Board.

SIX: This permit shall remain in effect until revoked. In the event any conditions in this permit are not complied with, it may be revoked on 15 days' notice.

SEVEN: It is understood and agreed to by the permittee that the start of any work under this permit shall constitute an acceptance of the conditions in this permit and an agreement to perform work in accordance therewith.

EIGHT: This permit does not establish any precedent with respect to any other application received by The Central Valley Flood Protection Board.

NINE: The permittee shall, when required by law, secure the written order or consent from all other public agencies having jurisdiction.

TEN: The permittee is responsible for all personal liability and property damage which may arise out of failure on the permittee's part to perform the obligations under this permit. If any claim of liability is made against the State of California, or any departments thereof, the United States of America, a local district or other maintaining agencies and the officers, agents or employees thereof, the permittee shall defend and shall hold each of them harmless from each claim.

ELEVEN: The permittee shall exercise reasonable care to operate and maintain any work authorized herein to preclude injury to or damage to any works necessary to any plan of flood control adopted by the Board or the Legislature, or interfere with the successful execution, functioning or operation of any plan of flood control adopted by the Board or the Legislature.

TWELVE: Should any of the work not conform to the conditions of this permit, the permittee, upon order of The Central Valley Flood Protection Board, shall in the manner prescribed by the Board be responsible for the cost and expense to remove, alter, relocate, or reconstruct all or any part of the work herein approved.

SPECIAL CONDITIONS FOR PERMIT NO. 18166-1 BD

THIRTEEN: All work approved by this permit shall be in accordance with the submitted drawings and specifications except as modified by special permit conditions herein. No further work, other than that approved by this permit, shall be done in the area without prior approval of the Central Valley Flood Protection Board.

FOURTEEN: The permittee shall maintain the permitted encroachment(s) and the project works within the utilized area in the manner required and as requested by the authorized representative of the Department of Water Resources or any other agency responsible for maintenance.

FIFTEEN: The permittee shall defend, indemnify, and hold the Central Valley Flood Protection Board and the State of California, including its agencies, departments, boards, commissions, and their respective officers, agents, employees, successors and assigns (collectively, the "State"), safe and harmless, of and from all claims and damages related to the Central Valley Flood Protection Board's approval of this permit, including but not limited to claims filed pursuant to the California Environmental Quality Act. The State expressly reserves the right to supplement or take over its defense, in its sole discretion.

SIXTEEN: The permittee is responsible for all liability associated with construction, operation, and maintenance of the permitted facilities and shall defend, indemnify, and hold the Central Valley Flood Protection Board and the State of California; including its agencies, departments, boards, commissions, and their respective officers, agents, employees, successors and assigns (collectively, the "State"), safe and harmless, of and from all claims and damages arising from the project undertaken pursuant to this permit, all to the extent allowed by law. The State expressly reserves the right to supplement or take over its defense, in its sole discretion

SEVENTEEN: The Central Valley Flood Protection Board and Department of Water Resources shall not be held liable for any damages to the permitted encroachment(s) resulting from flood fight, operation, maintenance, inspection, or emergency repair.

EIGHTEEN: The permittee shall contact the Department of Water Resources by telephone, (916) 574-0609, and submit the enclosed postcard to schedule a preconstruction conference. Failure to do so at least 10 working days prior to start of work may result in delay of the project.

NINETEEN: The permittee may be required, at permittee's cost and expense, to remove, alter, relocate, or reconstruct all or any part of the permitted encroachment(s) if removal, alteration, relocation, or reconstruction is necessary as part of or in conjunction with any present or future flood control plan or project or if damaged by any cause. If the permittee does not comply, the Central Valley Flood Protection Board may remove the encroachment(s) at the permittee's expense.

TWENTY: The permittee should contact the U.S. Army Corps of Engineers, Sacramento District, Regulatory Branch, 1325 J Street, Sacramento, California 95814, telephone (916) 557-5250, as compliance with Section 10 of the Rivers and Harbors Act and/or Section 404 of the Clean Water Act may be required.

TWENTY-ONE: The permittee shall be responsible for repair of any damages to the Morrison Creek and other flood control facilities due to construction, operation, or maintenance of the proposed project.

TWENTY-TWO: If the project, or any portion thereof, is to be abandoned in the future, the permittee or successor shall abandon the project under direction of the Central Valley Flood Protection Board and Department of Water Resources, at the permittee's or successor's cost and expense.

TWENTY-THREE: The permittee shall provide supervision and inspection services acceptable to the Central Valley Flood Protection Board. A professional engineer registered in the State of California shall certify that all work was inspected and performed in accordance with submitted drawings, specifications, and permit conditions.

TWENTY-FOUR: Upon completion of the project, the permittee shall submit as-built drawings to: Department of Water Resources, Flood Project Inspection Section, 3310 El Camino Avenue, Suite Rm 256, Sacramento, California 95821.

TWENTY-FIVE: No construction work of any kind shall be done during the flood season from November 1 to April 15 without prior approval of the Central Valley Flood Protection Board.

TWENTY-SIX: The proposed access ramp shall be graded to direct all surface drainage away from the levee section.

TWENTY-SEVEN: At all times during construction, at least one lane of the levee crown roadway shall be kept clear for vehicular access.

TWENTY-EIGHT: No excavation shall be made or remain in the levee section during the flood season from November 1 to April 15 without prior approval of the Central Valley Flood Protection Board.

TWENTY-NINE: A temporary bench mark, set to a known datum, shall be placed at the project site during construction.

THIRTY: All cleared trees and brush shall be completely burned or removed from the floodway, and downed trees or brush shall not remain in the floodway during the flood season from November 1 to April 15.

THIRTY-ONE: Temporary staging, formwork, stockpiled material and/or equipment shall not remain in the floodway during the flood season from November 1st to April 15.

THIRTY-TWO: The work area shall be restored to the condition that existed prior to start of work.

THIRTY-THREE: Trees, brush, sediment, and other debris shall be kept cleared from the bridge site and disposed of outside the floodway to maintain the design flow capacity and flowage area.

THIRTY-FOUR: If the bridge is damaged to the extent that it may impair the channel or floodway capacity, it shall be repaired or removed prior to the next flood season.

THIRTY-FIVE: All debris generated by this project shall be disposed of outside the adopted plan of flood control and/or the flood control project works.

THIRTY-SIX: There shall be no plantings within the project area under this permit, except that of native grasses, which may be required for slope protection.

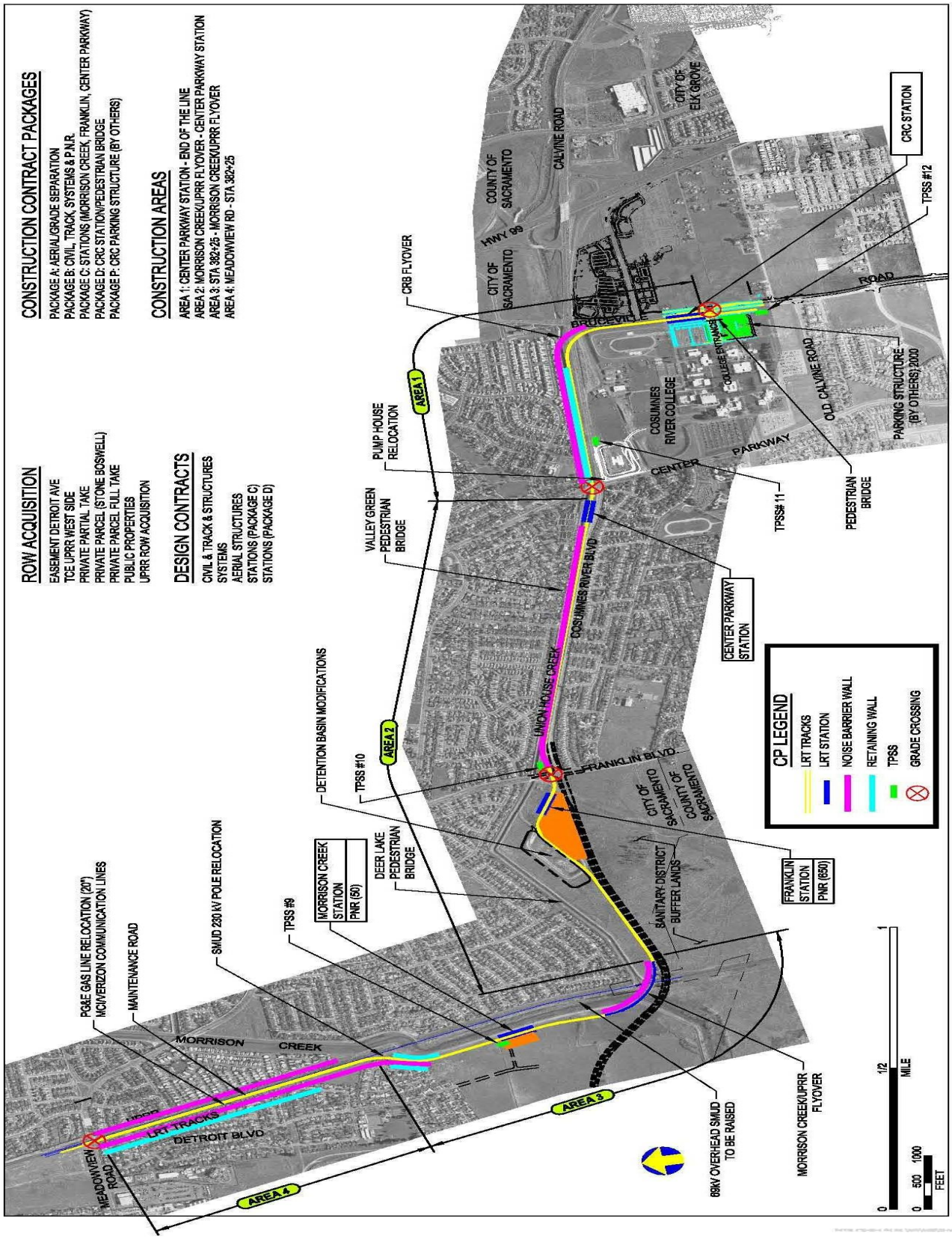
THIRTY-SEVEN: If the permitted encroachment result in an adverse hydraulic impact, the permittee shall provide appropriate mitigation measures, to be approved by the Central Valley Flood Protection Board, prior to implementation of mitigation measures.

THIRTY-EIGHT: The mitigation measures approved by the CEQA lead agency and the permittee are found in its Mitigation and Monitoring Reporting Program (MMRP) adopted by the CEQA lead agency. The permittee shall implement all such mitigation measures.

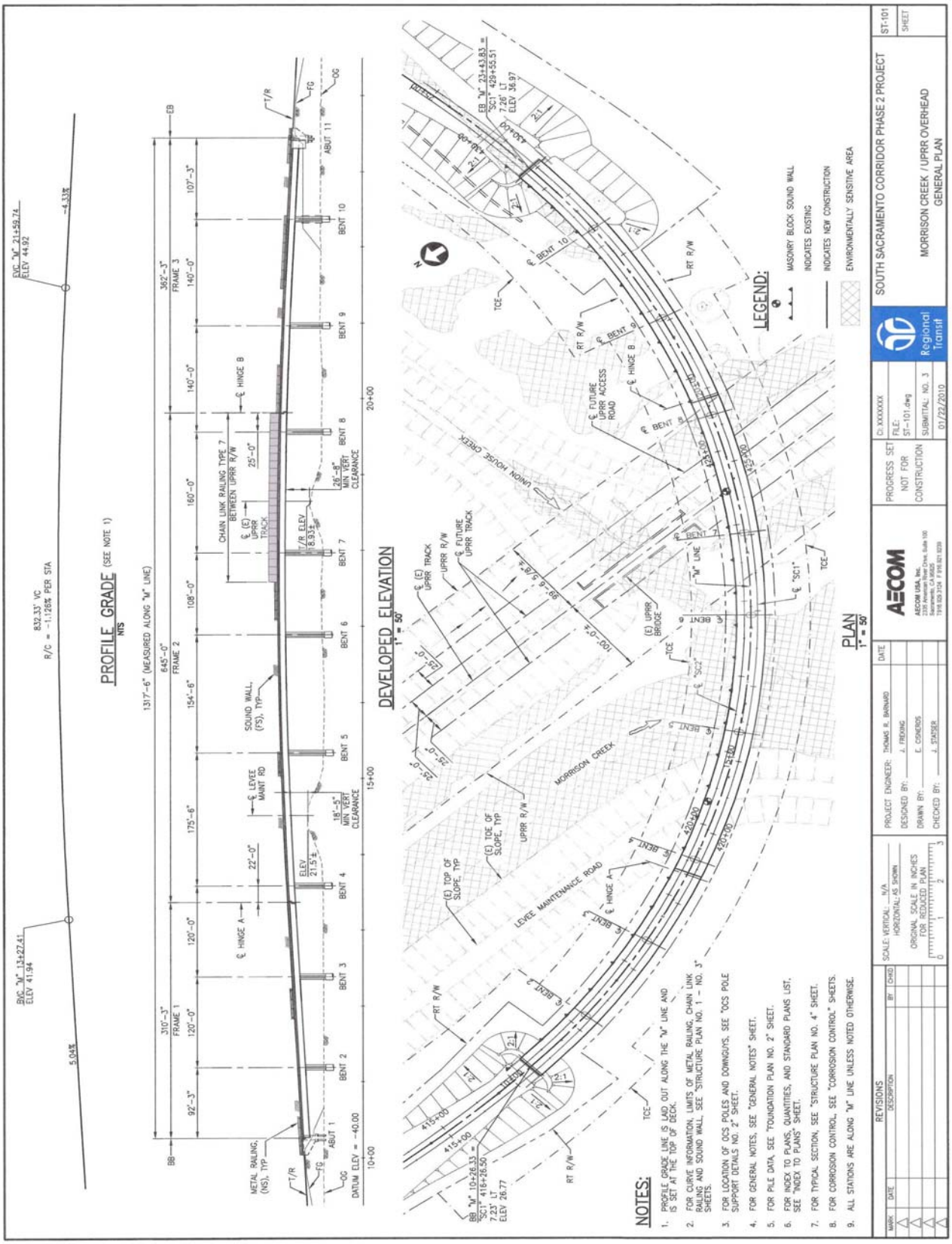
THIRTY-NINE: The permittee shall comply with all conditions set forth in the letter from the U.S. Army Corps of Engineers dated XXXXXX, which is attached to this permit as Exhibit A and is incorporated by reference.

ATTACHMENT C

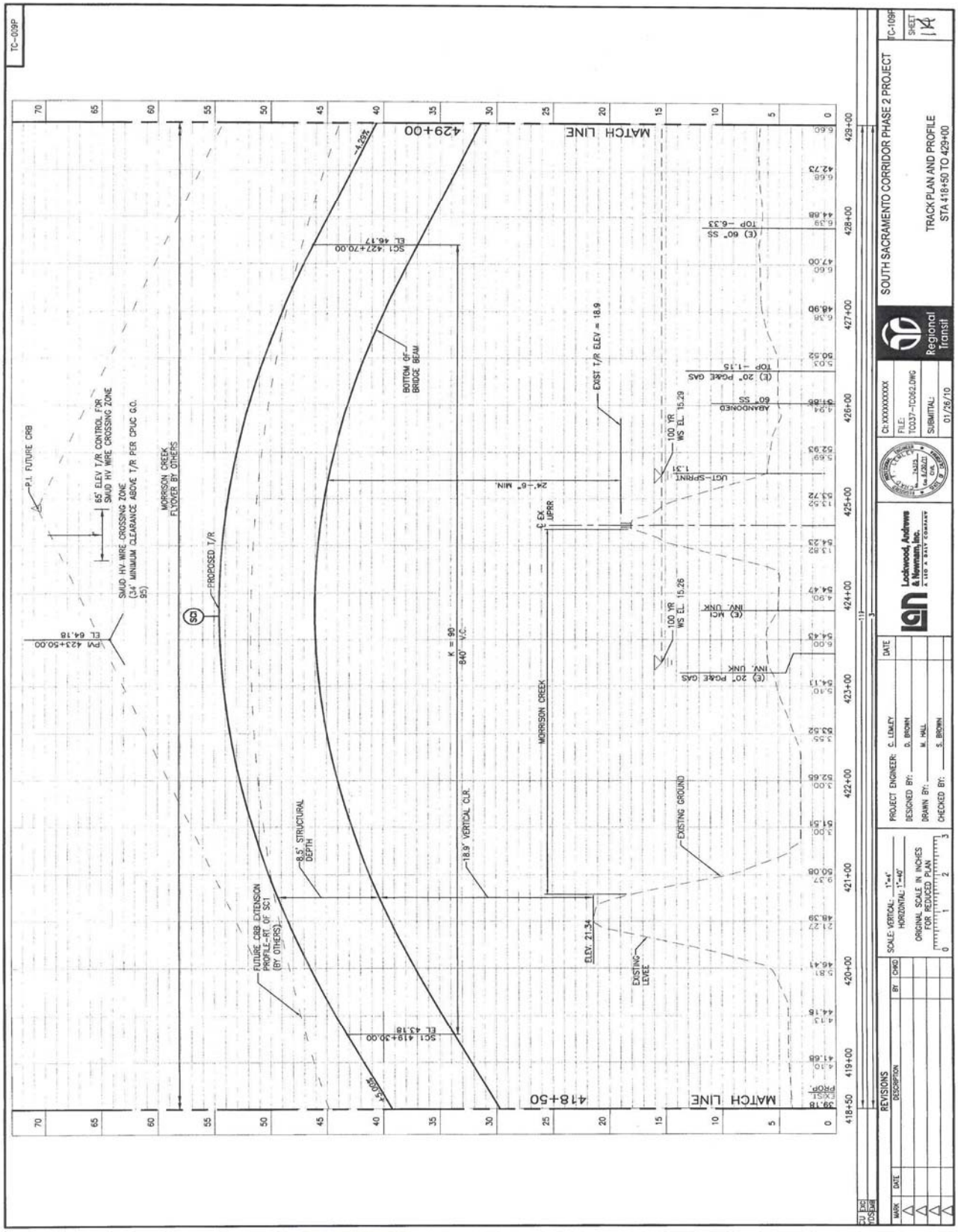
Aerial Map of Project



Morrison Creek Bridge Plan

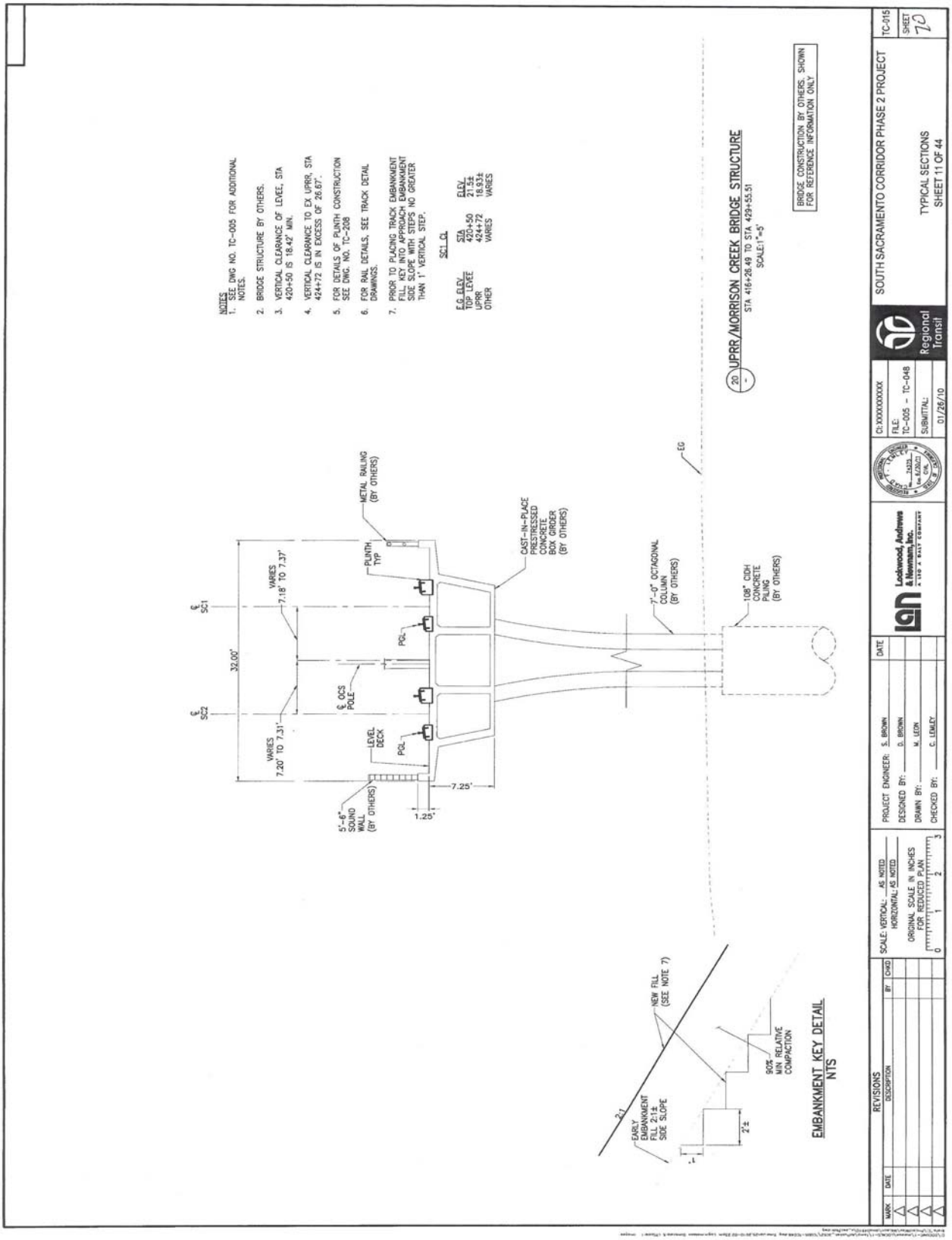


ATTACHMENT C



ATTACHMENT C

Bridge Pier Plan over Morrison Creek



ATTACHMENT D

Existing Condition of HEC-RAS Model (100-yr)

River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Ch	Flow Area	Top Width	Fr # Ch
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
21036. UPRR		Bridge									
21019	100 year	5362	0.98	15.65	5.58	15.7	0.000025	1.91	2806.09	243.26	0.1
21003.8*	100 year	5362	0.98	15.64	5.78	15.7	0.000086	1.96	2729.62	246.53	0.1
20961	100 year	5362	0.97	15.62	5.54	15.69	0.000112	2.17	2466.32	239.88	0.12
20903	100 year	5362	0.95	15.62	5.97	15.69	0.000098	2.02	2660.43	260.97	0.11
20854	100 year	5362	0.94	15.62	5.38	15.68	0.000083	1.92	2797	262.5	0.1
20800	100 year	5362	0.92	15.6	5.24	15.67	0.000099	2.09	2561.88	241.59	0.11
20747	100 year	5362	0.91	15.59	5.13	15.67	0.000105	2.16	2479.84	232.04	0.12
20695	100 year	5362	0.9	15.58	5.18	15.66	0.000114	2.23	2408.12	231.04	0.12
20641	100 year	5362	0.88	15.58	5.17	15.65	0.000116	2.25	2385.93	231.78	0.12
20588	100 year	5362	0.87	15.57	5.28	15.65	0.000114	2.23	2408.38	232.11	0.12
20537	100 year	5362	0.85	15.56	5.47	15.64	0.000118	2.24	2391.54	232.6	0.12
20486	100 year	5362	0.84	15.56	5.68	15.64	0.00012	2.25	2385.32	232.57	0.12
20430	100 year	5362	0.82	15.55	5.71	15.63	0.000112	2.2	2437.48	232.5	0.12
20378	100 year	5362	0.81	15.55	5.86	15.62	0.000111	2.19	2448.88	233.4	0.12
20324	100 year	5362	0.8	15.54	5.67	15.62	0.000108	2.16	2478.48	233.2	0.12
20271	100 year	5362	0.78	15.54	5.6	15.61	0.000107	2.16	2485.06	232.7	0.12
20221	100 year	5362	0.77	15.53	5.49	15.6	0.000104	2.14	2507.68	232.99	0.11
20164	100 year	5362	0.75	15.53	5.53	15.6	0.000104	2.14	2506.22	233.16	0.12
20112	100 year	5362	0.74	15.52	5.47	15.59	0.000105	2.15	2493.97	231.3	0.12
20062	100 year	5362	0.73	15.51	5.5	15.59	0.000107	2.16	2481.94	231.89	0.12
20008	100 year	5362	0.71	15.51	5.43	15.58	0.000106	2.15	2494.3	233.68	0.12
19955	100 year	5362	0.7	15.5	5.57	15.58	0.000107	2.16	2477.26	232.65	0.12
19902	100 year	5362	0.68	15.5	5.37	15.57	0.000104	2.14	2502.34	232.4	0.12
19850	100 year	5362	0.67	15.49	5.35	15.56	0.000104	2.15	2493.65	230.95	0.12
19799	100 year	5362	0.66	15.49	5.36	15.56	0.000106	2.17	2471	230.22	0.12
19743	100 year	5362	0.64	15.48	5.33	15.55	0.000109	2.19	2446.31	229.64	0.12
19689	100 year	5362	0.63	15.47	5.13	15.55	0.000101	2.13	2512.24	230.45	0.11
19641	100 year	5362	0.61	15.47	5.31	15.54	0.000105	2.15	2490.06	232.55	0.12
19588	100 year	5362	0.6	15.46	5.19	15.53	0.000103	2.14	2503.27	231	0.11
19534	100 year	5362	0.59	15.46	5.36	15.53	0.000106	2.16	2487.04	232.86	0.12
19481	100 year	5362	0.57	15.45	5.26	15.52	0.000104	2.14	2502.39	232.46	0.12
19430	100 year	5362	0.56	15.45	5.28	15.52	0.000103	2.14	2510.97	231.68	0.11
19375	100 year	5362	0.54	15.44	5.25	15.51	0.000102	2.12	2524.73	234.52	0.11
19324	100 year	5362	0.53	15.44	5.15	15.51	0.0001	2.11	2540.8	231.5	0.11
19269	100 year	5362	0.51	15.43	5.13	15.5	0.000099	2.11	2542.25	229.62	0.11
19218	100 year	5362	0.5	15.43	5.15	15.5	0.0001	2.12	2531.42	230.1	0.11
19160	100 year	5362	0.49	15.42	5.3	15.49	0.000105	2.15	2492.5	231	0.12
19111	100 year	5362	0.47	15.41	5.09	15.48	0.0001	2.13	2521.97	229.47	0.11
19058	100 year	5362	0.46	15.4	5.39	15.48	0.000112	2.21	2425.48	226.72	0.12
19004	100 year	5362	0.44	15.4	5.2	15.47	0.000107	2.19	2446.51	223.86	0.12
18951	100 year	5362	0.43	15.39	5.24	15.47	0.000108	2.2	2437.57	224.47	0.12
18898	100 year	5362	0.42	15.39	5.09	15.46	0.000104	2.18	2458.92	223.96	0.12
18846	100 year	5362	0.4	15.37	5.3	15.45	0.000116	2.25	2384.31	224.66	0.12
18793	100 year	5362	0.39	15.37	5.35	15.45	0.000117	2.24	2390.8	227.64	0.12
18744	100 year	5362	0.37	15.36	5.3	15.44	0.000112	2.22	2420.34	227.6	0.12
18688	100 year	5362	0.36	15.36	5.38	15.43	0.000116	2.24	2396.52	226.53	0.12
18634	100 year	5362	0.35	15.35	5.44	15.43	0.000117	2.25	2387.91	226.95	0.12

18584	100 year	5362	0.33	15.35	5.22	15.42	0.000104	2.16	2485.63	228.87	0.12
18531	100 year	5362	0.32	15.34	5.31	15.41	0.000105	2.16	2481.69	229.02	0.12
18479	100 year	5362	0.3	15.34	5.28	15.41	0.000104	2.15	2495.05	229.06	0.11
18423	100 year	5362	0.29	15.33	5.28	15.4	0.000104	2.15	2492.91	229.06	0.11
18372	100 year	5362	0.28	15.33	5.28	15.4	0.000104	2.16	2486.74	227.79	0.12
18320	100 year	5362	0.26	15.32	5.13	15.39	0.000099	2.12	2531.76	228.24	0.11
18264	100 year	5362	0.25	15.32	5	15.39	0.000096	2.1	2557.1	228.68	0.11
18215	100 year	5362	0.23	15.31	5.03	15.38	0.000098	2.11	2537.68	227.25	0.11
18162	100 year	5362	0.22	15.31	5.07	15.37	0.000099	2.12	2526.51	226.62	0.11
18107	100 year	5362	0.2	15.3	5.08	15.37	0.000099	2.13	2520.67	225.52	0.11
18055	100 year	5362	0.19	15.29	5.17	15.36	0.000101	2.14	2508.91	226.77	0.11
18000	100 year	5362	0.18	15.29	5.24	15.36	0.000096	2.09	2561.27	232.1	0.11
17949	100 year	5362	0.16	15.29	5.16	15.35	0.000085	1.97	2725.88	248.32	0.1
17790	100 year	6875	0.12	15.3	4.92	15.33	0.000053	1.58	4351.82	380.39	0.08
17739	100 year	6875	0.11	15.3	4.79	15.33	0.000039	1.35	5076.79	439.93	0.07
17687	100 year	6875	0.09	15.3	4.68	15.33	0.000031	1.22	5650.34	487.46	0.06
17632	100 year	6875	0.08	15.29	4.82	15.32	0.000041	1.41	4870.95	403.79	0.07
17528	100 year	6875	0.05	15.29	4.49	15.32	0.000037	1.36	5045.88	404.7	0.07
17476	100 year	6875	0.04	15.29	4.48	15.32	0.000036	1.34	5135.85	412.85	0.07
17422	100 year	6875	0.02	15.28	4.51	15.31	0.000039	1.39	4938.82	396.38	0.07
17369	100 year	6875	0.01	15.28	4.44	15.31	0.000036	1.34	5128.55	410.38	0.07
17341	100 year	6875	0	15.28	4.43	15.31	0.000034	1.32	5223.69	417.47	0.07
17312	100 year	6875	-0.5	15.29	3.41	15.3	0.000014	0.86	7974.43	635.77	0.04
16462	100 year	6875	-0.4	15.29	2.09	15.3	0.000003	0.4	17034.28	1299.67	0.02
15992	100 year	6875	-0.1	15.29	3.82	15.3	0.000003	0.36	18839.67	1872.59	0.02
15976	100 year	6875	-0.5	15.29	4.43	15.29	0.000003	0.39	17684.35	1597.05	0.02
15797	100 year	6875	-0.5	15.29	4.54	15.29	0.000004	0.41	16658.43	1531.86	0.02
15295	100 year	11427	-0.5	15.28	4.84	15.29	0.00001	0.68	16845.65	1512.61	0.04
14815	100 year	11427	-0.5	15.27	4.58	15.28	0.000015	0.83	13762.24	1210.77	0.04
14789	100 year	11427	-0.5	15.27	4.5	15.28	0.000012	0.73	15600.77	1370.61	0.04
14319	100 year	11427	-2	15.27	1.8	15.28	0.000009	0.74	15504.41	1103.29	0.03
13819	100 year	11427	-2	15.27	1.76	15.27	0.000009	0.73	15586.16	1108.7	0.03
13319	100 year	11427	-2	15.26	1.9	15.27	0.00001	0.77	14915.29	1066.72	0.04
12819	100 year	11427	-2	15.25	2.02	15.26	0.000011	0.82	13948.31	1009.61	0.04
12323	100 year	11427	-2	15.25	1.88	15.26	0.000009	0.75	15310.7	1079.43	0.03
11821	100 year	11427	-2	15.24	2.14	15.25	0.00001	0.79	14498.92	1023.94	0.04
11421	100 year	11427	-2	15.24	1.16	15.25	0.000005	0.53	21492.55	1629.65	0.03
11211	100 year	11427	-2	15.24	1.24	15.25	0.000004	0.47	24413.34	1923.93	0.02
10911	100 year	11427	-2	15.24	1.04	15.25	0.000003	0.4	28671.95	2223.95	0.02
10779	100 year	11427	-2	15.24	0.95	15.25	0.000003	0.39	29405.1	2321.82	0.02
9979	100 year	11427	-2.7	15.24	1.68	15.24	0.000003	0.37	31265.54	2940.14	0.02
9929	100 year	11427	-2	15.24	1.13	15.24	0.000002	0.33	34917.04	3035.64	0.02
9599	100 year	11427	-2	15.24	0.84	15.24	0.000002	0.31	36511.77	3310.19	0.02
9379	100 year	11427	-2	15.24	1.49	15.24	0.000003	0.32	36157.22	3559.34	0.02
9109	100 year	11427	-2	15.24	0.69	15.24	0.000002	0.27	42747.54	4065.19	0.01
8809	100 year	11427	-2	15.24	1.11	15.24	0.000001	0.24	46646.48	4209.19	0.01
8609	100 year	11427	-2	15.24	0.98	15.24	0.000001	0.26	44329.4	3992.18	0.01
8179	100 year	11427	-3.9	15.24	-0.8	15.24	0.000001	0.25	46242.68	3167.4	0.01
8079	100 year	11427	-2	15.24	1.01	15.24	0.000001	0.24	47108.49	3855.19	0.01
6466	100 year	11427	-2.6	15.24	-0.37	15.24	0.000001	0.23	47253.96	4136.1	0.01
4225	100 year	11427	-3.5	15.23	2.81	15.24	0.000001	0.2	58428.37	6723.62	0.01
3485	100 year	11427	-4.9	15.2	1.41	15.23	0.000028	1.39	8208.63	7441.95	0.06
3435	100 year	11427	-10	15.2	-6.56	15.23	0.000035	1.15	9959.61	479.5	0.04
3255	100 year	11427	-10	15.2	-6.56	15.22	0.000035	1.15	9956.6	479.5	0.04
3205	100 year	11427	-10	15.2	-3.67	15.22	0.000012	1.05	10878.6	526	0.04

ATTACHMENT D

Proposed Condition of HEC-RAS Model

River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Ch	Flow Area	Top Width	Fr # Ch
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
21036. UPRR		Bridge									
21019	100 year	5362	0.98	15.68	5.58	15.74	0.000025	1.91	2813.9	243.3	0.1
21003.8*	100 year	5362	0.98	15.68	5.78	15.74	0.000086	1.96	2737.72	246.58	0.1
20961	100 year	5362	0.97	15.65	5.54	15.73	0.000111	2.17	2474.26	240.41	0.12
20903	100 year	5362	0.95	15.66	5.97	15.72	0.000097	2.01	2669.06	261.36	0.11
20854	100 year	5362	0.94	15.66	5.38	15.71	0.000082	1.91	2805.69	262.78	0.1
20800	100 year	5362	0.92	15.64	5.24	15.71	0.000099	2.09	2569.9	241.89	0.11
20747	100 year	5362	0.91	15.63	5.13	15.7	0.000104	2.16	2487.56	232.38	0.12
20695	100 year	5362	0.9	15.62	5.18	15.69	0.000113	2.22	2415.83	231.46	0.12
20641	100 year	5362	0.88	15.61	5.17	15.69	0.000115	2.24	2393.69	232.23	0.12
20588	100 year	5362	0.87	15.6	5.28	15.68	0.000113	2.22	2416.16	232.53	0.12
20537	100 year	5362	0.85	15.6	5.47	15.67	0.000117	2.23	2399.34	232.96	0.12
20486	100 year	5362	0.84	15.59	5.68	15.67	0.000118	2.24	2393.14	232.87	0.12
20430	100 year	5362	0.82	15.59	5.71	15.66	0.000111	2.19	2445.31	232.83	0.12
20378	100 year	5362	0.81	15.58	5.86	15.66	0.00011	2.18	2456.74	233.72	0.12
20324	100 year	5362	0.8	15.58	5.67	15.65	0.000107	2.16	2486.35	233.51	0.12
20271	100 year	5362	0.78	15.57	5.6	15.64	0.000106	2.15	2492.92	232.98	0.12
20221	100 year	5362	0.77	15.57	5.49	15.64	0.000103	2.13	2515.57	233.24	0.11
20164	100 year	5362	0.75	15.56	5.53	15.63	0.000104	2.13	2514.13	233.47	0.11
20112	100 year	5362	0.74	15.55	5.47	15.63	0.000104	2.14	2501.83	231.62	0.11
20062	100 year	5362	0.73	15.55	5.5	15.62	0.000106	2.15	2489.83	232.2	0.12
20008	100 year	5362	0.71	15.54	5.43	15.61	0.000105	2.14	2502.26	234.01	0.12
19955	100 year	5362	0.7	15.54	5.57	15.61	0.000106	2.16	2485.21	232.96	0.12
19902	100 year	5362	0.68	15.53	5.37	15.6	0.000103	2.14	2510.29	232.7	0.11
19850	100 year	5362	0.67	15.53	5.35	15.6	0.000103	2.14	2501.56	231.29	0.11
19799	100 year	5362	0.66	15.52	5.36	15.59	0.000105	2.16	2478.9	230.58	0.12
19743	100 year	5362	0.64	15.51	5.33	15.59	0.000108	2.18	2454.2	229.98	0.12
19689	100 year	5362	0.63	15.51	5.13	15.58	0.0001	2.13	2520.16	230.81	0.11
19641	100 year	5362	0.61	15.5	5.31	15.57	0.000104	2.15	2498.07	232.93	0.12
19588	100 year	5362	0.6	15.5	5.19	15.57	0.000102	2.14	2511.24	231.55	0.11
19534	100 year	5362	0.59	15.49	5.36	15.56	0.000105	2.15	2495.1	233.53	0.12
19481	100 year	5362	0.57	15.49	5.26	15.56	0.000103	2.14	2510.44	233.08	0.11
19430	100 year	5362	0.56	15.48	5.28	15.55	0.000102	2.13	2518.99	232.22	0.11
19375	100 year	5362	0.54	15.48	5.25	15.55	0.000102	2.12	2532.87	235.07	0.11
19324	100 year	5362	0.53	15.47	5.15	15.54	0.000099	2.1	2548.83	231.87	0.11
19269	100 year	5362	0.51	15.47	5.13	15.53	0.000098	2.1	2550.23	229.92	0.11
19218	100 year	5362	0.5	15.46	5.15	15.53	0.000099	2.11	2539.43	230.43	0.11
19160	100 year	5362	0.49	15.45	5.3	15.52	0.000104	2.14	2500.56	231.56	0.11
19111	100 year	5362	0.47	15.45	5.09	15.52	0.000099	2.12	2529.99	230.03	0.11
19058	100 year	5362	0.46	15.44	5.39	15.51	0.000111	2.2	2433.42	227.27	0.12
19004	100 year	5362	0.44	15.43	5.2	15.51	0.000106	2.18	2454.36	224.25	0.12
18951	100 year	5362	0.43	15.43	5.24	15.5	0.000107	2.19	2445.46	224.82	0.12
18898	100 year	5362	0.42	15.42	5.09	15.49	0.000103	2.17	2466.79	224.28	0.12
18846	100 year	5362	0.4	15.41	5.3	15.49	0.000115	2.24	2392.23	224.88	0.12
18793	100 year	5362	0.39	15.4	5.35	15.48	0.000116	2.24	2398.84	227.99	0.12
18744	100 year	5362	0.37	15.4	5.3	15.48	0.000111	2.21	2428.39	227.91	0.12
18688	100 year	5362	0.36	15.39	5.38	15.47	0.000115	2.23	2404.55	226.81	0.12
18634	100 year	5362	0.35	15.38	5.44	15.46	0.000116	2.24	2395.96	227.26	0.12

18584	100 year	5362	0.33	15.38	5.22	15.45	0.000103	2.15	2493.75	229.17	0.11
18531	100 year	5362	0.32	15.38	5.31	15.45	0.000104	2.15	2489.83	229.33	0.12
18479	100 year	5362	0.3	15.37	5.28	15.44	0.000103	2.14	2503.21	229.36	0.11
18423	100 year	5362	0.29	15.37	5.28	15.44	0.000103	2.14	2501.08	229.37	0.11
18372	100 year	5362	0.28	15.36	5.28	15.43	0.000103	2.15	2494.88	228.14	0.11
18320	100 year	5362	0.26	15.36	5.13	15.43	0.000098	2.11	2539.92	228.63	0.11
18264	100 year	5362	0.25	15.35	5	15.42	0.000096	2.09	2565.29	228.98	0.11
18215	100 year	5362	0.23	15.35	5.03	15.42	0.000097	2.11	2545.82	227.55	0.11
18162	100 year	5362	0.22	15.34	5.07	15.41	0.000098	2.12	2534.64	226.93	0.11
18107	100 year	5362	0.2	15.34	5.08	15.4	0.000098	2.12	2528.78	225.76	0.11
18055	100 year	5362	0.19	15.33	5.17	15.4	0.0001	2.13	2517.07	227.03	0.11
18000	100 year	5362	0.18	15.33	5.24	15.39	0.000095	2.09	2569.63	232.45	0.11
17949	100 year	5362	0.16	15.33	5.16	15.39	0.000085	1.96	2734.83	248.66	0.1
17840		Culvert									
17790	100 year	6875	0.12	15.31	4.92	15.34	0.000053	1.58	4355.86	380.49	0.08
17770		Bridge									
17739	100 year	6875	0.11	15.3	4.79	15.33	0.000039	1.35	5078.2	439.96	0.07
17687	100 year	6875	0.09	15.31	4.68	15.33	0.000031	1.22	5651.91	487.46	0.06
17632	100 year	6875	0.08	15.29	4.82	15.33	0.000041	1.41	4872.25	403.8	0.07
17572		Bridge									
17528	100 year	6875	0.05	15.29	4.49	15.32	0.000037	1.36	5045.88	404.7	0.07
17476	100 year	6875	0.04	15.29	4.48	15.32	0.000036	1.34	5135.85	412.85	0.07
17422	100 year	6875	0.02	15.28	4.51	15.31	0.000039	1.39	4938.82	396.38	0.07
17369	100 year	6875	0.01	15.28	4.44	15.31	0.000036	1.34	5128.55	410.38	0.07
17341	100 year	6875	0	15.28	4.43	15.31	0.000034	1.32	5223.69	417.47	0.07
17312	100 year	6875	-0.5	15.29	3.41	15.3	0.000014	0.86	7974.43	635.77	0.04
16462	100 year	6875	-0.4	15.29	2.09	15.3	0.000003	0.4	17034.28	1299.67	0.02
15992	100 year	6875	-0.1	15.29	3.82	15.3	0.000003	0.36	18839.67	1872.59	0.02
15976	100 year	6875	-0.5	15.29	4.43	15.29	0.000003	0.39	17684.35	1597.05	0.02
15797	100 year	6875	-0.5	15.29	4.54	15.29	0.000004	0.41	16658.43	1531.86	0.02
15295	100 year	11427	-0.5	15.28	4.84	15.29	0.00001	0.68	16845.65	1512.61	0.04
14815	100 year	11427	-0.5	15.27	4.58	15.28	0.000015	0.83	13762.24	1210.77	0.04
14789	100 year	11427	-0.5	15.27	4.5	15.28	0.000012	0.73	15600.77	1370.61	0.04
14319	100 year	11427	-2	15.27	1.8	15.28	0.000009	0.74	15504.41	1103.29	0.03
13819	100 year	11427	-2	15.27	1.76	15.27	0.000009	0.73	15586.16	1108.7	0.03
13319	100 year	11427	-2	15.26	1.9	15.27	0.00001	0.77	14915.29	1066.72	0.04
12819	100 year	11427	-2	15.25	2.02	15.26	0.000011	0.82	13948.31	1009.61	0.04
12323	100 year	11427	-2	15.25	1.88	15.26	0.000009	0.75	15310.7	1079.43	0.03
11821	100 year	11427	-2	15.24	2.14	15.25	0.00001	0.79	14498.92	1023.94	0.04
11421	100 year	11427	-2	15.24	1.16	15.25	0.000005	0.53	21492.55	1629.65	0.03
11211	100 year	11427	-2	15.24	1.24	15.25	0.000004	0.47	24413.34	1923.93	0.02
10911	100 year	11427	-2	15.24	1.04	15.25	0.000003	0.4	28671.95	2223.95	0.02
10779	100 year	11427	-2	15.24	0.95	15.25	0.000003	0.39	29405.1	2321.82	0.02
9979	100 year	11427	-2.7	15.24	1.68	15.24	0.000003	0.37	31265.54	2940.14	0.02
9929	100 year	11427	-2	15.24	1.13	15.24	0.000002	0.33	34917.04	3035.64	0.02
9599	100 year	11427	-2	15.24	0.84	15.24	0.000002	0.31	36511.77	3310.19	0.02
9379	100 year	11427	-2	15.24	1.49	15.24	0.000003	0.32	36157.22	3559.34	0.02
9109	100 year	11427	-2	15.24	0.69	15.24	0.000002	0.27	42747.54	4065.19	0.01
8809	100 year	11427	-2	15.24	1.11	15.24	0.000001	0.24	46646.48	4209.19	0.01
8609	100 year	11427	-2	15.24	0.98	15.24	0.000001	0.26	44329.4	3992.18	0.01
8179	100 year	11427	-3.9	15.24	-0.8	15.24	0.000001	0.25	46242.68	3167.4	0.01
8079	100 year	11427	-2	15.24	1.01	15.24	0.000001	0.24	47108.49	3855.19	0.01
6466	100 year	11427	-2.6	15.24	-0.37	15.24	0.000001	0.23	47253.96	4136.1	0.01
4225	100 year	11427	-3.5	15.23	2.81	15.24	0.000001	0.2	58428.37	6723.62	0.01
3485	100 year	11427	-4.9	15.2	1.41	15.23	0.000028	1.39	8208.63	7441.95	0.06
3435	100 year	11427	-10	15.2	-6.56	15.23	0.000035	1.15	9959.61	479.5	0.04
3255	100 year	11427	-10	15.2	-6.56	15.22	0.000035	1.15	9956.6	479.5	0.04
3205	100 year	11427	-10	15.2	-3.67	15.22	0.000012	1.05	10878.6	526	0.04

ATTACHMENT D

WSEL Profile-Existing & Proposed Condition