Hydraulic and Hydrologic Engineering Studies
Refugio Road Low Water Crossings over Refugio Creek
Project No. 862361 Low Water Crossing

January 13, 2015

TASK 1A – PROJECT MANAGEMENT AND QC (PROJECT NO. 862361)

WEST Consultants will provide project management, administration, quality control, quality assurance, on-site project kick-off meeting, project meetings (3 in person, up to 10 over the phone), overall coordination, and preliminary data gathering. A kickoff meeting is assumed at the project site to be attended by the WEST team.

Assumptions: WEST will attend 3 PDT meetings in person and 10 via teleconference. Meetings for Project No. 862361 and 862362 will be held at the same time; the total meeting time is divided between the two projects in the cost estimate.

TASK 2A – PRELIMINARY COORDINATION / DATA GATHERING / SURVEY INFORMATION

The WEST team will review preliminary bridge concepts provided by the County and will review other pertinent site data such as geotechnical data and studies. WEST will coordinate with County staff to prepare a survey request with limits and features within the Refugio Creek channel.

***Deliverables*:** Proposed survey limits/features
Assumptions: The County will provide preliminary bridge design concepts for review.

TASK 3A – HYDROLOGIC ANALYSES

WEST will develop an HEC-HMS model of the watershed upstream of Project No. 862361. The SCS curve number loss method and standard unit hydrograph techniques within HEC-HMS will be used. Frequency rainfall, watershed soil and land use data, and other watershed characteristics will be gathered from available online sources. Watershed delineation will be completed using topographic data provided by the County. Frequency flows for the 2-, 5-, 25-, 50-, and 100-year events will be determined along with high fish passage flows that will be calculated as a percent of the 2-year flow rate. The bridge overtopping flow will be determined as part of Task 4A.

WEST will include routing reaches in the model based on the Muskingum Cunge 8-point cross section method.

WEST will compute peak flows for comparison purposes based on (1) a basin transfer approach using data from one or more nearby gaged basins, and (2) the best available regression equations.

Deliverables: Completed HEC-HMS model(s), including input/output files and results. For report deliverables, see Task 4A below.

Assumptions:

1. WEST will utilize the recommendations described in the Ventura County bulking factor study completed recently by WEST to determine an appropriate bulking factor for the site.
2. The County will provide topographic data (1-meter DEM) for the Refugio Creek watershed.

TASK 4A –HYDRAULIC ANALYSES

WEST will prepare the topographic data for the hydraulic analysis and will develop an HEC-RAS model for the project reach for existing and proposed conditions. Manning's roughness coefficients will be estimated based on site observations, standard references, and engineering judgment. In addition to the 1-D HEC-RAS model, WEST will develop a 2-D model in the vicinity of Low Flow Crossing #1 to determine expected flow patterns and to guide the 1-D modeling parameters and flow distribution. WEST will model three bridge alternatives in HEC-RAS rather than the 2-D model because multiple bridge scenarios can be modeled more efficiently in HEC-RAS. WEST will provide recommendations for the bridge low chord elevation, the bridge width, and other hydraulic features including depths and velocities. WEST will model the design flows as well as the overtopping flow. WEST assumes close coordination with the Santa Barbara County bridge design team during this design process.

A preliminary hydraulics summary table will be prepared (draft and final), followed by a technical memorandum summarizing hydrology and hydraulics (draft and final), followed by a bridge hydraulic report (draft and final). A Location Hydraulic Study and Summary Floodplain Hydraulic Encroachment Report will also be prepared. WEST will prepare a letter summarizing the hydraulic basis of the design exception to the County's policy on design flood and freeboard, if requested.

Deliverables:

1. Completed HEC-RAS model(s), including input/output files and results
2. Two-dimensional model, including input/output files and results
3. Draft and Final hydraulic summary table in electronic format
4. Draft and Final technical memorandum summarizing hydrology and hydraulics in electronic format
5. Draft and Final bridge hydraulic report in electronic format and 3 bound copies of final report

6. Location Hydraulic Study and Summary Floodplain Encroachment Report in electronic format
7. Letter summarizing hydraulic basis of design exception to the County's policy on design flood and freeboard in electronic format (optional)

Assumptions:

1. Topographic survey of the existing low water crossing will be performed by the County and available for use.
2. The County will provide initial design concepts for the bridge.

TASK 5A – SCOUR EVALUATION

Assuming that a soft bottom channel will be preferred through the bridge opening, WEST will calculate anticipated bridge scour depths considering pier scour, contraction scour, and abutment scour components per HEC-18 *Evaluating Scour at Bridges*, Fifth Edition (FHWA, 2012) guidelines. Long-term degradation will be estimated based on observations during the site visit, equilibrium slope methods, and engineering judgment. The equilibrium slope analysis will account for the anticipated stream slope change in the vicinity of the bridge resulting from the removal of the low flow crossing hydraulic control. The overall total scour depth can be used by Santa Barbara County to determine pier and abutment burial depths after consideration of any additional depth needed for structural stability.

An optional task to compute the required riprap sizes and toe-down depths for the riprap is included in the cost estimate. Riprap sizes and gradations will be calculated using the Caltrans method and toe-down depths will be estimated using applicable regime relationships based on calculated depth, velocity, and shear stress. WEST will prepare a conceptual plan showing riprap extents (plan, profile, and thickness).

***Deliverables*:**

1. Scour and long-term degradation results (and riprap sizing, if requested) will be summarized in the bridge hydraulic report (Task 4A).
2. Conceptual riprap plan (optional)

Assumptions:

1. The optional riprap calculation does not include preparation of detailed plans, specs, or estimates.

TASK 6A – TECHNICAL MEMORANDUM (ORDINARY HIGH WATER MARK)

Cardno Entrix will provide the OHW determination in the project reach.

***Deliverables*:**

1. Technical Memorandum of OHM (draft and final)
2. AutoCAD Civil 3D 2014 survey data in electronic formats, both PDF and AutoCAD

Hydraulic and Hydrologic Engineering Studies and Fish Passage Services
Refugio Road Low Water Crossings over Refugio Creek
Project No. 862362 Low Water Crossing

January 13, 2015

TASK 1B – PROJECT MANAGEMENT AND QC (PROJECT NO. 862362)

WEST Consultants will provide project management, administration, quality control, quality assurance, on-site project kick-off meeting, project meetings (3 in person, up to 10 over the phone), overall coordination, and preliminary data gathering. A kickoff meeting is assumed at the project site to be attended by the WEST team.

Assumptions: WEST will attend 3 PDT meetings in person and 10 via teleconference. Meetings for Project No. 862361 and 862362 will be held at the same time; the total meeting time is divided between the two projects in the cost estimate.

TASK 2B – PRELIMINARY COORDINATION / DATA GATHERING / SURVEY INFORMATION

The WEST team will review preliminary bridge concepts provided by the County and will review other pertinent site data such as geotechnical data and studies. WEST will coordinate with County staff to prepare a survey request with limits and features within the Refugio Creek channel.

Deliverables: Proposed survey limits/features
Assumptions: The County will provide preliminary bridge design concepts for review.

TASK 3B – HYDROLOGIC ANALYSES

WEST will develop an HEC-HMS model of the watershed upstream of Project No. 862362. The SCS curve number loss method and standard unit hydrograph techniques within HEC-HMS will be used. Frequency rainfall, watershed soil and land use data, and other watershed characteristics will be gathered from available online sources. Watershed delineation will be completed using topographic data provided by the County. Frequency flows for the 2-, 5-, 25-, 50-, and 100-year events will be determined along with high fish passage flows that will be calculated as a percent of the 2-year flow rate. The bridge overtopping flow will be determined as part of Task 4B.

WEST will include routing reaches in the model based on the Muskingum Cunge 8-point cross section method.

WEST will compute peak flows for comparison purposes based on (1) a basin transfer approach using data from one or more nearby gaged basins, and (2) the best available regression equations.

***Deliverables*:** Completed HEC-HMS model(s), including input/output files and results. For report deliverables, see Task 4B below.

Assumptions:

1. WEST will utilize the recommendations described in the Ventura County bulking factor study to determine an appropriate bulking factor for the site.
2. The County will provide topographic data (1-meter DEM) for the Refugio Creek watershed.

TASK 4B –HYDRAULIC ANALYSES

WEST will prepare the topographic data for the hydraulic analysis and will develop an HEC-RAS model for the project reach for existing and proposed conditions. An HEC-RAS model will be developed for the project reach for existing and proposed conditions. Manning's roughness coefficients will be estimated based on site observations, standard references, and engineering judgment. WEST will model three bridge alternatives in HEC-RAS and provide recommendations for the bridge low chord elevation, the bridge width, and other hydraulic features including depths and velocities. WEST will model the design flows as well as the overtopping flow. WEST assumes close coordination with the Santa Barbara County bridge design team during this design process.

A preliminary hydraulics summary table will be prepared (draft and final), followed by a technical memorandum summarizing hydrology and hydraulics (draft and final), followed by a bridge hydraulic report (draft and final). A Location Hydraulic Study and Summary Floodplain Hydraulic Encroachment Report will also be prepared. WEST will prepare a letter summarizing the hydraulic basis of the design exception to the County's policy on design flood and freeboard, if requested.

***Deliverables*:**

1. Completed HEC-RAS model(s), including input/output files and results
2. Draft and Final hydraulic summary table in electronic format
3. Draft and Final technical memorandum summarizing hydrology and hydraulics in electronic format
4. Draft and Final bridge hydraulic report in electronic format and 3 bound copies of final report
5. Location Hydraulic Study and Summary Floodplain Encroachment Report in electronic format
6. Letter summarizing hydraulic basis of design exception to the County's policy on design flood and freeboard in electronic format (optional)

Assumptions:

1. Topographic survey of the existing low water crossing will be performed by the County and available for use.
2. The County will provide initial design concepts for the bridge.

TASK 5B – SCOUR EVALUATION

Assuming that a soft bottom channel will be preferred through the bridge opening, WEST will calculate anticipated bridge scour depths considering pier scour, contraction scour, and abutment scour components per HEC-18 *Evaluating Scour at Bridges*, Fifth Edition (FHWA, 2012) guidelines. Long-term degradation will be estimated based on observations during the site visit, equilibrium slope methods, and engineering judgment. The equilibrium slope analysis will account for the anticipated stream slope change in the vicinity of the bridge resulting from the removal of the low flow crossing hydraulic control. The overall total scour depth can be used by Santa Barbara County to determine pier and abutment burial depths after consideration of any additional depth needed for structural stability.

An optional task to compute the required riprap sizes and toe-down depths for the riprap is included in the cost estimate. Riprap sizes and gradations will be calculated using the Caltrans method and toe-down depths will be estimated using applicable regime relationships based on calculated depth, velocity, and shear stress. WEST will prepare a conceptual plan showing riprap extents (plan, profile, and thickness).

***Deliverables*:**

1. Scour and long-term degradation results (and riprap sizing, if requested) will be summarized in the bridge hydraulic report (Task 4B).
2. Conceptual riprap plan (optional)

Assumptions:

1. The optional riprap calculation does not include preparation of detailed plans, specs, or estimates.

TASK 6B – TECHNICAL MEMORANDUM (ORDINARY HIGH WATER MARK)

Cardno Entrix will provide the OHW determination in the project reach.

***Deliverables*:**

1. Technical Memorandum of OHM (draft and final)
2. AutoCAD Civil 3D 2014 survey data in electronic formats, both PDF and AutoCAD

TASK 7B – FISH PASSAGE IMPROVEMENT DESIGN

Due to the high potential of debris, WEST will include design recommendations for pier geometry, abutment to abutment bridge width, and potentially pier debris deflectors in order to minimize flow blockages that could impede fish passage. Specific recommendations will depend on depths and velocities modeled in HEC-RAS and the specific bridge alternatives preferred by Santa Barbara County during the design process. Two fish passage designs will be analyzed using the HEC-RAS model developed in Task 4B as the starting point. A separate, more detailed HEC-RAS model will be developed for fish passage analysis if needed.

WEST will provide the 35% conceptual designs based on a mark-up of the proposed bridge general plan sheet (provided by the County). MGE will provide the 65%, 95%, and 100% plans, specs, and estimates for the design. A technical memorandum of the fish passage design (draft and final) will be prepared. MGE will provide the preliminary and final grading plans of the fish passage design.

***Deliverables*:**

1. 35% conceptual graphics for fish passage in electronic format
2. HEC-RAS model(s) for fish passage, including input/output files and results
3. Technical Memorandum for Fish Passage (draft and final) in electronic format
4. Preliminary and final grading plans for fish passage
5. PS&E for Fish Passage 65%, 95%, and 100%:
    - 65% (100% Plans, Details & Estimate)
        - Internal independent QA/QC completed prior to submittal to PW
        - Drafting complete in SB County PW AutoCAD Standards (Hard copy (3-11"x17") & electronic AutoCAD/PDF/Excel files)
    - 95% (Modified 65% Plans (hard copy 3-11"x17" & electronic AutoCAD/PDF files) & Estimate (Caltrans contract item numbers), Specifications-electronic MS Word)
        - Documented response to PW written comments
        - Specifications shall follow Caltrans Standard SSP's (Technical Specifications-Sections 8, 9 &10)
        - Special Provisions shall follow Caltrans style format – Strike & Hide (red), Modifications (Blue underlined) & Initials directly above modifications with date/justification comment
        - Quantity calculations (backup information along with any documented assumptions)
        - Proposed construction schedule
    - 100% (Final modifications to 95% PS&E, per County review comments)
        - Electronic AutoCAD/PDF files
        - Review project specification for conflict with PW boiler plate special provisions
        - One 22" x 34" wet signed scaled plans on bond paper

- Construction contract cost estimate
- Expedite (Wet Signature Plans and Specification)
  - One 22" x 34" wet signed scaled plans
  - One 11" x 17" wet signed scaled plans
  - Wet signed specification signature page
  - Electronic AutoCAD Files

Assumptions:

1. This scope of work assumes that an HEC-RAS hydraulic model will be adequate for the fish passage analysis and design. Creating a multi-dimensional model for fish passage design is beyond the current scope of work.
2. The 35% plans will be prepared by WEST based on a mark-up of the proposed bridge general plan sheet provided by the County.
3. PS&E for fish passage shall follow the Caltrans Standard Processes as shown in the State of California, Department of Transportation (Caltrans) Ready-To-List and Construction Contract Award Guide (RTL Guide).

in association with: MGE Engineering, Inc. · Cardno ENTRIX

Hydraulic and Hydrologic Engineering Studies
Refugio Road Low Water Crossings over Refugio Creek, Santa Barbara County, CA
Project No.: 862361 Low Water Crossing

	WEST						MGE Engineering, Inc.						Cardno Entrix						
	Vice President 214	Project Manager 174	Senior Engineer 139	Staff Engineer 110	Hydrol./ Scientist 124	Clerical 77	Project Manager 210	Sup. Engineer 190	Senior Engineer 165	Assoc. Engineer 145	Assistant Engineer 120	CAD Tech 100	Sr. Proj. Consultant 160	Project Coordinator 100	Wetlands Biologist 180	Sr. Staff Engineer 135	Sr. Staff Consultant 120	Total Task Hours	COST
Personnel	*Teal*	*Gusman, Smith, Bahner*		*Jenkins, Monk, Tripolitis*	*Baron*	*Staff*		*Jeff Crovitz*	*S. Hawkins & B. Reichel*		*Charlie Miller*		*Mulder*	*Picassa*	Klug	*Manha*			
A. LABOR COSTS																			
Task No. Description																			
1a Project Management and QC (Project No.: 862361)																			
(a) Project management, team leadership, and quality control	1	4											1	2				8	1,270.00
(b) Kickoff meeting at site		4		4									4					12	1,776.00
(c) Project Development Team Meetings (3 in person + 10 conf calls)		24		24									8					56	8,096.00
Subtotal	1	32	0	28	0	0	0	0	0	0	0	0	13	2	0	0	0	76	11,142.00
2a Preliminary Coordination/Data Gathering/Survey Information																			
(a) Data collection and review (coordinate with County staff)		4		4														8	1,136.00
(b) Provide survey limits and features				1	2													3	358.00
Subtotal	0	4	0	5	2	0	0	0	0	0	0	0	0	0	0	0	0	11	1,494.00
3a Hydrologic Analyses																			
(a) Delineate drainage area upstream of bridge				1	2													3	358.00
(b) Delineate drainage area for crossings 3-6		1		2	4													7	890.00
(c) Determine hydrologic soil group, land cover, SCS curve numbers		1		2	3													6	766.00
(d) Determine hypothetical precipitation; enter data in HMS		1		2	3													6	766.00
(e) Estimate unit hydrograph lag for basin upstream of bridge				2	2													4	468.00
(f) Estimate unit hydrograph lag for crossings 3-6		1		4	4													9	1,110.00
(g) Develop Muskingum-Cunge routing data upstream of bridge				1	2													3	358.00
(h) Develop Muskingum-Cunge routing data (needed for crossings 3-6)		1		6	6													13	1,578.00
(i) Run and analyze HMS (all frequency flows)		2		8														10	1,228.00
(j) Compute/compare peak flows using basin transfer and regression		1		6														7	834.00
Subtotal	0	8	0	34	26	0	0	0	0	0	0	0	0	0	0	0	0	68	8,356.00
4a Hydraulic Analyses																			
(a) Prepare topo for hydraulics (mosaic project topo & 1-meter DEM)				1	4													5	606.00
(b) Run GeoRAS processes and develop RAS geometry		1		8	4													13	1,550.00
(c) Estimate Manning's roughness		1		2														3	394.00
(d) Determine appropriate bulking criteria		1		2														3	394.00
(e) Develop 2-D model to guide 1-D modeling and parameters		4		16														20	2,456.00
(f) Enter bridge data for existing conditions		1		3														4	504.00
(g) Run and analyze HEC-RAS for existing conditions		2		16														18	2,108.00
(h) Enter bridge data (Alt 1, 2, and 3)		1		9														10	1,164.00
(i) Run and analyze RAS (Alt 1, 2, and 3)		1		12														13	1,494.00
(j) Develop/analyze overtopping flow		1		6														7	834.00
(k) Coordination with County (Alt 1, 2, and 3)		4		4														8	1,136.00
(l) Preliminary Hydraulics summary table (draft, final, comments/responses)	1	8		8														17	2,486.00
(m) Technical Memorandum of Hydrology and Hydraulics (draft, final, comments/responses)	2	8		16	4													30	4,076.00
(n) Bridge hydraulic report (draft, final, comments/responses)	2	16		24	8													50	6,844.00
(o) Determine base floodplain (existing and proposed) for LHS		2		4	12													18	2,276.00
(p) Prepare draft Location Hydraulic Study	1	1		4														6	828.00
(q) Review comments on draft LHS; prepare responses		2		2														4	568.00
(r) Prepare final Location Hydraulic Study	1	1		4														6	828.00
(s) Prepare Summary Floodplain Encroachment Report	1	4		8														13	1,790.00
(t) Coordination and preparation for Design Exception (OPTIONAL)	1	4																5	910.00
Subtotal	9	63	0	149	32	0	0	0	0	0	0	0	0	0	0	0	0	253	33,246.00
5a Scour Evaluation																			
(a) Calculate bridge scour (pier, contraction, abutment) for Alt 1		1		4														5	614.00
(b) Calculate bridge scour (pier, contraction, abutment) for Alt 2		1		4														5	614.00
(c) Calculate bridge scour (pier, contraction, abutment) for Alt 3		1		4														5	614.00
(d) Evaluate long term degradation/aggradation using equilibrium slope methodology	1	2		8														5	614.00
(e) Calculate riprap sizes and prepare conceptual plan (OPTIONAL)	1	4		16														11	1,442.00
(f) Calculate toe-down depths (OPTIONAL)	1	2		8														11	1,442.00
Subtotal	3	11	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	42	5,340.00

	WEST						MGE Engineering, Inc.						Cardno Entrix						
	Vice President 214	Project Manager 174	Senior Engineer 139	Staff Engineer 110	Hydrol./ Scientist 124	Clerical 77	Project Manager 210	Sup. Engineer 190	Senior Engineer 165	Assoc. Engineer 145	Assistant Engineer 120	CAD Tech 100	Sr. Proj. Consultant 160	Project Coordinator 100	Wetlands Biologist 180	Sr. Staff Engineer 135	Sr. Staff Consultant 120	Total Task Hours	COST
Personnel	*Teal*	*Gusman, Smith, Bahner*		*Jenkins, Monk, Tripolitis*	*Baron*	*Staff*		*Jeff Crovitz*	*S. Hawkins & B. Reichel*		*Charlie Miller*		*Mulder*	*Picassa*	Klug	*Manha*			
6a Technical Memorandum (Ordinary High Water Mark)																			
(a) Field survey of OHM													8		3		8	19	2,780.00
(b) Prepare AutoCAD locations of OHM																18		18	2,430.00
(c) Technical Memorandum of OHM (draft)		1											2			2		5	764.00
(d) Technical Memorandum of OHM (final)		1											2					3	494.00
Subtotal	0	2	0	0	0	0	0	0	0	0	0	0	12	0	3	20	8	45	6,468.00
TOTAL LABOR HOURS/COST	*13*	*120*	*0*	*260*	*60*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*2*	*3*	*20*	*8*	*495*	*66,046.00*

B. DIRECT COSTS		COST
Shipping, copies, maps, etc.	Note: All direct costs are split 50/50 between the two bridge projects (862361 and 862362)	325.00
MEETINGS		
Kickoff Meeting		
WEST - 1 Round Trip (420 miles x 1 trips x $0.565/mile)		118.65
MGE - 1 Round Trip (760 miles x 1 trips x $0.565/mile)		212.80
Cardno Entrix - 1 Round Trip (14 miles x 1 trips x $0.565/mile)		3.96
Project Development Team Meetings		
WEST - 3 Round Trips (420 miles x 3 trips x $0.565/mile)		355.95
Cardno Entrix - 3 Round Trips (14 miles x 3 trips x $0.565/mile)		11.87
ORDINARY HIGH WATER MARK COSTS		
Cardno ENTRIX - 3 Round Trips (70 miles x 3 trips x $0.565/mile)		59.33
Sub-Meter Accuracy Trimble GeoXH6000 @ $400/day		300.00
TOTAL DIRECT COST		*1,387.55*
TOTAL COST		*67,433.55*

WEST Consultants Inc

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Attachment B-2. Fee Proposal

Hydraulic and Hydrologic Engineering Studies and Fish Passage Services
Refugio Road Low Water Crossings over Refugio Creek, Santa Barbara County, CA
Project No.: 862362 Low Water Crossing

	WEST						MGE Engineering, Inc.						Cardno Entrix						
	Vice President 214	Project Manager 174	Senior Engineer 139	Staff Engineer 110	Hydrol./ Scientist 124	Clerical 77	Project Manager 210	Sup. Engineer 190	Senior Engineer 165	Assoc. Engineer 145	Assistant Engineer 120	CAD Tech 100	Sr. Proj. Consultant 160	Project Coordinator 100	Wetlands Biologist 180	Sr. Staff Engineer 135	Sr. Staff Consultant 120	Total Task Hours	COST
Personnel	*Teal*	*Gusman, Smith, Bahner*		*Jenkins, Monk, Tripolitis*	*Baron*	*Staff*		*Jeff Crovitz*	*S. Hawkins & B. Reichel*		*Charlie Miller*		*Mulder*	*Picassa*	Klug	*Manha*			
A. LABOR COSTS																			
Task No. Description																			
1b Project Management and QC (Project No.: 862362)																			
(a) Project management, team leadership, and quality control	1	4											1	2				8	1,270.00
(b) Kickoff meeting at site		4		4				8					4					20	3,296.00
(c) Project Development Team Meetings (3 in person + 10 conf calls)		24		24				12	8				8					76	11,696.00
Subtotal	1	32	0	28	0	0	0	20	8	0	0	0	13	2	0	0	0	104	16,262.00
2b Preliminary Coordination/Data Gathering/Survey Information																			
(a) Data collection and review (coordinate with County staff)		4		4														8	1,136.00
(b) Provide survey limits and features				1	2													3	358.00
Subtotal	0	4	0	5	2	0	0	0	0	0	0	0	0	0	0	0	0	11	1,494.00
3b Hydrologic Analyses																			
(a) Delineate drainage area upstream of bridge				1	2													3	358.00
(b) Determine hydrologic soil group, land cover, SCS curve numbers				2	3													5	592.00
(c) Determine hypothetical precipitation; enter data in HMS		1		2	3													6	766.00
(d) Estimate unit hydrograph lag				2	2													4	468.00
(e) Develop Muskingum-Cunge routing data upstream of bridge				1	2													3	358.00
(f) Run and analyze HMS (all frequency flows)		2		8														10	1,228.00
(g) Compute/compare peak flows using basin transfer and regression		1		4														5	614.00
Subtotal	0	4	0	20	12	0	0	0	0	0	0	0	0	0	0	0	0	36	4,384.00
4b Hydraulic Analyses																			
(a) Prepare topo for hydraulics (mosaic project topo & 1-meter DEM)				1	4													5	606.00
(b) Run GeoRAS processes and develop RAS geometry		1		8	4													13	1,550.00
(c) Estimate Manning's roughness		1		2														3	394.00
(d) Enter bridge data for existing conditions		1		3														4	504.00
(e) Run and analyze HEC-RAS for existing conditions		2		16														18	2,108.00
(f) Enter bridge data (Alt 1, 2, and 3)		1		9														10	1,164.00
(g) Run and analyze RAS (Alt 1, 2, and 3)		1		12														13	1,494.00
(h) Develop/analyze overtopping flow		1		6														7	834.00
(i) Coordination with County (Alt 1, 2, and 3)		4		4														8	1,136.00
(j) Determine appropriate bulking criteria		1		2														3	394.00
(k) Evaluate long term degradation/aggradation using equilibrium slope methodology	1	2		8														11	1,442.00
(l) Preliminary Hydraulics summary table (draft, final, comments/responses)	1	8		8														17	2,486.00
(m) Technical Memorandum of Hydrology and Hydraulics (draft, final, comments/responses)	2	8		16	4													30	4,076.00
(n) Bridge hydraulic report (draft, final, comments/responses)	2	16		24	8													50	6,844.00
(o) Determine base floodplain (existing and proposed) for LHS		2		4	12													18	2,276.00
(p) Prepare draft Location Hydraulic Study	1	1		4														6	828.00
(q) Review comments on draft LHS; prepare responses		2		2														4	568.00
(r) Prepare final Location Hydraulic Study	1	1		4														6	828.00
(s) Prepare Summary Floodplain Encroachment Report	1	4		8														13	1,790.00
(t) Coordination and preparation for Design Exception (OPTIONAL)	1	4																5	910.00
Subtotal	10	61	0	141	32	0	0	0	0	0	0	0	0	0	0	0	0	244	32,232.00
5b Scour Evaluation																			
(a) Calculate bridge scour (pier, contraction, abutment) for Alt 1		1		4														5	614.00
(b) Calculate bridge scour (pier, contraction, abutment) for Alt 2		1		4														5	614.00
(c) Calculate bridge scour (pier, contraction, abutment) for Alt 3		1		4														5	614.00
(d) Evaluate long term degradation/aggradation using equilibrium slope methodology	1	2		8														11	1,442.00
(e) Calculate riprap sizes and prepare conceptual plan (OPTIONAL)	1	4		16														21	2,670.00
(f) Calculate toe-down depths (OPTIONAL)	1	2		8														11	1,442.00
Subtotal	3	11	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	58	7,396.00

	WEST						MGE Engineering, Inc.						Cardno Entrix						
	Vice President 214	Project Manager 174	Senior Engineer 139	Staff Engineer 110	Hydrol./ Scientist 124	Clerical 77	Project Manager 210	Sup. Engineer 190	Senior Engineer 165	Assoc. Engineer 145	Assistant Engineer 120	CAD Tech 100	Sr. Proj. Consultant 160	Project Coordinator 100	Wetlands Biologist 180	Sr. Staff Engineer 135	Sr. Staff Consultant 120	Total Task Hours	COST
Personnel	*Teal*	*Gusman, Smith, Bahner*		*Jenkins, Monk, Tripolitis*	*Baron*	*Staff*		*Jeff Crovitz*	*S. Hawkins & B. Reichel*		*Charlie Miller*		*Mulder*	*Picassa*	Klug	*Manha*			
6b Technical Memorandum (Ordinary High Water Mark)																			
(a) Field survey of OHM													8		3		8	19	2,780.00
(b) Prepare AutoCAD locations of OHM		1														18		18	2,430.00
(c) Technical Memorandum of OHM (draft)		1											2			2		5	764.00
(d) Technical Memorandum of OHM (final)													2					3	494.00
Subtotal	0	2	0	0	0	0	0	0	0	0	0	0	12	0	3	20	8	45	6,468.00
7b Fish Passage Improvement Design																			
(a) Develop two fish passage concepts		8		16									8					32	4,432.00
(b) Incorporate fish passage concepts into HEC-RAS, analyze results		2		16														18	2,108.00
(c) Prepare 35% plans for two fish passage concepts		6		24									4					34	4,324.00
(d) Prepare 65% PS&E based on County response		2		4				22	68		104							200	28,668.00
(e) Prepare 95% PS&E based on County response		2		4				20	48		62							136	19,948.00
(f) Prepare 100% PS&E based on County response		2		2				10	10		56							80	10,838.00
(g) Technical Memorandum of Fish Passage (draft)	1	12		16									2					31	4,382.00
(h) Review comments on draft; prepare responses	1	4		4														9	1,350.00
(i) Technical Memorandum of Fish Passage (final)	1	6		8									1					16	2,298.00
(j) Final PS&Es		2		2				4	8		16							32	4,568.00
Subtotal	3	46	0	96	0	0	0	56	134	0	238	0	15	0	0	0	0	588	82,916.00
TOTAL LABOR HOURS/COST	*17*	*160*	*0*	*334*	*46*	*0*	*0*	*76*	*142*	*0*	*238*	*0*	*40*	*2*	*3*	*20*	*8*	*1086*	*151,152.00*

B. DIRECT COSTS		
Shipping, copies, maps, etc.	Note: All direct costs are split 50/50 between the two bridge projects (862361 and 862362)	COST
MEETINGS		325.00
Kickoff Meeting		
WEST - 1 Round Trip (420 miles x 1 trips x $0.565/mile)		118.65
MGE - 1 Round Trip (760 miles x 1 trips x $0.565/mile)		212.80
Cardno Entrix - 1 Round Trip (14 miles x 1 trips x $0.565/mile)		3.96
Project Development Team Meetings		
WEST - 3 Round Trips (420 miles x 3 trips x $0.565/mile)		355.95
Cardno Entrix - 3 Round Trips (14 miles x 3 trips x $0.565/mile)		11.87
ORDINARY HIGH WATER MARK COSTS		
Cardno ENTRIX - 3 Round Trips (70 miles x 3 trips x $0.565/mile)		59.33
Sub-Meter Accuracy Trimble GeoXH6000 @ $400/day		300.00
TOTAL DIRECT COST		*1,387.55*
TOTAL COST		*152,539.55*