

PREPARED FOR
MONTEREY PENINSULA WATER
MANAGEMENT DISTRICT

Los Padres Dam and Reservoir Alternatives and Sediment Management Study

DECEMBER 2016



PROPOSAL



December 28, 2016

Mr. Larry Hampson
Monterey Peninsula Water Management District
5 Harris Court, Bldg. G
Monterey, CA 93940

Re: Los Padres Dam and Reservoir Alternatives and Sediment Management Study

Dear Mr. Hampson:

We are happy to submit our proposal for services needed for the Los Padres Dam (LPD) and Reservoir Alternatives and Sediment Management Study. As one of the leading water resources, hydraulics, and dams engineering companies in California and the United States, MWH, now part of Stantec brings worldwide experience in dams and sediment removal projects that will support services that are effective, relevant, and will ultimately drive your project to success. Further, our overall team's experience in Carmel Valley and the Carmel River watershed for the previous Los Padres Dam sediment removal study, as well as support during multiple phases of the San Clemente Dam (SCD) Removal Project, provide us with the unparalleled working knowledge to provide efficient in-depth evaluation of alternatives and facilitation of stakeholder meetings for the project.

Team Experience. MWH is offering a team of experienced engineers and professionals, well versed in all aspects required for the development of alternatives, engineering, geomorphology, fisheries biology and construction planning, cost estimating, and environmental assessment for this project. We are assigning some of our most experienced engineering staff who are familiar and worked on the 2013 MWH Los Padres Dam Sediment Removal Study and the 2007 MWH EIR/EIS alternatives development and Basis of Engineering for the San Clemente Dam Removal Project, so that their knowledge, including knowing "what works & what doesn't", will be directly applied to the Los Padres Dam study. In addition, we have partnered with an industry-leading geomorphologist, Bob Mussetter, from Tetra Tech, as well as key steelhead experts from Cramer Fish Sciences to complement our in-house MWH staff. We have brought together this team in order to leverage the full complement of recent and direct local expertise for this project.

Our project team has local area knowledge and project history working on the Carmel River and with MPWMD. Our project team has experience working with the critical issues, policies, and procedures associated with projects located along the Carmel River and in Monterey County. They are well known and respected by DSOD, NMFS and California Fish & Wildlife. Our key leads have been active with the San Clemente Dam and Los Padres Dam dating back to the early 2000s; their experience is summarized below:

- Our Project Manager, Vik Iso-Ahola, was the Project Manager for the prior LPD and SCD sediment and dam removal studies for MWH, and has extensive experience with the DSOD on these projects as well as numerous other dam modification projects throughout the State.

- Dr. Bob Mussetter, our team's lead geomorphologist, is responsible for development of the most extensive sediment transport models on the Carmel River known to date as part of his work on SCD under MWH.
- Dr. Michael Beakes, our lead fisheries biologist, is an expert on the central California coast steelhead, performing extensive research and published papers on steelhead life history.

Mr. Iso-Ahola is our proposed Project Manager and primary contact and is authorized to represent MWH's interest on this project.

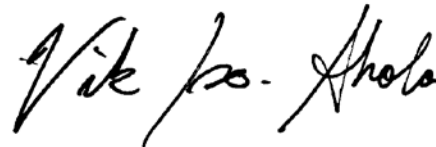
Vik Iso-Ahola, PE, PMP
2121 N. California Blvd.
Walnut Creek, CA 94596
Phone: (925) 627-4619
Fax: (925) 627-4501
Vik.Iso-Ahola@mwhglobal.com

Upon selection, we are prepared to work with MPWMD to develop mutually acceptable terms and conditions for the project. Thank you for the opportunity to submit this proposal to MPWMD. Should you have any questions or if you require additional information, please call Vik Iso-Ahola, Project Manager, at (925) 627-4619.

Sincerely,
MWH, now a part of Stantec



Craig Harris
U.S. West Business Center Management Leader



Vik Iso-Ahola, P.E., PMP
Project Manager

Enclosed
Original + 3 copies and 1 copy emailed to: larry@mpwmd.net

SIGNATURE PAGE

ISSUE DATE: November 2016

RFP EXTENSION DATE: _____

RFP: Los Padres Dam Sediment Management Study

**PROPOSALS ARE DUE IN
THE DISTRICT OFFICE BY
3:00 P.M., LOCAL TIME, ON: December 28, 2016**

MAILING ADDRESS:
Monterey Peninsula Water Management District
5 Harris Court, Building G
Monterey, CA 93940

QUESTIONS ABOUT THIS RFP #10340 SHOULD BE DIRECTED TO
Larry Hampson, larry@mpwmd.net, (831) 658-5620 or (831) 238-2543

Consultant MUST INCLUDE THE FOLLOWING IN EACH PROPOSAL:

1 original plus 3 copies = total of 4 copies plus one CD or DVD (no USB sticks)



ALL REQUIRED CONTENT AS DEFINED PER SECTION 7.1 HEREIN

This Signature Page must be included with your submittal in order to validate your proposal.

Proposals submitted without this page will be deemed non-responsive.

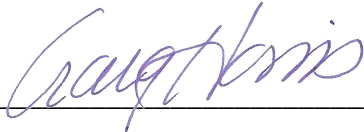


CHECK HERE IF YOU HAVE ANY EXCEPTIONS TO THIS SOLICITATION.

Consultant MUST COMPLETE THE FOLLOWING TO VALIDATE PROPOSAL

I hereby agree to furnish the articles and/or services stipulated in my proposal at the price quoted, subject to the instructions and conditions in the Request for Proposal package and the identified exceptions. I further attest that I am an official officer representing my organization and authorized with signatory authority to present this proposal package.

Company Name: MWH now a part of Stantec Date December 22, 2016

Signature:  Printed Name: Craig Harris

Street Address: 2121 N. California Blvd., Suite 600

City: Walnut Creek State: CA Zip: 94596

Phone: (925) 627-4619 Fax: (925) 627-4501 Email: Vik-Iso-Ahola@mwhglobal.com

Registered California Civil Engineer Name and License No.

Vik Iso-Ahola, PE #62772

RECEIPT OF ADDENDA

MWH acknowledges receipt of one addenda dated 12/27/16.

TABLE OF CONTENTS

SECTION 1 -- GENERAL	i
Cover Letter.....	i
Signature Page.....	iii
Receipt of Addenda	v
SECTION 2 - PRE-QUALIFICATIONS/LICENSING REQUIREMENTS	1
SECTION 3 - PROJECT EXPERIENCE AND REFERENCES	2
Project Experience.....	2
Sediment Studies.....	2
Sediment Management (Reuse/Disposal)	2
Dredge Spoils Experience.....	3
Sediment Sampling/Site Characterization	3
Dams and Reservoirs.....	3
Fish Passage Planning and Design Experience.....	4
Specific Carmel River Experience.....	4
MWH Project References.....	6
SECTION 4 – FIRM AND KEY PERSONNEL	30
MWH Overview	30
Subconsultant Team Members	31
Project Team Organization.....	32
Project Team Organization Chart	33
Key Staff and Roles	34
SECTION 5 – LITIGATION HISTORY	42
MWH Americas, Inc.....	42
Cramer Fish Sciences.....	42
Tetra Tech.....	42
SECTION 6 – TECHNICAL ASPECTS	43
MWH Approach to Deliver this Project.....	43
Scope of Work.....	43
Task 1 Feasibility Study Preparation	43
Task 2 Sediment Management Options	47
Task 3 Evaluate Effects on Steelhead.....	53
Task 4 Identify Feasible Alternatives	54
Task 5 Final Report.....	54

Task 6 Project Management.....	55
Optional Tasks	55
Task 7 - Field Survey	55
Confirmation Statement	55
SECTION 7 – PRICING AND SCHEDULE	56
Project Budget	56
Schedule	56
Confirmation Statement	56
2017 Hourly Rate Schedule	57
Project Schedule.....	58
Rate sheet.....	59
SECTION 8 - EXCEPTIONS	60
SECTION 9 - APPENDIX	61
Project team Resumes.....	61

SECTION 2 - PRE-QUALIFICATIONS/LICENSING REQUIREMENTS

MWH acknowledges that it meets all of the prequalification and licensing requirements to perform the Scope of Work as outlined within the RFP.

MWH and its core sub-consultants possess and maintain all permits, licenses, and professional credentials necessary to provide services as specified under the RFP. Our key proposed team members that will have responsible charge of the listed applicable discipline include the following. Other members of the team maintain required licenses and certifications for the work to be performed under this contract.

Licensed Professional Civil Engineer and DSOD Coordinator

Vik Iso-Ahola, PE, PMP

Licensed Professional Civil Engineer

Recent DSOD Project References (Project Name – DSOD Contact(s)):

- San Clemente Dam – Dave Gutierrez & Y-Nhi Enzler
- LL Anderson Dam – Melissa Collord
- Santa Anita Dam – Harpreet Hansra
- Big Tujunga Dam - Dave Gutierrez & Y-Nhi Enzler

Expertise in Reservoir Operations, Hydrology, Flood Control and Mapping

- Los Padres Dam Spillway Capacity Study – the project review of LPD hydrology, bathymetry, and determined the maximum spillway capacity as compared to maximum flood.
- LL Anderson Dam – reviewed Probable Maximum Flood (PMF), routed flood hydrograph through existing spillway, and developed spillway modification alternatives.
- Santa Anita Dam – included PMF determination, routing of flood hydrograph through existing spillway, and development of spillway rehabilitation alternatives
- Big Tujunga Dam - included PMF determination , routing of flood hydrograph through existing spillway, and development of spillway rehabilitation alternatives

Expertise in Reservoir Operations, Hydrology, Flood Control and Mapping

Eric Clyde, PE, WRE (MWH)

Certified Fisheries Biologist with Steelhead Experience

Michael Beakes, PhD (Cramer Fish Sciences)

Joseph Merz, PhD (Cramer Fish Sciences)

Stephanie Theis (MWH)

Qualified Geomorphologist with Experience in Fluvial Processes, Mass Wasting, Sediment Transport Analysis, and Floodplain Development

Bob Mussetter, PhD, PE (Tetra Tech)

Stu Trabant, PE (Tetra Tech)

Although MWH is a large company we focus our project teams with specialists having direct knowledge of the work and maintain the size of the team to most efficiently complete the work. We have additional depth of highly qualified, local and national expertise to draw upon if necessary.

SECTION 3 - PROJECT EXPERIENCE AND REFERENCES

PROJECT EXPERIENCE

The MWH team has extensive experience on similar projects that will be utilized to support this project. A summary of our specific areas of expertise are provided below. Summary descriptions for specific and applicable projects are found at the end of this section, and include several projects on the Carmel River, such as the San Clemente Dam Removal, Los Padres Dam Sediment Removal Study, and Sleepy Hollow Steelhead Rearing Facility Intake.

Sediment Studies

MWH provides a full range of sediment management and remediation services. Through a legacy of hundreds of sediment project assignments conducted over the past 80 years, MWH has the expertise to address sediments from a structural perspective, as well as on an environmental and ecological basis. In addition, MWH has extensive worldwide contaminated sediment investigation and remediation experience in numerous distinct geologic and climatic zones. We have hydrologic, hydraulic, geotechnical, and civil engineering specialists who are dedicated to providing solutions for sediment management issues under multiple environmental conditions.

MWH staff can perform focused studies that provide optimal solutions during project planning, design, and operation phases in the management of sediment impacting structures or the natural environment. Our capabilities encompass the collection of samples, laboratory analyses (quantity, physical characteristics and contaminant levels), modeling, risk assessment, evaluation of removal and placement alternatives, and estimation of sediment yield. MWH can provide experienced staff to conduct detailed sampling programs that fully characterize sediment conditions. Program support includes recommendation and procurement of necessary instrumentation and sampling equipment.

The volume and rate of sediment transported by streams is determined by both empirical methods and direct measurement. Suspended sediments can be measured over a range of stream discharges at many river stations, and numerous sediment loading curves can be constructed from the data. Transport rates from those curves are combined with discharge as indicated by streamflow-duration curves to determine total suspended sediment transport. Estimates of total sediment transport or yield have been developed for a number of client projects using the Modified Einstein or Colby methods. These empirically derived formulas are applied to hydraulic, suspended sediment, and geometric characteristics of a particular stream reach under study.

Sediment Management (Reuse/Disposal)

MWH has extensive experience in managing large soil/sediment excavation, reuse and disposal projects. The focus of these projects has been to maximize beneficial onsite reuse of excavated material for site grading and earthworks. Beneficial reuse of soil/ sediment expedites construction projects, minimizes off-site disposal of excavated material, decreases the volume of truck traffic through local communities, and results in significant cost savings to MWH's clients.

MWH has successfully used the results of focused sampling and analyses, fate and transport, and risk assessment programs to guide the development of excavation plans and strategies for segregating reusable soil/sediment from material requiring offsite disposal. These segregation plans and strategies have maximized on-site reuse and lowered project costs. Projects where MWH evaluated or managed the

soil excavation, reuse, and disposal of soil/sediment have included the San Clemente Dam Removal Project, and the Los Padres Dam Sediment Removal Study in the Carmel River watershed, as well as for Englebright Dam as part of the Yuba Salmon Forum. Utilizing this comprehensive approach to sediment management projects has resulted in millions of dollars of savings to MWH's clients. These projects and MWH's involvement are further described in the Highlighted Projects section.

Dredge Spoils Experience

MWH has managed and conducted dredge materials surveys for many years. We have conducted or provided oversight management of detailed sampling and analyses programs required for the permitting of offshore and upland disposal of dredge materials. MWH has conducted in-situ bioassays of material to assess its potential toxicity and suitability for offsite disposal.

We have worked with numerous dredge spoils contractors in the region and have intimate knowledge of the means and methods of dredge spoil dewatering, treatment, and processing that can make the material more suitable for disposal or re-use. We use this knowledge and experience to help guide our clients in dredge project planning to find the most cost-effective solution for dredge spoils placement.

Sediment Sampling/Site Characterization

MWH technical specialists have extensive experience in conducting environmental and ecological assessments of terrestrial, aquatic, and marine ecosystems to address a wide range of issues associated with sediment management. We have successfully applied cost-effective and innovative approaches to streamline the site investigation process and tailor our site investigations toward meeting the project's exit strategy goals. Our staff is sensitive to the importance of collecting the appropriate amount of data to support removal alternatives analysis and satisfy fate and transport and risk assessment data quality objectives. Our data-quality objectives are designed to ensure that data of known and appropriate quality are obtained to support remedy selection.

In support of sediment assessments, MWH staff have designed and implemented sediment sampling and analysis plans and applied rational and statistical methods to determine the appropriate amount of data required to meet assessment goals. MWH co-authored USEPA's Monitoring Guidance for the National Estuary Program that describes approaches and methods for characterizing sediment quality.

Dams and Reservoirs

Since 1920, MWH has specialized in wet infrastructure, including major water resource projects that have included the planning, design and construction management of dams both in the U.S. and around the world. MWH has experience in all types of dam design and construction and has built a reputation for innovation and quality engineering. MWH has the in-house expertise and experience necessary to handle all aspects of project development, including the capability of assessing and addressing any potential environmental impacts. MWH can draw on the skills and experience of a staff of engineers and scientists, many of whom have 20 or more years of continuous service with the firm in the planning and implementation of dam and water resource projects.

Over the years, MWH has led the industry in the design of earth and rockfill dams and concrete dams. The company possesses the capabilities and experience for any dam related project. Our experience includes dam projects on every continent.

Fish Passage Planning and Design Experience

MWH has been a leading provider of both fish biology and fish passage engineering services to most of the major hydroelectric projects and water supply dams on the west coast of the US encompassing work on most major river systems.

MWH has completed in excess of 50 fisheries projects in the last 25 years. In the last 15 years our fisheries engineers have designed more than 25 fish screens ranging in size from 30 cfs to over 2,500 cfs that are now in operation. Many of these are for fish protection at auxiliary water intakes for fish ladder systems. We offer an industry leading team of specialized fisheries engineers that have worked on fisheries projects across the continent, with our primary focus in the West Coast.



MWH has creative fisheries engineers with comprehensive experience in developing value-based solutions to all types of fish facilities. In addition, MWH has specialized expertise in fisheries science and bioengineering and has applied this expertise at dozens of major dam and hydro projects, many of which must protect fish species covered by the Endangered Species Act (ESA) of 1973. MWH's expertise covers all aspects of fish passage engineering including barrier assessment, conceptual plan development, hydraulic modeling with both mathematical and physical models, hydraulic design of flow structures, structural, mechanical and electrical design of fish screens and fish ladders, design and

evaluation of debris removal devices for fish screens, and regulatory requirements for fish passage and screening projects. We also offer technical expertise in fisheries research including fish behavior, fish predator concerns, fish tagging and monitoring, and regulatory requirements for protected and endangered fish.

MWH has been retained by utilities, irrigation districts, and water districts to provide fish passage at their dams, and intake facilities. For fish passage services, our clients include public utilities, power companies, irrigation districts, federal agencies, state agencies, and water districts primarily in California, Washington, Oregon, and Idaho. During development of fish passage projects, close interaction with state and federal government fishery agencies such as California DFG, NMFS and USFWS, is necessary to develop facilities that successfully pass fish to meet the requirements of both the owner and fishery agencies. During the course of developing over 50 successful fish passage facilities, MWH has earned the respect of state and federal fishery agencies. An indication of this is that we have even been hired by these agencies to provide fish passage designs, serve on expert panels and to advise them on designs by others.

Specific Carmel River Experience

Since several of our team member's initial involvement in 2001, we have played a key role in the evaluation of alternatives and the associated potential impacts for the San Clemente Dam Seismic Retrofit Project. Dr. Mussetter performed the initial sediment-transport studies for the San Clemente Dam retrofit study for the California Department of Water Resources (CDWR). After completion of that study, California American Water Company (Cal-Am) contracted with Dr. Mussetter to perform a more detailed evaluation of the potential flood hazards in the river downstream from the dam associated with the alternatives that were analyzed in the CDWR study. In the initial modeling that was performed for CDWR, the sediment loading

under baseline conditions was assumed to be the same as the upstream watershed sediment yield, under the assumption that the existing reservoir will have minimal sediment trap efficiency, and the sediment loading to the downstream river associated with the dam-notching and -removal alternatives was approximated based on the transport capacity of the upstream reach of the river.

Due to uncertainty about the validity of these assumptions, and uncertainty about the gradation of the existing reservoir deposits, Cal-Am subsequently retained Dr. Mussetter to perform additional analyses that included collection of detailed topographic, bathymetric, and sediment data in San Clemente Reservoir, and development of a sediment-transport model of the reservoir that could be used to directly evaluate the existing trap efficiency and rate of erosion after notching or removal of the dam. Subsequent to these initial studies, MWH and Dr. Mussetter were involved throughout the planning phases of the project through completion, including:



- In January 2005, Dr. Mussetter was retained by Cal-Am to perform hydraulic and sediment-transport analyses on the Carmel River Reroute and Dam Removal (CRRDR) Option for the San Clemente Dam Seismic Retrofit Project. A sediment-transport analysis was performed for three scenarios, including baseline conditions with no dam (i.e., pre-dam conditions), baseline conditions with the existing dam configuration, and conditions representing the CRRDR option.
- From 2005 to 2007, under the leadership of our current Project Manager, Vik Iso-Ahola, MWH supported the San Clemente Dam Seismic Retrofit EIS Team by developing conceptual designs and detailed cost estimates for dam removal, sediment removal, no action, and CRRDR alternatives. The effort included support to CalAM during public outreach and TRC reviews and discussions.
- From 2007 to 2008, MWH prepared the Draft Basis of Design Report for the CRRDR, including performing geotechnical investigation for the bypass under contract to the State Coastal Conservancy. Under contract to MWH, Dr. Mussetter summarized an evaluation of flood hazards and an analysis of the downstream impacts associated with the CRRDR option. The downstream impact analysis included an evaluation of the effects of the CRRDR option on suspended sediment concentrations, fish passage conditions (i.e. a critical riffle analysis), and changes in the bed material gradation.
- In 2007, Dr. Mussetter assisted the California State Coastal Conservancy (SCC) and its consultants in further evaluating the CRRDR option. During this phase of the project, Dr. Mussetter reviewed the technical analysis and preliminary designs, and provided input on the viability of those designs.

- Most recently, Dr. Mussetter and TetraTech staff served as the lead design engineers on the Design-Build (DB) team for the recently constructed CRRDR Project, which is billed as the largest dam removal project in California history. Tetra Tech also provided post-design services and engineer of record inspections during construction.

In 2013, building upon the experience and knowledge gained supporting the San Clemente Dam Removal project, MWH developed an initial conceptual assessment on the general feasibility of sediment removal at Los Padres Dam and Reservoir, including development of cost estimates for each feasible alternative.

The results of the study highlighted the differences between the San Clemente Dam Removal and Los Padres Dam (LPD) Sediment Removal, where a similar “re-route” alternative could not be developed for LPD due to the lack of adjacent drainages and steeper terrain in the upper Carmel River watershed. The challenges for removing sediment from LPD was identified to be similar or even more difficult as compared to San Clemente Dam. While several removal alternatives were studied and identified to be feasible for extending the useful life of the reservoir, it was ultimately recommended that additional studies are required to develop an alternative that balances environmental impacts and costs against gained benefits.



MWH PROJECT REFERENCES

The following project descriptions have specific application to the Los Padres Dam and Reservoir Alternatives and Sediment Management Study. These projects demonstrate the team’s experience and expertise with DSOD, reservoir operations, sediment management, fisheries biology, and fluvial geomorphology.

Los Padres Reservoir Sediment Removal Feasibility Study

Location

Monterey County, California

Client

California American Water Company (Cal-Am)

Services

Initial Conceptual Assessment
 Evaluation of Sediment Removal Methods
 Identification of Disposal Sites
 Cost Estimating for Alternatives

Completion Date

Study: 2012 – 2013

Contact

Douglas A. Fraser, PE
 831-236-4494
douglas.fraser@amwater.com



California American Water Company (Cal-Am) is the owner and operator of the **Los Padres Dam and Reservoir** located on the Carmel River in Monterey County, California with an original reservoir storage capacity of 3,070 af. The storage capacity has been reduced by over 1,284 acre-feet (af), or about 40 percent, as a result of sediment deposition over its 60 years of operation. Cal-Am retained MWH Global (MWH) to perform a study on the **feasibility of removing an estimated 2 million cubic yards of sediments** from the Los Padres Reservoir in order to restore the original storage capacity.

The scope of this study was intended to provide an initial conceptual **assessment** on the general feasibility of sediment removal at Los Padres Dam and Reservoir. MWH's assessment served to facilitate the long-term planning for **management of the reservoir and sediments**. The scope of work for this study included the following.

1. **Assessment** of existing reservoir conditions and data;
2. Conceptual evaluation of methods for **reservoir sediment** removal, transport and disposal;
3. Identification of potential commercial use and preliminary selection of disposal sites for the removed sediment
4. Identification of potential environmental issues and permitting requirements for removal and disposal of the sediment;
5. Description and cost estimate for three conceptual **alternatives** based on feasible methods removal, transportation and disposal of the sediment.

This study researched the recommended reservoir sediment management practices by the USBR, USSD and Heinz Center. Typically applied **sediment management strategies**, such as sediment re-routing, drawdown flushing, reservoir emptying, and siphoning, were considered, but deemed not practical based on the dam configuration and design, and the reservoir operation constraints. MWH's study outlined possible dredging or dry excavation methods and transport to proposed nearby upstream or downstream

storage locations. A detailed evaluation of preferred **alternatives** and permitting requirements was performed and further environmental study and benefit-cost comparison was recommended prior to selection of a feasible **alternative**.

Los Padres Dam Spillway Capacity Study

Location

Monterey County, California

Client

Douglas A. Fraser, P.E.
Senior Project Manager
California American Water,
Central Division
511 Forest Lodge Rd., #100
Pacific Grove, CA 93950
831-236-4494

Services

- CFD Modeling
- Flood Routing
- Rating curve development

Completion Date

2012 – 2013



California American Water Company (Cal-Am) is the owner and operator of the Los Padres Dam and Reservoir located on the Carmel River in Monterey County, California with an original reservoir storage capacity of 3,070 af.

Spillway Capacity Study Computational Fluid Dynamics (CFD) Modeling

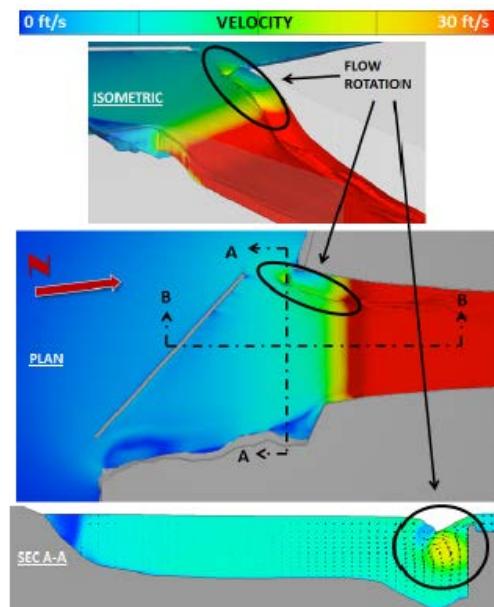
Cal-Am had previously conducted an investigation using a 2-dimensional (2D) numerical hydraulic model to compare the estimated peak reservoir surface elevations and flow velocities near the spillway both with and without a new fish collector installation. The study results suggested that the existing spillway capacity of the Los Padres Dam was significantly lower than the original rating curve developed by the California Division of Safety of Dams (DSOD) in 1980.

In order to confirm the spillway capacity, Cal-Am engaged MWH to conduct an independent three dimensional (3D) Computational Fluid Dynamics (CFD) analysis. The CFD was performed on the existing spillway and reservoir.

Results of the analyses found the following:

- There was a significant rotational component to the spillway flow, which led to continual scour along the toe of the west retaining wall.
- The discharge coefficients computed by the CFD showed a 6% reduction in the discharge capacity from the original DSOD rating curve due to 3D effects not previously identified.

Because the spillway capacity reduction was shown to be not as severe as predicted, MWH's study results allowed Cal-Am to negotiate a delay to necessary spillway changes with DSOD and revisit the use of the fish collector, saving Cal-Am substantial unbudgeted expenditure.



Carmel River Reroute and San Clemente Dam Removal Project

Location

Monterey County, CA

Client

California-American Water Company (initial and ongoing phases of project)
 State Coastal Conservancy (separate phase)

Services

- Sediment Removal Feasibility Study
- Identification of Environmental Compliance Requirements
- Soil, Groundwater, and Other Media Sampling
- CEQA/NEPA
- Restoration
- Hydraulics/Hydrologic
- Civil & Geotechnical

Completion Date

2015, monitoring through 2021

Contacts

(CalAm)

Douglas A. Fraser, PE
 831-236-4494
 douglas.fraser@amwater.com

(State Coastal Conservancy)

Trish Chapman, Project Manager,
 (510) 286-0749



MWH supported the California American Water Company (Cal-Am) in the **San Clemente Dam Removal Study**. MWH provided a conceptual **alternatives development**, preliminary engineering, construction cost estimating, and support of the ongoing EIS/R process for San Clemente Dam. The San Clemente Dam was a 106-foot-high, concrete-arch dam, built in 1921 on the Carmel River. This dam was owned by California-

American Water Company, located at the confluence of the Carmel River and San Clemente Creek, 18.5 miles upstream from the Pacific Ocean in Monterey County.

The California Department of Water Resources – Division of the Safety of Dams (DSOD) issued a safety order for the structure in the early 1990s. This order required the San Clemente Dam meet dam safety criteria relative to the maximum credible earthquake (MCE) and probable maximum flood (PMF).

Studies concluded the PMF would overtop the dam and subject the foundation to erosion, or the MCE would cause severe overstressing of the dam structure. Findings determined standards could be achieved by either notching the dam to a level where DSOD requirements are met, or by removing the dam.

MWH assisted in formulating measures and alternative plans and evaluating and comparing alternative plans including **dam rehabilitation, dam notching, dam removal**, and re-route of the river with **dam removal**. We calculated **volumes of dredged material and developed dredged material placement plans**. The MWH team developed benefits and cost estimates to evaluate **alternative plans** for all dam modification and/or removal alternatives.

During the interactive EIS/EIR process, we coordinated an interdisciplinary team and **held stakeholder workshops and meetings**, and provided engineering support and guidance to the NEPA/CEQA team. MWH worked closely with CAW, USACE, **DSOD**, and other stakeholders throughout the project.

MWH performed **geotechnical investigation** surveys and analyses, providing supporting data for the evaluated alternatives, and developed dredging and **sediment placement plans** for each alternative. The team applied GIS to develop flood (hydrologic & hydraulic) and **sediment transport (geomorphic) analyses** (MWH subconsultant Dr. Mussetter) of each alternative. MWH also provided preliminary design of structural measures required for each alternative (e.g., dam penetrations, notching, channel and disposal site stabilization, pipelines, etc.).

Options for addressing the safety deficiency included **strengthening the existing dam** (the owner's initial preference) and **complete dam removal**. Various options for **managing the sediment** with complete **dam removal** were studied, and the Carmel River Reroute and San Clemente Dam Removal (CRRDR) option was ultimately selected.

As a follow up to the EIR/EIS support and under contract to the State Coastal Conservancy, MWH prepared the Draft Basis of Design Report for the CRRDR, including performing geotechnical investigation for the bypass.

Subconsultant Experience

The CRRDR option was recently completed by a Design-Build team and Dr. Mussetter and Tetra Tech is part of that team performing Channel Reconstruction Design.

Project features include:

- Access roads, staging areas, and stream diversions for the three-year construction project.
- Construction of a diversion dike and a channel through the bedrock ridge between the Carmel River and San Clemente Creek that reroutes the Carmel River around the majority of the **reservoir sediment deposits**.
- Removal of the **reservoir sediment** deposits in the San Clemente arm of the reservoir.
- Reconstruction of a natural channel to provide fish passage and riparian habitat.
- Stabilization of the accumulated sediment in the bypassed, Carmel River arm of the reservoir.
- Wetland and upland habitat restoration throughout the site.
- Removal of San Clemente Dam and the smaller (the Old Carmel River Dam 0.4 miles downstream).



For the past 15 years members of the Tetra Tech design team have been involved in the development of the project characterized by the three phases. The most recent is the completed Design Build Effort. Team

members performed two earlier efforts that helped develop the approach and important information for the CRRDR Design Build Effort. These were initial **Sediment Transport and Modeling Studies and Technical Review Team Management**.

Design Build Effort (2013 to present). Tetra Tech recently completed its role as part of a design-build team for the CRRDR, led by Granite Construction, which is under contract to California American Water, the owner of the dam. Tetra Tech is a subconsultant to the Lead Designer and is responsible for hydrologic and hydraulic analyses, and design of the approximately 4,500-foot-long, reconstructed stream channel corridor that provides upstream and downstream passage for **steelhead** in the rerouted section of the Carmel River. The California State Coastal Conservancy (Conservancy) is the lead agency who coordinated engineering and environmental services for the preliminary design phase, and they continue to be the lead agency for implementation of the CRRDR option.

Sediment Transport and Hydraulic Modeling Studies (2001-2008). Mussetter Engineering, Inc. (now part of Tetra Tech after being acquired in May 2009) performed detailed sediment transport modeling for a wide range of potential **dam removal** or retrofit options for the California Department of Water Resources, California-American Water, and the Conservancy to assist with the feasibility and environmental studies leading up to selection of the CRRDR option. These studies included **data collection** related to both the topography and bathymetry of the river and reservoir, and a drilling program to provide detailed characterization of the reservoir sediment deposits. The work also included use of the **sediment modeling** results to assess potential impacts to channel capacity, flooding and channel stability in the 18.5-mile reach of the Carmel River downstream from the dam.

Technical Review Team Management (2009-2011). Tetra Tech managed a Technical Review Team that included federal agencies (U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, U.S. Bureau of Reclamation); state agencies (California Department of Fish and Game, California Department of Water Resources); local agencies (Monterey County Water Resource Agency, Monterey Peninsula Water Management District); and private consultants. Tetra Tech maintained the contacts list, distributed draft documents for review, collected and organized review comments, and maintained communications throughout the process. Tetra Tech also assisted in organizing and facilitating Technical Review Team meetings that took place at the Conservancy's offices in Oakland, California.

Specific aspects of the effort related to the project elements from the RFQ include:

Complex Dam Removal

Tetra Tech analyzed the system response to nearly 20 **alternatives for removal** of the San Clemente Dam. This involved 1-D **sediment transport modeling** of sediment deposited behind the dam to establish the rate at which flows could remove deposited sediments. Downstream **sediment transport modeling** was performed to determine potential changes in channel **morphology** and flooding.

Ecosystem Restoration – Accumulated Sediment Management Plan

Prior to the current Design-Build project, Tetra Tech performed **geomorphic, hydraulic and sediment transport analyses for a wide range of potential alternatives** for removing or retrofitting San Clemente Dam to bring it to an appropriate seismic safety condition. These studies involved **geomorphic** analysis of conditions in the 18.5-mile reach of the Carmel and **hydraulic and sediment transport modeling** to quantify the likely effects of releasing stored sediment. Initially, thirteen scenarios with sediment releases ranging from 300 ac-ft to 1,500 ac-ft were investigated. After it became clear that the downstream impacts of releasing the stored sediment would be unacceptable, additional **alternatives** for reducing the downstream impacts were modeled. The effects of these **alternatives** on downstream **sediment** loads

ranged from only minor changes from existing (i.e., with-dam) conditions to release of large quantities of **sediment** over a period of a few decades followed by return to the natural background sediment loads.

To understand potential effects, additional analyses were performed to quantify the effects of bed changes on downstream flooding, fish passage, instream habitat and channel stability. The local effects depended on varying **geomorphic** character of the river over the 18.5-mile study reach that flows through a narrow, boulder-bed and bedrock-confined canyon in the upstream portions of the reach, becomes a mobile, gravel/cobble bed river over the middle portion of the reach, and then abruptly transitions to a sand bed system in the downstream approximately 4 miles of the reach. **Sediment deposition** in the approximately 1-mile-long lagoon between the Pacific Coast Highway and the coast was of significant concern. Based on the high cost, potential for unacceptable downstream impacts and significant challenges associated with finding a suitable repository to place excavated reservoir sediment, the Reroute Project was identified as a means of isolating the majority of the reservoir deposits.

Ecosystem Restoration – Habitat, Channel, Floodplain and Revegetation Aspects

The purpose of the Channel Restoration is to provide naturally-functioning stream channels that will evolve over time through **fluvial processes** and exhibit resiliency to major floods and **sediment** events, such that long-term sustainability is maximized and maintenance requirements for the channels are minimized. The Channel Restoration Design uses natural, and where necessary, biodegradable materials; concrete, metal cabling or metal anchors are not used in the design. The restored channel was designed to meet the four specific design criteria: fish passage for upstream migration of adult **steelhead** and downstream migration of kelts, smolts and juvenile **steelhead** during the historical migration period, long-term sustainability and resiliency to the full range of floods and **sediment-transporting events**, provide high quality aquatic and riparian habitat, and develop a channel that emulates the natural variability in channel conditions.

The San Clemente Creek Valley in which the reconstructed channel being built is relatively steep and confined compared to the historical main river valley, presenting significant design challenges to criteria. The 3,000-foot-long Combined Flow Reach (CFR) has an average gradient of 2.7 percent, and consists of a series of boulder step-pool sequences separated by resting pools. Channel substrate consists of a well-graded mixture of cobbles, gravel and sand that remains stable up to a 5-year peak discharge but will adjust and sort during higher flows. The channel banks are being constructed from a combination of boulder toe protection and fabric encapsulated soil lifts containing live willow stakes to promote rapid development of a robust riparian corridor. The approximately 600-foot long, 0.8 percent Reroute Channel that connects the upstream river to the CFR is being constructed with a riffle-pool morphology. The upstream 1,000 feet of the project reach are being re-constructed to provide a transition from the Reroute Reach to the undisturbed Upper Carmel River. The Tetra Tech design team is coordinating with the ecological design team to develop and implement a robust re-vegetation and habitat restoration plan for the overbanks and other disturbed areas.

Hydraulics, Hydrologic, River Engineering and Wetland Restoration

Besides the extensive **hydraulic and sediment transport modeling** previous described to support development of the **sediment management plan and dam removal scheme**, Tetra Tech performed 1-dimensional (1-D) and **2-D hydraulic modeling** for the final channel and floodplain design. The 1-D modeling was executed using the Corps of Engineers HEC-RAS software and the 2-D modeling was performed using the Bureau of Reclamation SRH-2D software. The 1-D model was used to establish the initial design configuration because of the ease with which the channel configuration can be iteratively modified. A 2-D model was then developed for the initial configuration that met most of the rigorous engineering design requirements established by the Owner and agencies, and this model was then used to refine the design and assess the detailed performance requirements for fish passage and channel stability.

The 2-D model was also used to develop hydraulic data for design of the diversion dike that routes the Carmel River through the bedrock cut into the former San Clemente Creek valley and the Stabilized **Sediment** Slope that buttresses the downstream end of the bypassed **sediment** deposits. These features must be stable for the Probable Maximum Flood. As a result, the model was run for a wide range of flows from the low end of the fish passage range (about 15 cfs) to the PMF (~100,000 cfs). Specific flows between these values that were used to design various aspects of the project included the 5-year through the 100-year peaks.

Civil Engineering

To control erosion in the overbanks, approaches were designed to address two types of erosion. The re-vegetation plan being prepared by Rana Creek, in cooperation with Tetra Tech, was designed to prevent near-term surface erosion on the overbank surfaces. The overbank restoration plan calls for LWD to create immediate overbank roughness with Manning's n-values of 0.08 to 0.12 to prevent channel avulsion. Tetra Tech also assisted the geotechnical engineers with the design of a small tributary channel that crosses over the top of the stabilized **sediment** (i.e., **sediment** that is being isolated in the Carmel Arm of the reservoir), and then down the steep face of the Stabilized **Sediment** Slope into the reconstructed river.

Geotechnical Engineering

Throughout the various phases of the project, Tetra Tech coordinated with and used information supplied by geotechnical engineers to determine likely subsurface conditions (depth to bedrock, size distribution of alluvium, bank characteristics and of deposited reservoir sediments). Tetra Tech worked with the geotechnical engineers to develop the Stabilized **Sediment** Slope that buttresses the downstream end of the bypassed sediment deposits.

Life History Variation in Steelhead Trout

Location

Central Valley, California

Client Reference

Lindsay E. Correa, Delta Science Program, Delta Stewardship Council
Lindsay.Corrae@deltacouncil.ca.gov

Date of Services

2011

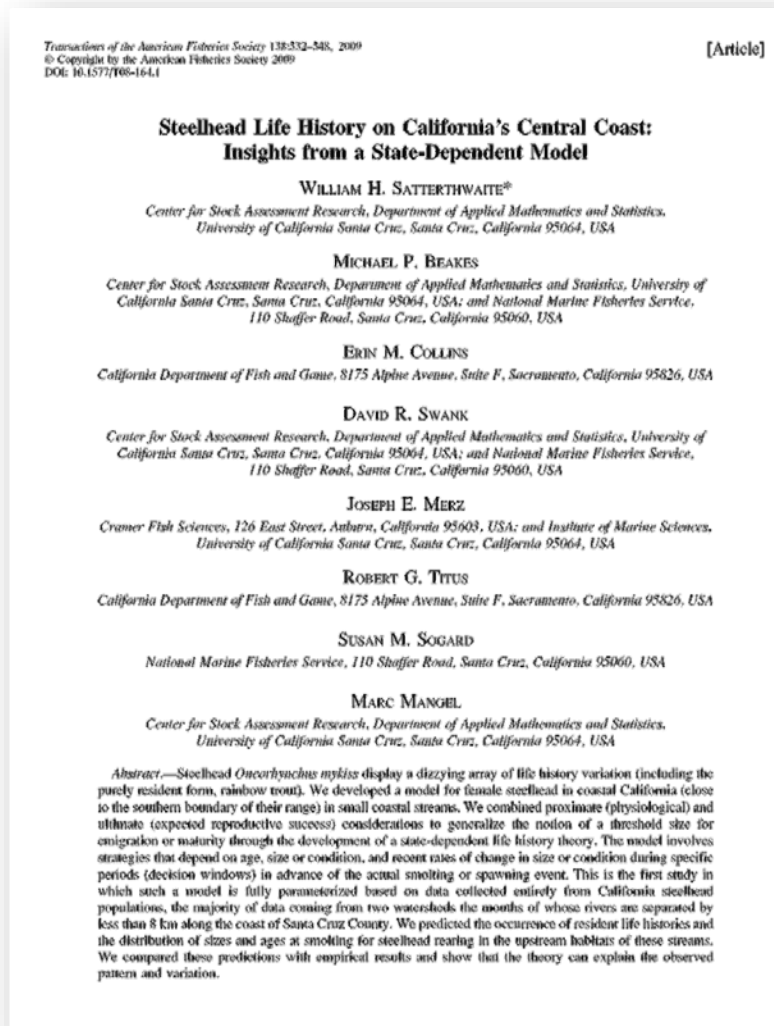
Total Fees

\$40,000 (CFS Component)

Cramer Fish Sciences (CFS) staff Dr. Joseph Merz and Dr. Michael Beakes participated in a multi-year program project evaluating and modeling factors influencing steelhead trout anadromy. The project led to the publication of several papers, two are shown here.

Steelhead *Oncorhynchus mykiss* display a dizzying array of **life history variation** (including the purely resident form, rainbow trout). Dr. Merz & Beakes developed a model for female steelhead in coastal California (close to the southern boundary of their range) in small coastal streams.

They combined proximate (physiological) and ultimate (expected reproductive success) considerations to generalize the notion of a threshold size for emigration or maturity through the development of a state-dependent **life history theory**. The model involved strategies that depend on age, size or condition, and recent rates of change in size or condition during specific periods (decision windows) in advance of the actual smolting or spawning event. This was the first study in which such a model is fully parameterized based on data collected entirely from California steelhead populations, the majority of data coming from two watersheds the mouths of whose rivers are separated by less than 8 km along the coast of Santa Cruz County. They predicted the occurrence of resident **life histories** and the distribution of sizes and ages at smolting for steelhead rearing in the upstream habitats of these streams. The predictions were compared with empirical results and show that the theory could explain the observed pattern and variation.



Dr. Beakes and Merz tested the effect of temporal patterns in food supply on **life history** decisions in coastal steelhead

Oncorhynchus mykiss irideus from a Central California coastal (CCC) population (Scott Creek) and a Northern California Central Valley (NCCV) population (upper Sacramento River basin). They manipulated growth through feeding experiments conducted from May to the following March using warm (2006 cohort) and cool (2007 cohort) temperature regimes. Survival in seawater challenges just before the time of typical juvenile emigration provided an index of steelhead smolt versus non-smolt **life history** pathways. Survival varied significantly with fish size (with larger fish being more likely to survive than smaller fish) and by source population (with CCC steelhead being more likely to survive than NCCV steelhead of the same size). The timing of increased food supply (treatment group) did not significantly affect seawater survival rates in either NCCV or CCC steelhead. For both strains, the eventual survivors of seawater challenges (putative smolts) diverged from the eventual mortalities (putative non-smolts) in both size and growth rate by June in both years, suggesting that the initial growth advantages were maintained throughout the experiments. A significant divergence in condition factor between smolts and non-smolts by December matched the expected morphological transition of smolts, which showed faster growth in length than weight compared with non-smolts. The apparent timing of the decision window, several months before the typical period of smolt emigration, matched the patterns observed for other salmonids. In coastal California, this decision must occur before fish have had the opportunity to take advantage of improved winter–early spring feeding conditions. The results support the role of early growth opportunity in **life history** decisions and provide insight into the applicability of **life history** models for managing California steelhead.

Transactions of the American Fisheries Society 139(000):000, 2010
 © Copyright by the American Fisheries Society 2010
 DOI: 10.1577/T09-146.1

[Article]

Smolt Transformation in Two California Steelhead Populations: Effects of Temporal Variability in Growth

MICHAEL P. BEAKES*

Center for Stock Assessment Research, Department of Applied Mathematics and Statistics,
 University of California–Santa Cruz, Santa Cruz, California 95064, USA;
 and National Marine Fisheries Service, 110 Shaffer Road, Santa Cruz, California 95060, USA

WILLIAM H. SATTERTHWAITÉ

Center for Stock Assessment Research, Department of Applied Mathematics and Statistics,
 University of California–Santa Cruz, Santa Cruz, California 95064, USA; and MRAG Americas,
 Post Office Box 1490, Capitola, California 95010, USA

ERN M. COLLINS

California Department of Fish and Game, 8175 Alpine Avenue, Suite F, Sacramento, California 95826, USA

DAVID R. SWANK

National Marine Fisheries Service, 650 Capitol Mall, Suite 8-300, Sacramento, California 95814-4708, USA

JOSEPH E. MERZ

Cramer Fish Sciences, 126 East Street, Auburn, California 95603, USA;
 and Institute of Marine Sciences, University of California–Santa Cruz, Santa Cruz, California 95064, USA

ROB G. TITUS

California Department of Fish and Game, 8175 Alpine Avenue, Suite F, Sacramento, California 95826, USA

SUSAN M. SOGARD

National Marine Fisheries Service, 110 Shaffer Road, Santa Cruz, California 95060, USA

MARC MANGEL

Center for Stock Assessment Research, Department of Applied Mathematics and Statistics,
 University of California–Santa Cruz, Santa Cruz, California 95064, USA

Abstract.—We tested the effect of temporal patterns in food supply on life history decisions in coastal steelhead *Oncorhynchus mykiss irideus* from a Central California coastal (CCC) population (Scott Creek) and a Northern California Central Valley (NCCV) population (upper Sacramento River basin). We manipulated growth through feeding experiments conducted from May to the following March using warm (2006 cohort) and cool (2007 cohort) temperature regimes. Survival in seawater challenges just before the time of typical juvenile emigration provided an index of steelhead smolt versus non-smolt life history pathways. Survival varied significantly with fish size (with larger fish being more likely to survive than smaller fish) and by source population (with CCC steelhead being more likely to survive than NCCV steelhead of the same size). The timing of increased food supply (treatment group) did not significantly affect seawater survival rates in either NCCV or CCC steelhead. For both strains, the eventual survivors of seawater challenges (putative smolts) diverged from the eventual mortalities (putative non-smolts) in both size and growth rate by June in both years, suggesting that the initial growth advantages were maintained throughout the experiments. A significant divergence in condition factor between smolts and non-smolts by December matched the expected morphological transition of smolts, which showed faster growth in length than weight compared with non-smolts. The apparent timing of the decision window, several months before the typical period of smolt emigration, matches the patterns observed for other salmonids. In coastal California, this decision must occur

* Corresponding author: michael.beakes@noaa.gov

Received August 13, 2009; accepted April 6, 2010
 Published online Month 00, 2010

Yuba River Fish Passage and Salmon Forum and Englebright Lake Dam Removal Evaluation

Location

Yuba River, CA

Client

Yuba County Water Agency,
National Marine Fisheries Service
Geoff Rabone (YCWA contract)
(530) 741-3000
grabone@ycwa.com
Rick Wantuck (NMFS contract)

Services

- Fish Passage Feasibility Study
- Sediment Removal Feasibility Study
- Identification of Environmental Compliance Requirements
- AACE Cost Estimates

Dates of Service

2011 - 2014



Yuba River Fish Passage and Salmon Forum

MWH was retained initially by NMFS and then by Yuba Water County Agency to perform a **feasibility investigations of alternatives** for anadromous salmon passage past dams and obstructions in the upper Yuba River. The Yuba River Basin supports a number of anadromous fish species including Central Valley spring-run Chinook, California Central Valley steelhead, and the Southern DPS of the North American green sturgeon. The upper Yuba River has been identified in a NMFS Draft Recovery Plan as a prime candidate for reintroduction of spring-run Chinook salmon and **steelhead**. Dams in the upper river include Englebright Dam, New Bullards Bar Dam, and Our House Dam.

Englebright Dam and New Bullards Bar dams are both very tall arch dams, 260-ft and 645-ft tall respectively, that currently present complete barrier to fish movement into the upper watershed. Daguerre Point Dam, in the lower Yuba River, also currently provides a barrier to fish passage into the upper Yuba River below Englebright.



For the initial NMFS study, MWH evaluated upstream and downstream passage **alternatives** included a new trap and haul system over Daguerre Point Dam, a fish ladder over Englebright Dam, and a tramway over Englebright Dam. Downstream passage **alternatives** included a fish screen in the Englebright Dam reservoir, fish screens along the upper tributaries of the Yuba River, and a trap and floating surface collector in the Englebright reservoir. Subsequent to the study for

NMFS, MWH was contracted by Yuba County Water Agency to participate in the Yuba River Salmon Forum (YSF), providing engineering assessment of fish passage facilities and associated appurtenances, costs, permitting issues, and operations. The process included participation in the YSF Technical Working Group (TWG) meetings. Passage concepts developed are intended to support the TWG's examination and deliberation on information and sound science to identify a path to a preferred **alternatives** for reintroduction of anadromous salmonids into the upper Yuba River. MWH's scope for this project included formulating a matrix of potential **alternative** project elements, developing and gathering information on the **alternatives** and appurtenances and refine/revise the matrix, developing screening process/criteria, conducting **alternative** screening, and preparing technical memoranda documenting the results of the study. MWH also signed another contract to be a member of the Technical Advisory Committee for YWCA's development on the North Yuba.

For **History & Data Compliation**, MWH reviewed and prepared a technical memorandum summarizing existing information and **data gaps, including history** of Yuba River fisheries, barriers to passage, and regulatory considerations. MWH performed **civil engineering design and cost estimating** to a AACE Class 5 level for each of the conceptual design **alternatives**. For **Fisheries Biology**, our team reviewed previous studies on Chinook Salmon and Steelhead and surveyed potential available habitat upstream of the passage barriers.

Englebright Lake Dam Removal Evaluation

In an effort to **restore riverine ecosystems and historical fish populations**, such as salmon to the Yuba River, evaluation of the **removal or notching** of the Englebright Lake and Daguerre Point Dams was conducted. MWH was retained to provide a high level engineering assessment of **dam removal** or notching options for the Englebright Dam, including AACE Level 5 cost estimates. The 280 ft (85 m) high variable radius concrete arch dam was constructed in 1941 by the Army Corps of Engineers for the primary purpose of **trapping sediment** derived from anticipated hydraulic mining operations in the Yuba River watershed. Extensive hydraulic and hard rock mining occurred upstream in the Sierra Nevada prior to 1884 and resumed on a limited basis until the 1930s during the great depression under the regulation of the California Debris Commission. Although no hydraulic mining in the upper Yuba River watershed resumed after construction of the Englebright Lake Dam, abandoned mine sites and tailings continue to contribute impacted **sediments** to the upper Yuba River, Englebright Lake, and the reach of Yuba River located between the Englebright Lake and Daguerre Point Dams.

MWH provided advice on regulatory requirements for **dam removal and impacted sediment disposal** or discharge. MWH identified and



defined critical parameters for **dam removal and/or notching options** (e.g., max. fish ladder height, required downstream or upstream mitigations, **sediment placement** sites, etc.). MWH engineers also developed high level breakdown of each **Dam Removal/Notching** option, listing major construction work items, planning and design requirements, and regulatory requirements. **Each item was evaluated** in regard to additional study and overall information gathering that would be required during subsequent development phases of each option.

MWH developed cost estimates for each removal/notching option using AACE cost estimation methodology for a Level V cost estimate.

Shasta Dam Fish Passage Evaluation

Location

Shasta Lake, CA

Client

U.S. Bureau of Reclamation

Services

Feasibility Study
 Predesign Drawings

Completion Date

2014

Contact

John Hannon, USBR
 (916) 414-2413
 jhannon@usbr.gov

Project Features Similar to the Los Padres RFP

Fish Passage Feasibility at high head dams



The Shasta Dam Fish Passage Evaluation is an effort by the U.S. Bureau of Reclamation to evaluate the feasibility of reintroducing Sacramento River winter-run Chinook salmon to tributaries above Shasta Lake. At the inception of this work MWH participated in a **multi agency** working group to brainstorm and review upstream and downstream concepts for fish passage.

The Fish Passage Pilot Implementation Plan was developed for a Pilot Program collaboratively with representatives from Federal and State agencies. The Pilot Program is an adaptive management approach identifying **biological, management, and engineering evaluations** designed to determine the feasibility of a long-term reintroduction. Successful delivery of these documents was supported by development of a Stakeholder and Public Outreach Plan that was informed by a results of a situation assessment of the stakeholder community.

This outreach plan was used to guide the conduct of public meetings and landowner meetings throughout the period of performance. Additional technical actions include captive broodstock juveniles and eggs, and natural adult transport, and release and evaluation of **life-stage** specific survival rates.

Key challenges facing the implementation of the Pilot Program include: (1) landowner acceptance and cooperation; (2) Endangered Species Act compliance, permits and rules to authorize pilot-level and long-term reintroductions; (3) design of collection facilities to provide for juvenile passage; and (5) public concerns about the interaction between reintroduced Chinook salmon and the world-class wild trout fishery. The Pilot Plan provides an assessment strategy and protocols for investigation of critical biological performance criteria and fish passage engineering options to evaluate the potential for success of re-establishing a viable population of Sacramento River winter-run Chinook salmon upstream from Shasta Dam.



For **history & data compilation**, MWH developed environmental sections of the EIS summarizing field investigations, habitat surveys, permitting challenges, and project impacts. MWH performed **civil engineering design** for the proposed pilot program and conceptual adult upstream and downstream passage facilities. For **Fisheries Biology**, MWH performed a habitat assessment upstream of Shasta Dam to support reintroduction of a reasonable number of Chinook Salmon and biological feasibility of conceptual passage options. Subsequent to the plan developments MWH assisted the TWG with the review and concept selection for interim passage options that could be implemented as part of the pilot program.

Vern Freeman Dam Fish Passage

Location

Ventura County, CA

Client

United Water Conservation District

Services

Expert Review
 Alternatives Assessment
 Feasibility Analysis
 Predesign Drawings
 Cost Estimating

Completion Date

2011

Contact

Michael Solomon
 (805)525-4431

Project Features Similar to the Los Padres RFP

Fish Passage Feasibility at high head dams
 High Sediment Transport



United Water Conservation District (UWCD) operates Vern Freeman Diversion Dam (VFDD) on the Santa Clara River, Ventura County, California. In October 2008, the National Marine Fisheries Service and the United Water

Conservation District approved the appointment of six engineers and biologists to an independent panel that would evaluate the upstream passage of steelhead rainbow trout at the dam. Adequate fish passage past the dam is important for recovery of **steelhead** in the upper reaches of the river. The mission of the fish panel was to **review existing information**, evaluate performance of the existing fish ladder, identify improvements to the existing fish passage facilities, and to perform predesign drawings and prepare cost estimates for proposed fish passage improvements .

The Panel began by **collecting and evaluating available information** for the project. This primarily included reviewing existing fish passage facilities, current diversion operations, hydrology and hydraulic information. This review helped Panel members to understand the current fish passage performance of the facility, as a basis to develop ideas to improve fish passage. The Panel brainstormed potential fish passage solutions, narrowing the list to five **alternative** solutions: a vertical slot fishway, a nature-like fishway, a rock ramp, a hardened ramp, and **dam removal**.

Dennis Dorratcague from MWH participated in the expert review panel. MWH staff led the development of several alternative concepts for a vertical-slot fishway to provide volitional passage along the left abutment of the dam. The fishways consisted of an entrance structure, fish ladder, exit structure, and auxiliary water provided through two intake screens and a buried pipeline. Variations in the fishway design involved the design capacity of the flow through the fish ladder. A concepts for a nature-like fishway along the left abutment was also prepared. Conceptual-level opinions of probable construction costs were prepared for all alternatives.

For **history & data compilation**, MWH reviewed historical hydrology studies, ladder operations, **sediment papers, and flow data**. We provided **civil engineering design and cost estimating** for the fish ladder and nature-like fishway alternatives. Throughout the study, the Panel used typical fish passage

Sleepy Hollow Steelhead Rearing Facility Intake

Location

California

Client

Monterey Peninsula Water Management District

Services

Assessment of infrastructure
Design of screen/intake system,

Completion Date

March 2015 – November 2016

Contact

Larry Hampson, MPWMD
831-658-5620
larry@mpwmd.dis.ca.us

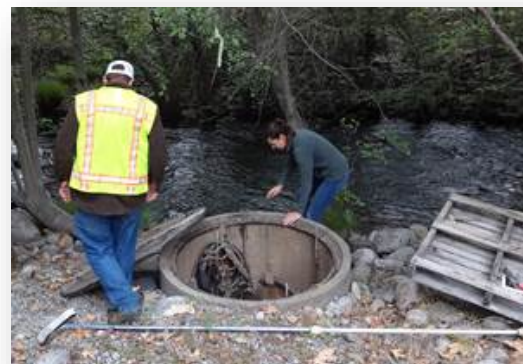
Proposed and Actual Engineering Costs:

\$401,000 / \$152,000 (to date)



The Sleepy Hollow **Steelhead** Rearing Facility relies on a water supply from the **Carmel River** that is subject to frequent **sediment loading issues**. Tetra Tech worked with the Freshwater Institute to evaluate options for recirculating tank systems that would allow the facility to reduce reliance on the surface water source and susceptibility to surface water quality issues. Tetra Tech performed an **assessment** of the aging infrastructure at the facility and designed a new river screen/intake system, new wet well and pump system, water reuse system, water treatment system and operation and maintenance improvements. The new pump system integrates with existing pipes, cold well, quarantine tanks, cooling tower, rearing channel and outlet. Tetra Tech proposed disease control dosing for recirculation, and integrated the recirculation system with existing drain systems for the rearing channel and quarantine tanks and with office facilities using non-potable water. Existing water quality controls were integrated with the recirculation system and new water quality controls systems. New facilities also were integrated with the existing electrical system, with backup systems, alarms and a protocol for alerts.

As part of this project, Tetra Tech performed hydraulic and **sediment-transport modeling** to inform the design. A **hydraulic model** of the project reach of the Carmel River that was previously developed by Tetra Tech was updated with **new survey data that was collected** for this study, and used to assess water-surface elevations and hydraulic conditions at the proposed intake structure. An existing 1-dimensional (1-D) **sediment-transport model of the Carmel River**, also developed by Tetra Tech, was also updated to reflect the new survey



data and revised to include a range of anticipated **sediment loadings** associated with the recently constructed Carmel River Reroute and **Dam Removal** (CRRDR) Project. Results from this model were used to assess **sediment loading** to the structure, and in particular suspended sediments that could affect the performance of the intake. Results from the modeling were also used to **design sediment-control features** and scour countermeasures for the intake structure.

Lagunitas Creek Lifecycle Monitoring

Location

Lagunitas Creek, California

Client Reference

Greg Andrew
Marin Municipal Water District
415-945-1191

Scope of Services

- Design of a statistically rigorous sampling design.
- Sampling juvenile coho salmon populations with electrofishing and snorkeling according to established protocols.
- Estimation of juvenile abundance and population spatial structure.
- Estimation of juvenile coho over-winter survival using PIT tags and mark recapture models.

Date of Services

2012 – Ongoing

Total Fees

\$160,000



Cramer Fish Sciences (CFS) was contracted by the Marin Municipal Water District to implement the Coastal Monitoring Plan (CMP); a comprehensive sampling program created by state and federal resource agencies to monitor coastal populations of coho and steelhead in California. Lagunitas Creek is considered a stronghold of coho salmon and as such has been designated a **life cycle** monitoring station where all

freshwater salmonid **life stages** are monitored. The sampling program is designed to monitor trends in abundance and habitat occupancy while maximizing the spatial extent of fish sampling.

Cramer staff used a generalized random tessellation (GRTS) to create a rotating panel of sample sites in the watershed and coordinated with the National Park Service to provide them with sample sites from the selection procedure. Snorkel surveys and electrofishing were performed by CFS staff at the selected sites each year to collect fishes and relevant habitat data. During these surveys, both half and full-duplex PIT tags were surgically implanted into coho salmon of appropriate size for detection during the spring outmigration.

Each year, data collected by CFS was integrated with the data collected by the Park Service to provide MMWD with estimates of coho and steelhead population sizes in the watershed. Additionally, habitat occupancy rates for each species were estimated for three major tributaries. Following the spring out migration period, tag detections were combined in a mark-recapture model to estimate overwinter survival of coho. Models were constructed to test different hypotheses of overwinter survival including: 1) survival is a function of the tributary where the fish was tagged, and 2) survival is a function of fish size at tagging.

Each season, CFS staff collaborated with the MMWD to construct a joint report on the CMP monitoring and other monitoring performed in the watershed. Additionally, CFS constructed and maintained a relational database containing all the CMP data and provided it to the MMWD.



Battle Creek Passage and Steelhead Life Cycle Modeling

Location

Red Bluff, California

Client Reference

Mary Marshall
U.S. Bureau of Reclamation, Mid-Pacific Region
916-978-5248

Scope of Services

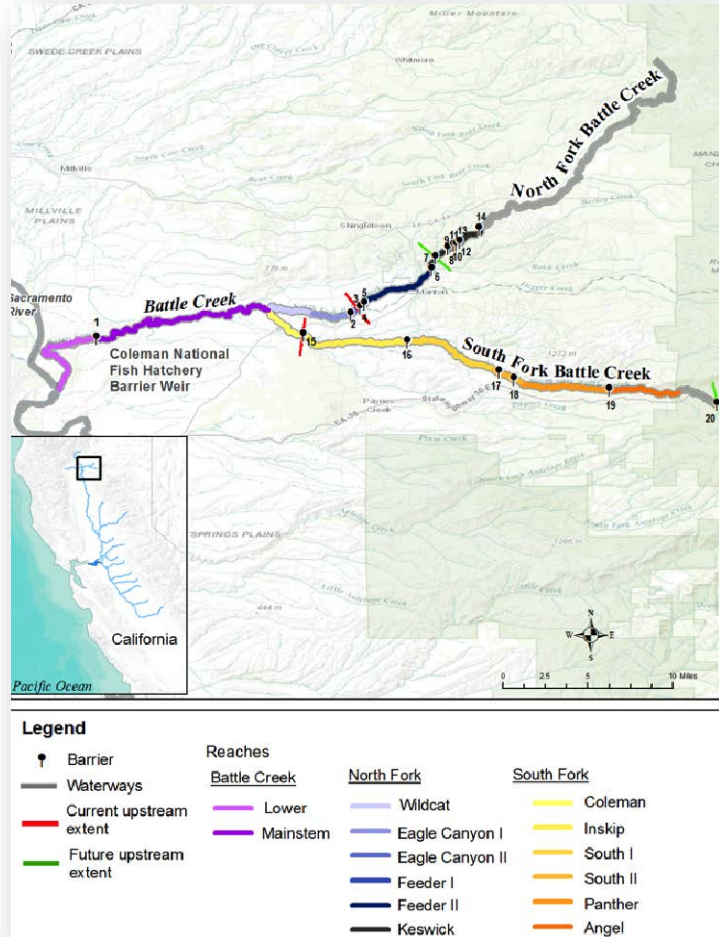
- Developing a **steelhead** life cycle model to represent consequences of fish passage, hatchery introgression, and habitat productivity
- Experience modeling complex steelhead life histories and passage issues
- Expert knowledge of fish habitat and passage behavior

Date of Services

2016

Total Fees

\$350,000



The Battle Creek watershed, like many in the west, is a complex environment, providing important opportunities for both the natural and man-made environments. Agency and stakeholder representatives with interests in the Battle Creek watershed have worked over the last two decades to reconcile the conflicts between ecological functions and human services. These efforts have mainly focused on conserving and restoring aquatic habitats for native salmonid reproduction and growth, while preserving the use of water resources for hydropower production and water diversions. Mandated fish hatchery operations at the Coleman National Fish Hatchery (CNFH) is another longstanding use that increases the complexity of these reconciliation efforts.

Restoration of the upper Battle Creek watershed, motivated through FERC relicensing of PG&E hydropower facilities, focuses on providing fish access to historical habitat for the re-establishment of naturally occurring salmonid populations. The Battle Creek watershed is considered a highly important watershed that historically supported large numbers and a broad diversity of anadromous salmonids. Infrastructure modifications associated with the Battle Creek Salmon and Steelhead Restoration Project (BCRP) began in early 2010. The goal of the BCRP is to provide high quality habitat and improve fish passage throughout 48 miles of stream habitat. Once completed, the BCRP will be adaptively managed as described in a project-specific adaptive management plan (BCRP-AMP).

Cramer Fish Sciences was contracted to develop **steelhead** and Chinook salmon **life cycle** models for the Battle Creek watershed in order to assess effectiveness of restoration efforts and passage enhancements. Cramer Fish Sciences led technical discussions, conducted analyses, completed population models and drafted an Adaptive Management Plan to guide further investigations, particularly as related to potential conflicts between operation of Coleman National Fish Hatchery and the Battle Creek Restoration Program.

Battle Creek includes numerous man-made and natural passage barriers. A central component of our quantitative modeling effort was to represent how each of the barriers could influence the success of **steelhead** and Chinook salmon recovery. Expected improvements in barrier passage were assessed in this project to guide future enhancement activities.

SECTION 4 – FIRM AND KEY PERSONNEL

This proposal and qualifications package to provide engineering services for the Los Padres Dam and Reservoir Alternatives and Sediment Management Study is being submitted by MWH, now a part of Stantec in association with our subconsultant firms. This team was formed to provide the Monterey Peninsula Water Management District (MPWMD) with a highly experienced team with relevant project experience and local expertise to accomplish the objectives of the Study.

The MWH team offers the following advantages to MPWMD for this project:

Team Experience. MWH is offering a team of experienced engineers and professionals, well versed in all aspects required for the development of alternatives, engineering, geomorphology, fisheries biology and construction planning, cost estimating, and environmental assessment for this project. We are assigning some of our most experienced engineering staff who are familiar and worked on the 2013 MWH Los Padres Dam Sediment Removal Study and the 2007 MWH EIR/EIS alternatives development and Basis of Design for the San Clemente Dam Removal Project, so that their knowledge, including knowing “what works & what doesn’t”, will be directly applied to the Los Padres Dam study. In addition, we have partnered with an industry-leading geomorphologist, Bob Mussetter, from Tetra Tech, as well as key steelhead experts from Cramer Fish Sciences to complement our in-house MWH staff. We have brought together this team in order to leverage the full complement of recent and direct local expertise for this project.

Our project team has local area knowledge and project history working on the Carmel River and with MPWMD. Our project team has experience working with the critical issues, policies, and procedures associated with projects located along the Carmel River and in Monterey County. They are well known and respected by DSOD, NMFS and California Fish & Wildlife. Our key leads have been active with the San Clemente Dam and Los Padres Dam dating back to the early 2000s; their experience is summarized below:

- Our Project Manager, Vik Iso-Ahola, was the Project Manager for the prior LPD and SCD sediment and dam removal studies for MWH, and has extensive experience with the DSOD on these projects as well as numerous other dam modification projects throughout the State.
- Bob Mussetter, our team’s lead geomorphologist, is responsible for development of the most extensive sediment transport models on the Carmel River known to date as part of his work on SCD under MWH.
- Dr. Beakes, our lead fisheries biologist, is an expert on the central California coast steelhead, performing extensive research and published papers on steelhead life history.
- Eric Clyde, our reservoir operations and mapping specialist, has an over 40-year background in hydrology, hydraulic modeling, mapping, and reservoir operations planning primarily in California.

MWH OVERVIEW

MWH, now a part of Stantec, specializes in water and natural resources. MWH employees use innovative ideas and technology to help solve complex infrastructure and environmental challenges. This work is built on a nearly 200-year history during which MWH has delivered services from initial planning and design through construction, start-up and operations.

Since its founding, MWH has specialized in major water resource projects that have included the planning, design, and construction management of dams both in the United States and around the world. MWH has experience in all types of dam design and construction techniques and has built a reputation for innovation and quality engineering. MWH has the in-house expertise and experience necessary to handle all aspects of project development including the capability of assessing and addressing any potential environmental impacts associated with these developments. MWH can draw on the skills and experience of a staff of engineers and scientists many of whom have 20 or more years of continuous service with the firm in the planning and implementation of dam and water resource projects.

MWH's fisheries capabilities are centered in the San Francisco Bay area and the Pacific Northwest; however, we have completed fish engineering projects throughout the country and around the world. Our engineers and fisheries scientists collaborate using their knowledge of fish behavior, regulations and engineering criteria related to fish facilities design. MWH's fisheries experts are familiar with the biological requirements and engineering criteria for recirculating aquaculture systems, fish screening, passage, holding, and capture for both juvenile and adult fish. MWH staff engineers work daily with biologists and fishery agency engineers in developing innovative, efficient and reliable designs that are proven through years of successful operation that match the Owners expectations.

SUBCONSULTANT TEAM MEMBERS

Although MWH routinely provides the majority of the technical skills necessary to complete our projects, we frequently retain the services of "Best-in-Class" specialty subcontractors to provide local expertise in specific areas. It has been our experience that utilizing the services of locally based subcontractors is beneficial to the project through the unique expertise that they bring to the project and the socio-economic benefits that they provide to the greater community. For this project we wanted to supplement MWH's expertise in the Carmel Valley with two firms that bring specific Carmel River knowledge and expertise in steelhead biology that has been requested for the Study.



**CRAMER
FISH SCIENCES®**

CRAMER FISH SCIENCES (CFS) is a team of experts at assessing the productivity and limiting factors of fish populations and their habitats. Cramer has a staff of more than 40 fisheries biologists, ecologists, and geneticists at six locations throughout the West Coast. For more than 27 years, their focus has been to empower natural resource managers and stakeholders with cutting-edge science and practical solutions to environmental issues. CFS has a history of achieving firsts in introducing new field study methods, synthesizing fisheries information across regions and agencies, developing new analytical methods that encompass the full life-cycle of fish, and creating ESA Recovery Plans. CFS is well-known for their expertise in the planning and implementation of research studies and for our advanced quantitative methods. CFS staff has expertise in a wide range of methodologies and tools for investigating fish population dynamics, fish habitat and restoration and fish movement and behavior. CFS staff includes biologists and technicians with expertise in a wide breadth of methodologies and equipped with boats, fish sampling gear, and habitat survey instruments. Their scientific credibility across a wide spectrum of natural resource regulators, developers, and conservationists, combined with their advanced capabilities for research and quantitative analysis, have enabled Cramer Fish Sciences to move clients past imposing hurdles with environmental issues.



TETRA TECH is a full service company and has been involved since 2001 and played a key role in evaluating sediment transport, river hydraulics and hydrology, and fish passage alternatives design and construction in the Carmel River. Their project focus has been on the San Clemente Dam and studies have extended upstream to include the Los Padres Dam vicinity and surrounding watershed. Tetra Tech performed the initial sediment-transport studies for the California Department of Water Resources (CDWR) DSOD. Follow on work was performed for California American Water Company (CalAm) and the California Coastal Conservancy to evaluate potential flood hazards and sediment loading in the river downstream from San Clemente Dam associated with fish passage and dam removal alternatives. Tetra Tech also performed analyses that included collection of detailed topographic, bathymetric, and sediment data and development of a sediment-transport model of the reservoir that could be used to directly evaluate the existing trap efficiency and rate of erosion for dam removal. Tetra Tech served as the lead stream design engineer on the CRRDR Project, which included reconstruction of a 4,300-foot-long natural channel to provide fish passage and instream and riparian habitat in the affected reaches. Tetra Tech is currently working with MPWMD to support the design and construction of the Sleepy Hollow Steelhead Rearing Facility Intake.

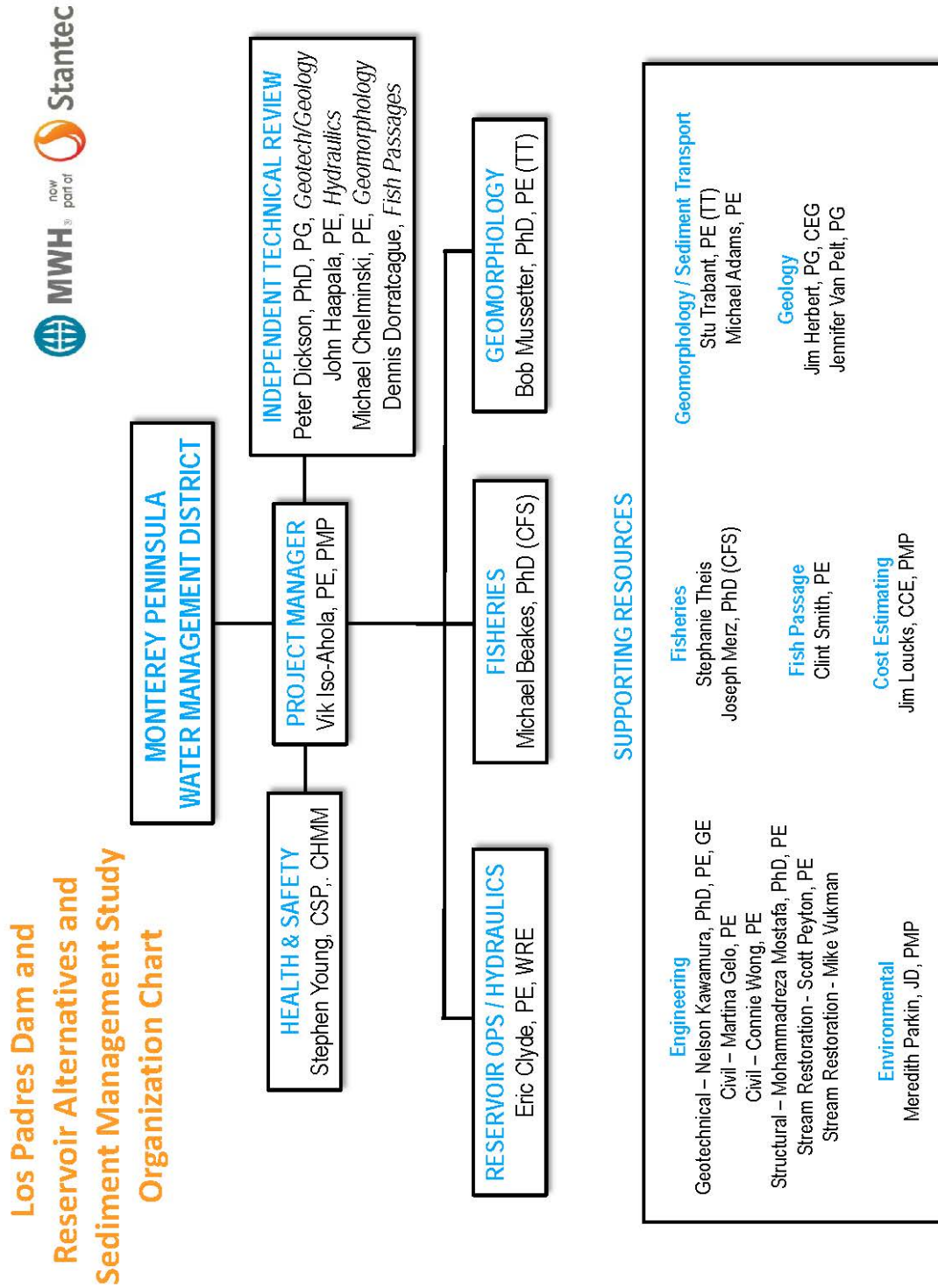
PROJECT TEAM ORGANIZATION

One of the keys to project success is bringing the right people to the project and assigning them to the right roles. We have brought some of our best talent to this project, and have structured our team to align reporting and delivery responsibilities with the overall project objectives. Our team is results-oriented. They can envision a successful project end point, then drive the work products to get there and arrive on time and on budget.

The strength of our team begins with our selection of a project manager. Our team will be led by Vik Iso-Ahola, who as our Project Manager, brings 19 years of experience working with water-resources related projects involving civil, geotechnical, structural, and construction engineering, cost estimating, and planning. Vik Iso-Ahola not only has worked extensively in the Carmel River watershed, but also is an experienced civil engineer and certified project management professional whose breadth of knowledge and experience with dams and dam removal, DSOD, and other regulators will allow him to effectively manage the diversity of work tasks to be completed by the project team. He has facilitated risk evaluation workshops for a number of PG&E dams as a FERC Part 12 Independent Consultant, soliciting input from Owner and Regulatory personnel that resulted in concise and coherent updates to the dam probable failure modes analysis documents. Mr. Iso-Ahola's project experience has provided him with a regular and ongoing working relationship with Federal Energy Regulatory Commission and the California DSOD, providing him a depth of experience and excellent reputation in addressing stakeholder requirements and understanding of regulatory compliance issues. In addition, he has published papers on spillway modification, dam removal issues, concrete thermal analysis, liquefaction evaluation, dam rehabilitation, and structural design optimization for dam raising and dam retrofit using FEM analysis.

Vik will oversee the technical team and provide local insight based on his previous work on similar projects throughout the western US. The organization chart of the team supporting Mr. Iso-Ahola presented below, followed by summaries of key staff who provide the expertise in sediment transport, flood risk evaluation, water supply, steelhead biology and lifecycle dynamics, and cost estimating.

Project Team Organization Chart



KEY STAFF AND ROLES

Short biographies for our key Team members are included in the following pages along with descriptions of their specific role or expertise. In addition to our senior resources, we have included core mid-level engineers with highly relevant experience that will allow us to perform the work in a cost-effective and efficient manner. Full resumes are presented in Section 9 – Appendix.

RESERVOIR OPERATIONS / MAPPING / HYDROLOGY

Eric Clyde, PE, WRE, Reservoir Operations/Hydraulics

Mr. Clyde is a Principal Engineer with over **39 years of experience in water resources engineering, storm drainage and flood control, reservoir operations modeling, computer modeling of hydrology, storm drainage, reservoir operations, and open channel hydraulics**. He has supervised and participated in hydrologic and water resources projects throughout the United States. His computer modeling experience includes HEC-HMS, HEC-RAS, RESSIM, DSS, SWMM, InfoWorks, UNET, HEC-FDA, and many other hydraulic, and hydrologic programs. Mr. Clyde served on the Board of Directors of the Floodplain Management Association for 14 years, including 2 years as Chair, and is currently serving as Chair of the Professional Development Committee and as Senior Advisor to the Board.

FISHERIES

Michael Beakes, PhD - Cramer Fish Sciences

Dr. Beakes brings over 13 years of research experience and a strong combination of field-based and quantitative research experience to the team. By coupling field data with quantitative modelling techniques Michael enhances the team's ability to advance fisheries science by improving understanding of how stream and river ecosystems function and providing insight into how best to manage them. Michael's primary role at Cramer Fish Sciences as a senior biologist is to develop, coordinate, and implement a broad range of habitat restoration projects and monitoring throughout California. Michael received a BSc in Biology with an emphasis in Fish and Wildlife Management from Northern Arizona University in 2002, and received his Ph.D. in Biology from Simon Fraser University in Vancouver, British Columbia, Canada in 2014. While at SFU Michael's research was focused on examining the dynamics of large-scale natural and anthropogenic disturbance in stream and river ecosystems across large spatiotemporal scales. His research experience includes studies on the effects of wildfire on stream temperatures and food webs in a small California coastal watershed, flow regulation on California Central Valley rivers, salmon life-cycle models and habitat capacity in California and Washington State, and climate change on the Fraser River in British Columbia, Canada.

GEOMORPHOLOGY

Bob Mussetter, PhD, PE – TetraTech

Dr. Mussetter has over 35 years of experience in analysis and design for a broad range of water-resource and civil engineering projects, including numerous hydraulic and **sediment transport** projects on the Carmel River over the past approximately 15 years. His primary area of expertise involves integration of hydrology, hydraulic engineering, and river mechanics with **fluvial geomorphology** to solve river stability, flooding, and environmental problems. Dr. Mussetter is nationally recognized as an expert in hydraulic and **sediment-transport** analysis. His experience includes projects throughout the United States and internationally involving a broad range of stream types and physical environments, varying in scope from collection and analysis of field data through development and application of mathematical models to evaluate sediment transport in both sand- and gravel-bed systems. He has extensive experience with the full suite of hydrologic, hydraulic and **sediment-transport** models, including HEC-HMS, HEC-RAS, HEC-6

and HEC-6T, RMA-2V, FLO-2D, and SRH-2D, and many other similar models.

Dr. Mussetter has particular experience in analyzing and predicting **sediment transport and fluvial processes** in natural streams, including the effects of human-induced and natural disturbances such as reservoirs, diversions, landslides and rare floods on channel stability and instream aquatic habitat. He also has considerable experience in developing measures to mitigate the potential adverse impacts of these disturbances, including channel stabilization measures using natural materials, **sediment flushing flows, and sediment augmentation**. His experience includes collection and analysis of substrate data, analysis of aerial photographs, flood inundation studies, and preparation of **sediment budgets**. Dr. Mussetter has authored or co-authored several manuals and design guides relating to river stability, erosion control and surface erosion. In addition, he has been an instructor for the National Highway Institute-sponsored "Stream Stability and Scour at Highway Bridges" training course and was involved in preparation of the Federal Highway Administration documents HEC-18, "Evaluating Scour at Bridges" and HEC-20, "Stream Stability at Highway Structures." This training course and the related documents describe the current standard of engineering practice for evaluating stream stability and scour in the riverine environment.

TECHNICAL REVIEWERS

Our team's independent technical reviewers will be utilized to provide insight and review of our deliverables prior to delivery to the District and TRC. Also, as necessary and as requested, these independent experts may be called upon to supplement our core team presented above to provide input into TRC reviews and discussions.

Peter Dickson, PhD, PG, Geotechnical/Geology

Dr. Dickson has **40-years of broad experience on a large variety of water resource projects** in many parts of the world including **dams for water supply** and hydroelectric projects, power plants, penstocks, tunnels, caverns, pumping stations, and **flood control structures**. His experience includes project screening and ranking; design and supervision of **geological, geotechnical, and hydrogeologic** investigations; siting of project features and developing layouts and arrangements; dam type selection (fill dams, CFRD, RCC, gravity, arch dams), slope stability evaluations and slope design; landslide studies; technical training and technology transfer; determining criteria for planning, design and construction of tunnels, caverns, and dams; detailed design and contract document preparation. His work includes assessment of risk, identification and evaluation of mitigation options and alternative project arrangements, development of project cost parameters, independent technical review, and constructability review.

John Haapala, PE, Hydraulics

Mr. Haapala has **42 years of specialized experience in hydrology, hydraulics, flood studies, dam-break inundation studies, reservoir operation** and power studies, engineering economics, and fisheries issues with an emphasis on computer applications. He is adept at the usage and adaptation of many existing standard **hydrologic and hydraulic** computer programs, and has developed a number of new application programs. He has been the hydrology lead on numerous hydrology and hydraulics studies for hydroelectric power developments worldwide. Throughout his career, he has performed Probable Maximum Flood studies and other floods studies in diverse locations including Alaska, Florida, California, Washington, and Indiana. He has performed **power and operation studies of more than 100 reservoirs** and power plants including complex multi-reservoir, multi-use systems. The studies were performed to determine firm water supply yield, hydroelectric generation, benefits of component sizing and the effects of alternative instream flow requirements. A normal part of the **reservoir operation studies** has been to determine the hydraulic losses in the penstock and tunnel conduit system. His hydrologic and hydraulic

analysis experience also includes reservoir and channel flood routing, spillway sizing, gated spillway flood operations, freeboard analysis and riprap sizing for shore protection. Hydraulics experience includes the design of hydraulic structures such as spillways, energy dissipaters, developing spillway rating curves, and the static and hydraulic transient analysis of pipelines and tunnels. He has performed dam-break studies to develop inundation maps and inflow design floods for several projects including using HEC-RAS as the dam-break model with multiple downstream dams from the failed dam.

Michael Chelminski, PE, Restoration and Dam Removal

Mr. Chelminski is responsible for technical aspects of ecological evaluation, mitigation, and restoration analyses and designs. His work includes the development of hydrologic and hydraulic studies for integration with Stantec's skills in the ecological and biological sciences. A licensed engineer, his project experience includes ecological restoration design and monitoring, **fish passage assessments, effluent mixing analyses, and dam safety evaluations**, and is the **engineer-of-record for more than a dozen completed small dam removal projects**. He has worked on watersheds including the Allegheny, Connecticut, Deerfield, Delaware, Housatonic, Hudson, Ohio, Potomac, and Penobscot Rivers in the United States; and projects in Alberta, British Columbia, New Brunswick, Newfoundland and Labrador, and Saskatchewan, Canada.

Dennis Dorratcague, Fisheries

Mr. Dorratcague has **over 40 years of specialized experience in fish passage projects** on the west coast for irrigation, power, and municipal projects. Mr. Dorratcague was the key developer of the Vee-type fish screen for screening large canal diversions. Working with Milo Bell in the mid-1980's, he developed the concept and led the design of the first two Vee-shaped structures that were constructed in the early 1990's. He is past president of the Bioengineering Section of the American Fisheries Society. Mr. Dorratcague has been working in the field of hydrology and hydraulics since 1972. His main areas of concentration have been hydraulic structures, fisheries engineering, computer modeling of hydrology and hydrodynamics.

SUPPORTING RESOURCES

Our team's supporting staff have been selected for their skills and abilities in the varied knowledge areas required to develop the Study alternatives and gather additional data. We have included a range of experience and skill on the team to allow for economical yet effective execution of the proposed tasks.

Engineering

Nelson Kawamura, PhD, PE, GE, Geotechnical Engineering

Dr. Kawamura has **38 years of experience** as a geotechnical engineer in civil, mining and geo-environmental engineering projects in the U.S. and abroad, including 30 years of experience in **dams** and appurtenant structures, hydropower facilities and tunnels; possesses experience in subsurface investigations, analysis and design, and construction QA/QC; worked on all design phases of dam, spillway, powerhouse and tunnel rehabilitation projects; is experienced in dynamic analysis of tunnels and dams. Has expertise in dam safety engineering in conformance with FERC and **DSOD** requirements.

Martina Gelo, PE, Civil Engineering

Martina Gelo is civil/structural engineer with **15 years of experience** in structural design and analysis for **water resources**, mining, and natural gas engineering projects. She is proficient in civil/structural analysis, calculations, design; drafting, material take offs and cost estimating. Her experience includes design and analysis of variety concrete foundations (equipment foundations, building foundations, pipe support foundations), concrete retaining walls, culverts, bridges, concrete boxes, pump intake structures,

structural steel platforms and support structures. Martina also has experience with open channel and pipe hydraulics, hydrology analysis, grading design, and piping design.

Connie Wong, PE, Civil Engineering

Ms. Wong is a civil engineer with over five years of project experience. She assists in the civil design of wet infrastructure projects involving dams, powerhouses, and canals. Ms. Wong also has a focus in geotechnical engineering and assists in the geotechnical and slope stability analyses of projects involving landslide mitigation, water treatment pond design, reservoir evaluation, and **sediment storage facilities**.

Mohammadreza Mostafa, PhD, PE, Structural Design

Dr. Mostafa has more than 15 years of consulting experience in seismic analysis and design of various steel, concrete, and masonry structures. He has experience managing a design team working on appurtenant structures to dams, such as underground and surface hydropower plants, dry and pressurized tunnels and shafts, intake, outlet structures and residential and industrial buildings. He is experienced in seismic evaluation of existing structures, as well as in structural design of Water/Wastewater facilities. He has extensive knowledge of current design codes: CBC, IBC, ACI 318, ASCE 7, ACI 350, AISC 360, AISC 341, AISC 358, API, USACE, AWWA D10 and PTI.

He is skilled in dynamic analysis (response spectrum and nonlinear time history) of building and hydraulic structures using relevant commercial software and design codes (US Army Corps of Engineers' engineering manuals and FERC publications). He has also experience on seismic analysis and design of different concrete and steel bridges based on AASHTO LRFD design code.

Scott D. Peyton, PE, Stream Restoration

Mr. Peyton is an engineer with experience in a variety of water resource and design projects. He has direct project experience with ecosystem and stream restoration and enhancement projects including conceptual level planning, preliminary and final design, permitting, assistance during construction, and post construction monitoring. Mr. Peyton also has experience in **hydrologic and hydraulic modeling**, performing floodplain analysis and delineation, water quality studies, and a variety of storm water and water resources projects including watershed management and planning. He is a proficient user of many hydrologic, hydraulic, and GIS applications, including RIVERMorph, HEC-HMS, HEC-RAS, ArcView, and ArcInfo. In addition, he has experience in water resources planning projects including EPA NPDES Phase II programs and permit applications, hazard mitigation planning, and watershed planning and improvement projects.

Mike Vukman, Stream Restoration – Stantec

Over his career, Mr. Vukman has been able to compile a diverse set of skills as a project manager, including skills obtained while facilitating large stakeholder groups in an effort to restore greenways along riparian corridors. Experienced in stream restoration, Natural Channel Design, **fluvial geomorphology**, biotechnical streambank erosion control methods, and trail alignment, design, construction, and maintenance, Mr. Vukman's involvement within these projects has included management of subcontractors, budget tracking, grant writing, facilitation of community meetings, preparation of required permits, data gathering and processing, construction, post-project maintenance and monitoring, and final report writing. His interpersonal skills have allowed him to successfully manage several diverse stakeholder groups whose goals were based on prevention of private property loss through the design and implementation of comprehensive stream restoration projects. Furthermore, Mr. Vukman is trained as a **fluvial geomorphologist**, having completed Levels I-IV of Dr. David Rosgen's Wildland Hydrology short

courses. With approximately 17 years of experience designing and implementing numerous biotechnical streambank erosion control projects, he is an expert practitioner of soil bioengineering and other biotechnical erosion control methods and is often called upon by local agencies for advice and guidance. His expertise also includes long-term maintenance and monitoring of riparian restoration and trail construction projects. Additionally, he draws on leadership skills honed by years of experience managing conservation corps crews and serving as a Sergeant in the US Army.

Environmental

Meredith Parkin, JD, PMP, Environmental

Ms. Parkin has over **21 years of experience** in policy, regulatory and environmental compliance, permitting, planning, and land use for various **dam and reservoir, water-related**, and infrastructure projects, including previous studies for Los Padres Dam and San Clemente Dam Removal. She has assisted both public agencies and private interests in addressing regulatory challenges, with a focus on identifying challenges early through the integration of policy and compliance during all phases of project development, from planning through construction. Her experience includes environmental compliance and permitting for multi-purpose local, State and Federal projects and programs. Ms. Parkin is currently managing the CEQA and/or NEPA compliance on a variety of dam and reservoir and water-related and infrastructure projects and has managed the permitting effort for 160 infrastructure facilities in 60 different jurisdictions in CA and NV. She is also managing the acquisition of environmental permits from regulatory agencies such as the NMFS, USACE, USFWS, Regional Water Quality Control Boards, and the California Department of Fish and Wildlife.

Fisheries

Stephanie Theis, Fisheries Biologist

Ms. Theis is a lead **fisheries biologist** with over 25 years of professional experience, in both freshwater and estuarine environments, emphasizing fish ecology, Endangered Species Act (ESA) compliance, fisheries monitoring, fish passage, habitat restoration design and monitoring, and environmental impact assessment. Her experience includes a comprehensive knowledge of **life history** and habitat needs of anadromous and resident fishes. Ms. Theis is an expert in adaptive management as well as ESA and EFH compliance procedures and has successfully conducted numerous Section 7 consultations with NMFS and USFWS. She has led plans for fish passage in multiple watersheds and monitoring programs for habitat restoration programs.

Joseph Merz, Ph.D. – Fish Biologist – Cramer Fish Sciences

Over the past 23 years, Dr. Joseph Merz has worked as a **fisheries ecologist**, performing studies and monitoring of fish populations, on coastal and Central Valley **steelhead** and Chinook salmon populations. Joe teaches professional courses in salmonid ecology, habitat assessment, and fish passage. Dr. Merz has coauthored a variety of peer-reviewed publications, focusing on river rehabilitation, fish movement and reproductive success, invasive species, woody debris/redd associations, and evaluation of salmonid spawning and rearing habitat enhancement. Personally, he has been honored with multiple awards and scholarships for his performance, and has initiated numerous interagency and multidisciplinary grants totaling over US \$15 million for California salmonid restoration, **life cycle modeling** and habitat assessment projects. Joe has performed numerous assessments of habitat manipulation on aquatic resources including habitat enhancement, flow manipulation, invasive species, and regulation implementation, including Chinook salmon and **steelhead** spawning. One of Joe's unique strengths is his public outreach skills and ability to collaborate with a variety of constituents. He has taught at university and

public education levels, worked with federal and state representatives, and partnered with local entities (i.e., outreach groups, planners, volunteer organizations, etc.). Recently, Dr. Merz has been part of a multiagency technical teams developing strategies for Chinook Salmon re-introduction on the Upper Columbia River watershed and providing guidance for resource management on the Lower American River during the most recent drought. He is a member of American Fisheries Society and the Southwestern Association of Naturalists, and the Ecological Society of America.

Fish Passage

Clint Smith, PE, *Fish Passage*

Mr. Smith has **31-years-of-experience** in civil, environmental and water resource engineering. His background includes the planning, analysis and design of **water intake facilities; fish transport, passage and screening facilities; municipal water**, wastewater and storm drainage conveyance and treatment systems; hydrologic and meteorological instrumentation **data collection** systems.

Cost Estimating

James Loucks, CCP, PMP, *Cost Estimating*

Mr. Loucks has over 30 years of constructability, cost estimating/project management experience in civil works and process infrastructure of water treatment plants, water conveyance pipelines, **water storage facilities** and industrial process plants. During his career, Mr. Loucks has gained experience in multiple project delivery methods including design-build, engineer-procure-construct (EPC) and traditional design-bid-build (DBB) or hard dollar contracting. He has been associated with some of the most respected self-performing contractors in the country as well as leading international consulting engineering firms. Mr. Loucks has gained significant domestic and international experience with specific international exposure in Asia, Latin America and the United Kingdom. As Cost Management Practice Leader for MWH Americas, Mr. Loucks leads a group dedicated to total cost management which is a systematic approach to managing cost and constructability throughout a project's lifecycle. His tasks include systems integration, staff recruiting, workload resourcing, detailed and conceptual estimating, third party estimate reviews, client presentations, and quality control. Prior to joining MWH, Mr. Loucks held key estimating, project management and project engineering positions for Arizona and California based general engineering contractors.

Geomorphology/Sediment Transport

Stuart C. Trabant, PE, *Sediment-Transport - TetraTech*

Mr. Trabant has over 20 years of experience in hydrologic, hydraulic, water-resources and civil engineering. He has completed projects throughout the United States and internationally involving a broad range of stream types and physical environments, and varying in scope from collection and analysis of field data through development and application of mathematical models to evaluate **hydrologic, hydraulic and sediment-transport conditions** for both sand-bed and gravel-bed systems. His primary areas of expertise are in hydraulics, hydrology, **fluvial geomorphology**, and erosion and **sedimentation**. **Mr. Trabant has significant experience in performing analyses to support the planning and design phases of water-resources and sediment management projects**, as well as preparation of design plans and specifications. He also has extensive field experience in topographic and bathymetric (GPS and total station) surveying, **sediment sampling, stream gaging and geomorphic mapping and interpretation**.

Mr. Trabant has served as the lead design engineer or project manager for numerous stream and river restoration design projects that have focused on habitat improvement, municipal development, flood conveyance, irrigation and agriculture, recreation, flood damage recovery, and water quality, among other

things. He was the primary **sediment-transport modeler** for a number of studies that were carried out to assess **alternatives** for **removal of San Clemente Dam** on Carmel River. Mr. Trabant was also the project manager and design engineer for a stream restoration design of an approximately 1-mile long reach of North Fork Clear Creek, near Blackhawk, CO that was undertaken to accommodate highway widening, improve the mining affected water quality, and restore salmonid habitat. He recently instructed a course on engineering geomorphology that was conducted for the Northeast Ohio Regional Sewerage District that was conducted as part of the Districts Master Planning Standards Development Program. He has extensive experience with the full suite of industry-standard hydrologic models, 1-D and 2-D hydraulic models and **sediment transport models**, (HEC-RAS, HEC-6, HEC-6T, SAM, HEC2-SR, SED2D and CH3D-SED), as well as GIS (ArcGIS), AutoCAD and MicroStation.

Michael F. Adams, Jr. PE, Geomorphology/Sediment Transport

Michael is a Civil Engineer experienced in stream restoration, natural channel design, **water resources**, **fluvial geomorphology**, and underwater inspection. Michael's responsibilities include project management, technical review, design, project scoping, **geomorphic assessments**, stream and watershed studies, development of restoration **alternatives**, and natural channel design. He has been involved in all phases of a stream restoration design project including developing project goals and objectives, scoping, field data collection, design calculations, development of plans and specifications, permitting, construction oversight and monitoring. Michael is a registered Professional Engineer and has attended all four levels of stream restoration courses taught by Dave Rosgen and he currently assists with the Level 3 courses as an instructor. He is especially familiar with **sediment transport** and early in his career worked on Stantec's dive crew inspecting **scour problems** at bridge sites. Michael is also well versed at writing and public speaking, and won the 2001 Daniel Terrell Award for outstanding paper presented by the District 9 Council of ASCE. He also helps teach stream restoration related short courses across the country and frequently presents at stream restoration conferences.

Geology

Jim Herbert, PG, CEG, Geologist

Mr. Herbert has 34 years of extensive and varied experience in the engineering geology, geotechnical assessments, and associated construction fields. He has spent considerable time effectively managing quality control programs for significant earthwork construction, structural distress, rock excavation, groundwater assessment, dam instrumentation, and rock/soil slope stability assessments and stabilizations. Mr. Herbert is adept at evaluating existing site conditions with respect to design plans/construction specifications, distress indicators, geotechnical documentation, geological maps and literature, and aerial imagery to develop comprehensive models of subsurface conditions in support of site development, rehabilitation and forensic investigations. Given his wide-ranging experience, Mr. Herbert is capable of working easily with the project managers, design and construction professionals, environmental consultants, and local/state/federal regulators to develop implementable geotechnical, geologic, and **hydrogeologic** investigations within the confines of budget and schedule. During the course of his career, he has provided detailed plans for investigations into deep foundations, landslides and soil creep, rock slope stability, channel erosion, embankment and structural settlements, bridge and dam foundations, and aggregate resources.

Jennifer Van Pelt, PG, Field Investigation

Ms. Van Pelt has worked on a wide variety of projects, developing a range of capabilities involving geological and geotechnical skills. She has participated in project teams in several phases including proposal writing, field investigation, data analysis, and reporting. Ms. Van Pelt's project experience includes

field mapping (traditional and rope access techniques), geotechnical drill core logging and sampling, soils logging and sampling, photogrammetric evaluation, slope stability analyses and evaluation, fracture and kinematic analysis, foundation preparation inspection, consolidation grouting implementation and inspection, groundwater and surface water sampling, report preparation, and laboratory experience.

SECTION 5 – LITIGATION HISTORY

MWH AMERICAS, INC.

The Office of Corporate Counsel of MWH Americas, Inc. (MWH) treats information concerning pending litigation and claims as proprietary and confidential. Despite the scope and volume of MWH's business as well as the increased litigious environment, the company is involved in relatively few legal proceedings. Some proceedings may be confidential or involve the privacy rights of individuals; however, MWH currently has no significant pending litigation which would adversely impact MWH's financial stability or capability to provide quality services. If Monterey Peninsula Water Management District would like to receive more specific information about MWH's claims or litigation history, MWH's Associate General Counsel, John D. Wood, would be available at (303) 410 – 4147 to respond to any further inquiries.

This information is not to be used for any other purpose without the written permission of the General Counsel of MWH Americas, Inc.

CRAMER FISH SCIENCES

No history of litigation in the past 5 years.

TETRA TECH

No history of litigation in the past 5 years.

SECTION 6 – TECHNICAL ASPECTS

As outlined in the RFP, this section summarizes MWH's technical project approach to the work, divided into the following areas:

- Project Understanding and Approach – A high level description of MWH's understanding and general approach to successfully completing this project.
- Scope of Work – A description of the detailed scope of work, supplementing and expanding upon the scope breakdown and outline provided in the RFP.
- Optional Tasks – Additional services to be added to the project at a later time at MPWMD's discretion.
- Confirmation Statement

MWH APPROACH TO DELIVER THIS PROJECT

MWH will undertake this project with a team of professionals with extensive qualifications and experience in dams and relevant reservoir sediment removal, construction, estimating, and permitting expertise. In addition to the Los Padres Dam (LPD) sediment removal study in 2013 for CAW, MWH performed a similar sediment removal study and prepared EIR/EIS documents for CAW's San Clemente Dam (SCD) Removal Project from 2005 to 2008. Several of the MWH designated team members were part of both the LPD and SCD project team and will provide valuable insights and transfer of knowledge on related tasks from these projects. MWH will incorporate information, research, database, and experience from the extensive study efforts at both projects to the next phase of evaluation for LPD. The appropriate level of effort and resources will be committed to complete the project efficiently.

The focus of this study will be to identify and evaluate no action, dam and sediment removal alternatives, reservoir capacity increase, and sediment management alternatives for the Los Padres Dam (LPD) reservoir. Each alternative will be analyzed with respect to anticipated environmental impacts, permitting, constructability, cost and schedule impacts associated with removing the dam and restoring the river, or increasing reservoir storage by removing sediments or raising the dam, or combinations thereof. We are excited and well qualified to highlight and recommend potential solutions to this fish habitat, regional water supply, and environmental issue. Information and results from the feasibility study will facilitate MPWMD and CAW's planning and future actions for the Los Padres Dam reservoir. MWH will work closely with MPWMD, CAW, and the TRC to gain a clear understanding of CAW's needs and expectations for this analysis.

SCOPE OF WORK

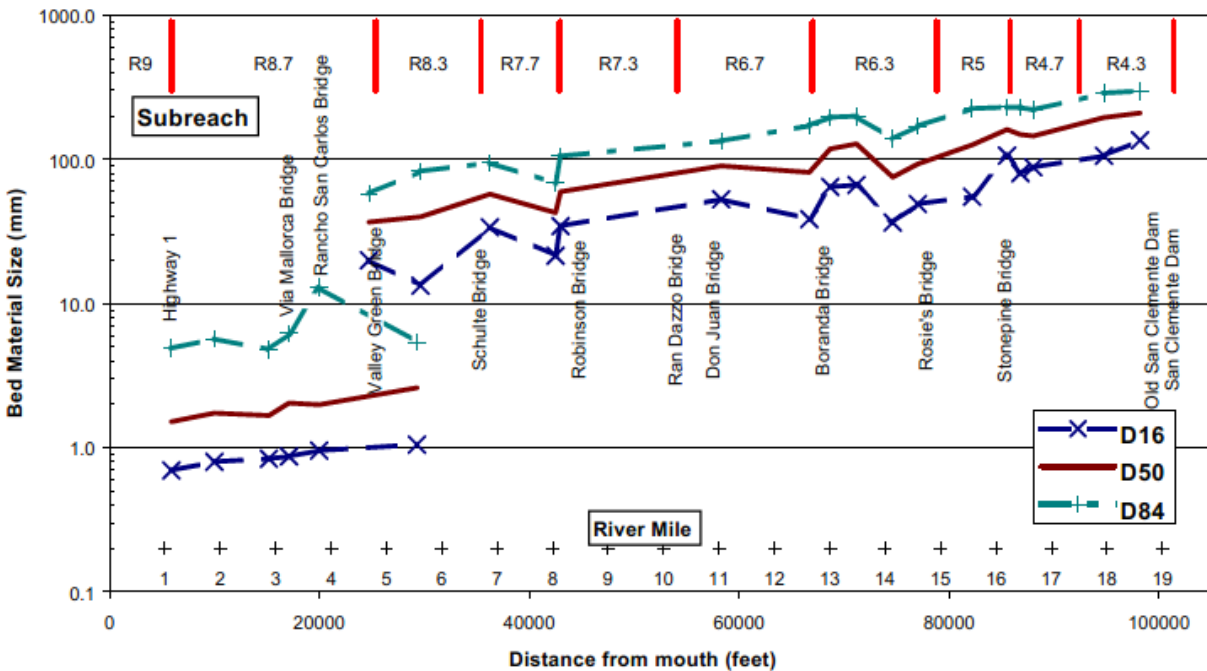
Task 1 Feasibility Study Preparation

Task 1-1 Compile Background Information

As part of this task, the MWH team will compile and summarize relevant data and findings from reservoir operations, biological design criteria, and previous geomorphic analyses at Los Padres Dam and the Carmel River. In addition, cost data will be gathered from other similar projects for use in comparison and baseline against alternatives developed for LPD. Given our team's history and intimate knowledge of Los Padres Dam and the Carmel River watershed, our data gathering efforts will be executed efficiently, yet with diligence to provide a thorough reference data set.

In addition to the information we gathered during our prior evaluation of the Los Padres Dam sediment removal alternatives study, key members of MWH's project team were responsible for the geomorphic analysis and a wide range of modeling to assess key elements and the potential downstream effects of various alternatives during the planning phases of the San Clemente Dam Seismic Retrofit and Carmel River Reroute and Dam Removal (CRRDR) projects. In performing this work, we obtained, reviewed and used the bulk of the relevant information from studies that had been completed by others at that time (i.e., prior to about 2008), and we also participated in collection of a significant amount of additional geomorphic data on the river.

Since completion of those studies, members of our team have continued to obtain, review and use new data being collected by the MPWMD, U.S. Geological Survey (USGS) and the California State University Monterey Bay (CSUMB), among others, to support work on the CRRDR Design-Build and Sleepy Hollow Raw Water Intake and Supply System Upgrade projects. Through the cumulative experience from the above work, conducted more or less continuously over the past approximately 15 years, the project team has obtained, synthesized and directly used most, if not all, of the relevant geomorphic data for the Carmel River, providing us with unparalleled understanding of the conditions in the river, the available data with which to quantitatively evaluate those conditions, and the factors that drive the behavior of the river. In completing this task, we will revisit the reports and data to review that all relevant information has been considered and will provide a concise summary of the information that can be used to meet the objectives of this study.



Carmel River bed material gradations downstream from San Clemente Dam (as of April 2001).



Bridge pier at Rancho Canada Golf Course Cart Path (~RM 2.7) showing scour and typical gravel bed material (photo by R. Mussetter, November 7, 2007). Contrast with sand/fine gravel gradation from 2001 samples in Figure 1.

Deliverables: Summary Memorandum of Data Compilation, including electronic submittal of compiled data files

Task 1-2 Evaluation Criteria

The MWH project team will develop appropriate technical evaluation criteria to be used to assess impacts of the sediment management alternatives to water quality, geomorphology, and water rights, as well as economic feasibility criteria that define acceptable cost-benefit ratios. If available, the impacts of climate change effects on long-term water availability will be included as a criterion. The criteria will include identification of “fatal flaws” that would eliminate alternatives from consideration. In addition to the criteria provided in Appendix A-2 of the RFP (e.g., effects of alternative on fish passage, potential for monitoring, adaptability of alternatives, etc.), below are some initial thoughts on each general criterion category and potential “fatal flaws”:

- **Water quality** – Utilizing the available water quality data for LPD and downstream as baseline, quantitative criteria will be established as a measure to compare relative (i.e., qualitative, or high level quantitative estimates) impacts of each alternative to water quality. While utilizing a clear quantitative “bright line” criterion may not be practical during the initial alternatives evaluation phases, the baseline data can be used as reference points for evaluation of relative impacts of alternatives. As alternatives are refined, the baseline water quality data can be used as a reference that cannot be exceeded by a given factor. For example, an alternative must not significantly increase turbidity from the baseline average, where if it is estimated that turbidity will increase by a factor of X, the alternative will be eliminated (i.e., not to exceed values and durations for each water quality measurement will be defined as fatal flaws that eliminate alternatives).
- **Geomorphology** – The data gathering phase will establish the current “as-built” snapshot of the Carmel River downstream of LPD, as well as upstream conditions, where it is expected that the sediment sampling and field reconnaissance in the reservoir will provide ample baseline data. This compiled snapshot will establish the baseline criterion to compare alternatives against with qualitative expert evaluation of impacts to the river geomorphology. It is expected that future alternative evaluation phases will require computer modeling of candidate alternatives which will be compared against the established baseline. Fatal flaws may include excessive increase in

downstream flooding, significant increase in suspended sediments, notable or costly increases required of structural or stream features downstream, etc.

- Water Rights – The current water rights in Los Padres Reservoir (2,179 AF) will be used as the baseline against which alternatives are compared, where it is expected that each alternative will have an impact on this right, which will be rated against the relative impact (loss) imposed by other alternatives. Fatal flaw criteria would likely include the complete loss of water right with no, or costly mitigation.
- Economic Feasibility – MWH's prior sediment removal study at LPD identified technically feasible scenarios for managing sediments; however, these were estimated at high economic as well as potentially unacceptable environmental cost. This stage of the project's feasibility evaluation will further refine the prior, as well as new, alternatives to provide a clearer picture on economic feasibility of each. The economic feasibility evaluation will be balanced with the gained benefits; therefore this criterion may be defined in terms of a cost-benefit ratio, or qualitative cost-benefit measure that is influenced by the other criteria such as water rights, water quality, etc. It's envisioned that an economic fatal flaw will be defined by an upper limit cost that makes implementation of an alternative untenable.

Deliverables: Draft Evaluation Criteria Memorandum (Final to be incorporated into Task 1-4 deliverables)

Task 1-3 Critical Data Gaps

Upon completion of Task 1-1, critical data gaps will be identified and presented to the TRC for review. Also, depending on the results of the evaluation criteria definition in Task 1-2, additional data needs may be identified to help provide baseline information for defining evaluation criteria (e.g., if certain water quality is found to be scarce, additional data gathering may be recommended to establish baseline evaluation criteria). Further, the gaps identified will be considered and incorporated where applicable into the investigation plan in Task 2-1, which should be completed prior to TRC Meeting #1 (Task 1-4).

We note that there are a significant amount of data and information available for the reach of the Carmel River downstream from the head of the former San Clemente Reservoir, but a paucity of data for the reach between Los Padres Dam (LPD) and San Clemente Reservoir. Based on our current understanding of the available data, critical data gaps for the geomorphic analysis likely include representative river cross sections and bed material sediment data in the Los Padres to San Clemente Reservoir reach that can be used to quantify sediment transport rates and related river responses. The bed material sampling can be performed during a field reconnaissance by the project team that is proposed as part of the basic scope of work. This reconnaissance will be key to understanding the current status of the reach, and in addition to the sampling, will provide site-specific observations that will be invaluable in evaluating the alternatives.

While detailed hydraulic and sediment transport modeling is not envisioned for this alternatives evaluation, sufficient cross sections that are representative of key portions of the reach will be necessary to facilitate quantification of hydraulic, bed mobilization and sediment transport under existing and alternative conditions at a level of detail sufficient to understand likely effects and relative merits of the alternatives. The cross section surveys are proposed as an additional task in the optional tasks section below.

Deliverables: Memorandum identifying data gaps and proposal for additional data acquisition needs and activities

Task 1-4 TRC Meeting #1

Subsequent to completion of the tasks above, a technical memorandum summarizing the tasks will be developed and submitted six weeks prior to the TRC meeting to be held at a MPWMD office (or other location). The objective of the meeting will be to present the background and setting of the project, which will lead into a discussion and establishment of the evaluation criteria for the alternatives. The meeting protocols and preparation requirements defined in the RFP will be followed. Given that it is expected that the workshop will require approximately ½ day or more to review the baseline information, discuss and agree upon criteria, the MWH key leads (PM and DSOD engineer, Reservoir Operations expert, Fisheries Biologist, and Geomorphologist) are proposed to attend in person. In addition, a staff level professional will be in attendance to take notes and support the team.

Deliverables: Technical Memorandum summarizing Tasks 1-1 to 1-3, Draft and Final Meeting Minutes, Final Evaluation Criteria (revision to Draft Evaluation Criteria from Task 1-2)

Task 2 Sediment Management Options

Task 2-1 Obtain and Analyze Reservoir Sediment Samples

The primary goal of this task will be to characterize the depth, type, and size of material deposited in the reservoir starting at the dam and to the tail of the reservoir. The proposed program is designed to gather sufficient information to develop a stratigraphic map of the deposits within the reservoir that can be used as a credible basis for developing and comparing sediment management alternatives. Our most experienced Engineering Geologist, Jim Herbert, will lead the effort along with support from our field geologist, Jennifer Van Pelt, both of whom have experience with prior investigations along the Carmel River for the CRRDR Basis of Design geotechnical investigation as well as Jim's field reconnaissance and aggregate resource investigation conducted as part of the preliminary design of New Los Padres Dam in the late 1990s.

Development of the sediment investigation will include:

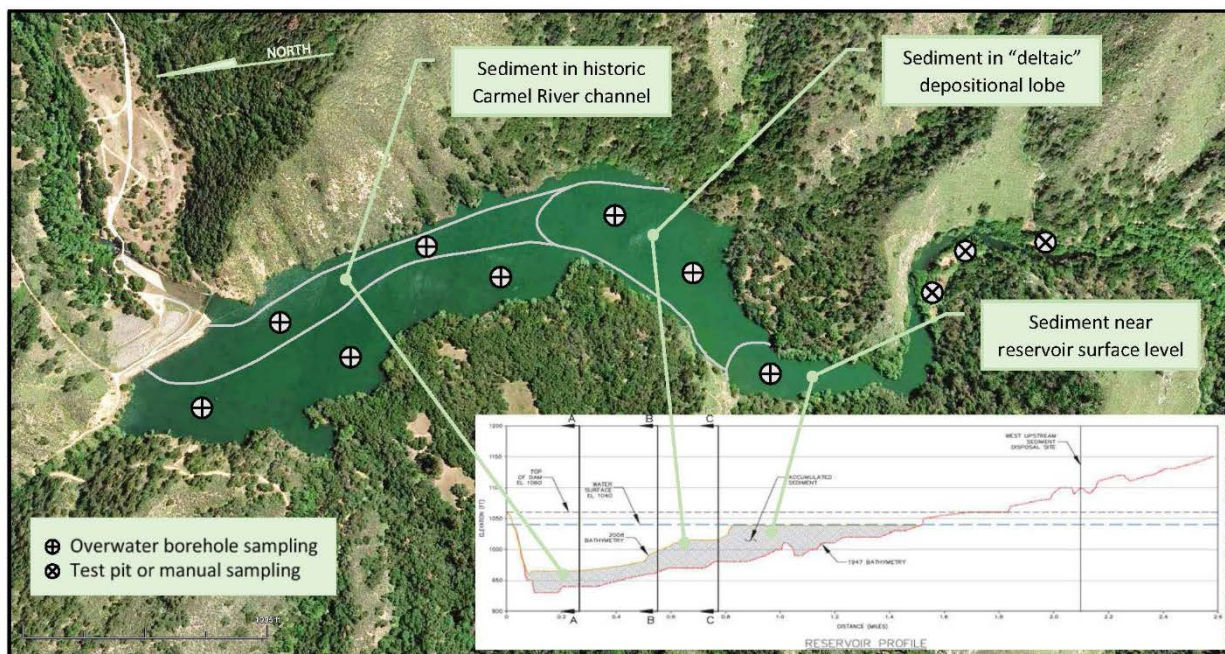
- Review of available background information, focusing on sediment types and deposition patterns.
- Evaluation of 2008 and 2016 bathymetric data and (if needed) development of a bathymetric elevation contour map to identify reservoir sediment depositional patterns.
- Development of an isopach (i.e., equal thickness) map comparing the 2008 bathymetric data to the pre-reservoir (1948) topography, illustrating the pattern of sediment deposition and sediment volumes.
- Geomorphic interpretation of bathymetric contour map and isopach map to identify areas of similar sediment deposition. This interpretation will identify the fewest number of sampling points needed to characterize the sediment types and volumes.
- Information reviewed and synthesized above will be used as input into a carefully targeted sediment sampling program.

The preliminary plan, which will be further detailed in a Work Plan developed for MPWMD and other regulatory approvals, proposes to sample sediments along the main stem channel down to the pre-1948 topography at an approximate spacing of 400 to 750 feet from the dam through the reservoir to its tail,

resulting in approximately 8 borings with samples collected with California Modified sample barrel, Pitcher barrel or Shelby tube depending upon the granularity of the materials encountered. Samples will be taken approximately every five feet from barge-mounted borehole set ups. In addition, given that the sediments at the tail of the reservoir are largely exposed in dry point bars and are expected to be primarily coarse grained, we propose to collect samples from three (3) test pits or manually-excavated pits. However, if determined necessary and sufficient budget is available, a limited access drill rig may be mobilized from the barge at the tail of the reservoir and used for additional borings to confirm soil types near the base of the deposits.

Upon completion of the sampling phase, select samples from each boring will be sent to the laboratory for characterization, including particle size distribution with hydrometer (ASTM D422), Atterberg limits (ASTM D4318) and visual classification (ASTM D2487). Results of the sampling (boring logs) and sample testing will be used to develop a stratigraphic profile of the sediments in the reservoir, as well as provide a basis to estimate the volume and distribution of organics, fines, sands, gravel, and cobble. This information along with a summary of the investigation will be provided in a draft sediment investigation report submitted within two weeks of completion of the laboratory testing.

If additional characterization of the sediments within the reservoir is desired, Cone Penetration Test (CPT) soundings may be used as an inexpensive method to split between borings along portions of the reservoir where it is expected that sediments and stratigraphy will be of similar composition. While CPTs do not typically extract samples for use in characterization, they provide quick, yet fairly accurate representations of soils/sediments along a soil column when calibrated with adjacent borings and samples. This method is not included in our investigation estimate, but can be discussed with MPWMD if there is a desire to accumulate additional data for the overall study.



Illustrated are proposed overwater and on-land sediment sampling locations based our understanding of reservoir sedimentation through comparison of the original reservoir pool topography and the findings of a 2008 bathymetric study (Watershed Institute).

Our sediment sampling plan and budget is based on the assumptions stated herein. However, the proposed investigation is subject to discussion with MPWMD and CalAm and may be modified depending on budgetary limitations and permitting requirements/difficulty, as well as MPWMD's objectives for the investigation.

Deliverables: Draft and Final Work Plan, Draft and Final Sediment Investigation Report

Task 2-2 Describe Alternatives

This task will describe each alternative provided in the RFP, including details of potential effects to the river and within the watershed, conceptual layouts that provide a visual and physical depiction, and discussion of longevity and benefits of each. High level order of magnitude estimated costs will be provided for comparison purposes relative to other alternatives (e.g., cost classified as "high" above \$50M, "extremely high" above \$100M, etc.), but will not be detailed in a formal cost estimate (to be provided later in Task 5). The considerations for each alternative described in the RFP will be included as a minimum, but additional ideas, impacts, variations on alternatives, etc. will be discussed. Some additional thoughts for each alternative are provided below:

1. No Action Alternative – Utilizing input from our geomorphologic experts, we will re-visit, summarize, and update as necessary our prior estimates for complete reservoir sedimentation. This revision will drive how long-term impacts of no action will be quantified and estimated, such as the eventual and complete loss of water rights in the reservoir, feasibility of fish passage, etc.
2. Dam Removal – Detailing how a feasible dam removal could be executed will be important to describe, as each sub-alternative (e.g., phased removal, partial removal, complete removal) within this category will have its unique requirements, challenges, and potentially high economic and environmental cost. For example, a phased removal may be favorable for providing a managed release of sediments from the reservoir, but each phase may require notable engineering and construction to allow the lowered dam at each phase to safely pass the maximum flood, which may be costly. On the contrary, a single, complete dam and sediment removal may provide less risk from a dam overtopping perspective, but would require substantial construction activity in one or two seasons that could have significant short term environmental impacts in the river as well as to local communities.
3. a. & b. Dredge and Place Sediment Downstream, on or off Cal-Am Property – Our 2013 report will be revisited and additional disposal sites investigated, where consideration could be given to the bypassed reservoir at the former San Clemente Dam site downstream. Also, expanding the sediment placement sites along the river immediately downstream of the previously proposed sites as well as conveyance to a previously unidentified property could be considered. Given the expanded footprint for these alternatives, the team will have to consider the additional and wider impacts to the riparian and overall watershed habitat. Also, the long-term sustainability of this option(s) will be described and provided as an evaluation criterion.
4. Reservoir Storage Expansion – Similar to the detailing required for the dam removal alternative, each reservoir expansion sub-alternative will be developed and described in sufficient detail to characterize their relative costs, impacts, and long-term viability. Each alternative will have unique challenges for implementation, especially the dam replacement alternative, which would require creative ideas and planning to obtain and bring construction materials onsite while minimizing impacts to the environment and local communities.

5. Sediment Management Program – Given that it is expected that sedimentation in LPD reservoir will continue, a sediment management program could be implemented as a stand-alone alternative that utilizes dredging or other removal method to maintain the current reservoir capacity. Or, as indicated in the RFP, sediment management will be described as part of the other alternatives that maintain LPD in place. While it is expected that dredging or mechanical excavation are the likely feasible alternatives for managing sediments, our 2013 evaluation of feasible sediment management techniques will be re-visited, considered, and adapted for each alternative that may have unique requirements and challenges for sediment management. For example, a dam raise or replacement could inundate areas that were previously considered feasible for sediment disposal, which would require identification of new sediment disposal areas that may impact the overall feasibility of a dam raise alternative.

Further, as part of the evaluation and description for all alternatives, we will prepare initial, qualitative descriptions of the range of potential effects of each alternative on the geomorphic behavior of the downstream channel. Specific issues that will be addressed include:

1. Anticipated short- and long-term changes in the overall sediment balance in both the canyon-bound, upper reach of the Carmel River downstream from LPD and the alluvial, lower reach,
2. Anticipated changes in the riparian vegetation, if any, associated with the various water management alternatives,
3. Potential effects of the above changes on vertical and lateral stability of the river channel,
4. Potential effects of the above changes on the flood carrying capacity of the lower river, particularly in the alluvial, lower reach where flood capacity is already limited, and
5. Likely changes in the bed material gradations, particularly as they could impact instream habitat and fish passage.

Deliverables: Alternatives Description Technical Memorandum, includes conceptual drawings and figures (approx. 2-3 figures per alternative)

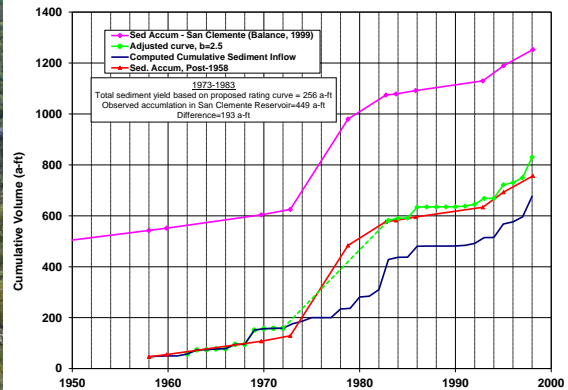
Task 2-3 Evaluate Geomorphic Effects of Changes in Sediment Load

Following development of the qualitative descriptions of potential effects from Task 2-2, we will quantify the effects at a sufficient level of detail to facilitate comparison of the alternatives. The analyses will include at least the following:

1. Development of a bed material (i.e., sand and coarser) sediment supply rating curve for the inflows to LPD. This curve will be developed based on the historic sediment storage in the reservoir and the bulk gradation of the reservoir deposits that will be determined from the sampling program to be completed under Task 2-1. The trap efficiency of Los Padres Reservoir will be considered in the analysis; however, it is believed that the vast majority of the sand and coarser load that has been delivered from the upstream watershed since closure of the dam is currently stored in the reservoir. A similar approach was used to develop the inflowing sediment load rating curve for San Clemente Reservoir for the dam removal planning studies [Mussetter Engineering, Inc. (MEI), 2003]. MWH (2013) estimated that the rate of sediment deposition in Los Padres Reservoir over the 69-year period between closure of LPD in 1949 and the 2008 bathymetric surveys was about 21 ac-ft/yr, including episodic events such as the intense period of rainfall after the 1977 Marble Cone Fire. For comparison, MEI (2005) estimated that the sediment supply to San Clemente

Reservoir between the late-1940s and early-2000s was about 17.5 ac-ft/yr including episodic input such as the Marble Cone fire and the Dormody landslide, and about 16.5 ac-ft/yr in the absence of those inputs. Accordingly, sensitivity evaluation of the deposition rate will be incorporated into bed material supply analyses.

Data from the reservoir sediment characterization that was conducted for MEI (2003) indicated that about 65 percent of the material deposited in the Carmel Branch of San Clemente Reservoir was sand, about 22 percent was gravel and cobbles and 13 percent was silt and clay. The gradation of the material in Los Padres Reservoir is likely similar (but will be verified through the Task 2-1 sediment characterization study); thus, the bulk of the supply is in the sand and finer size-ranges, release of which is not necessarily favorable for instream fisheries habitat. The results of this task will represent the natural (i.e., unimpaired) sediment supply to the reach downstream from LPD.



Reservoir deposits at head of San Clemente Reservoir (April 9, 2001) and sediment accumulation in San Clemente Reservoir (1950-1999) used as part of basis for sediment supply rating curve.

- Estimates of the portion of the natural sediment supply that will pass into the downstream reach, including both the volume and gradation, for each of the alternatives. Under the No Action alternative, the sediment supply to the downstream reach will be similar to the historic supply, at least under near-term conditions. If no action is taken to remove sediment from the reservoir, the trap efficiency will eventually decrease, with an increasing quantity of primarily sand and finer material passing through the reservoir. Delivery of significant quantities of gravel- and cobble-sized material through the reservoir is unlikely without direct mechanical intervention, even under the extreme condition in which the reservoir is essentially full of sediment. Under the Dam Removal alternative(s), the near-term sediment supply to the downstream river will likely be elevated above the natural supply due to erosion of the residual reservoir deposits. The magnitude of this supply will, of course, depend on the extent to which the existing deposits are removed and/or stabilized in conjunction with removing the dam. Over the long-term, the downstream supply should approach natural conditions. The effects of the Dredging, Reservoir Expansion, and Sediment Management alternatives on the near- and long-term sediment supply to the downstream reach will range from essentially no change from existing conditions to effects similar to the Dam Removal alternative, depending on how each alternative is implemented, including changes to the storage capacity of the reservoir and the disposition of sediment removed from the reservoir. Quantification of the volume, timing and gradation of the altered sediment

supply will be critical to evaluating the relative effects of these alternatives on downstream channel behavior, including both aggradation/degradation response and instream habitat.

3. Incipient motion calculations to quantify the range of discharges over which the existing bed material in key portions of the Los Padres to San Clemente Reservoir reach is being mobilized. Knowledge of the frequency and duration of bed mobilizing flows is key to understanding both channel stability and instream habitat dynamics.
4. Transport capacity calculations for the reach between Los Padres Reservoir and the head of the former San Clemente Reservoir using appropriate relationships for the existing, coarse-grained material (most likely either Parker, 1990 or Wilcock-Crowe, 2003 for the bed load, coupled with the Einstein procedure for quantifying suspended bed material load). These calculations will provide a basis for determining the likely bed response (both aggradation/degradation and changes in bed material characteristics) for those alternatives that would significantly alter the downstream sediment supply. Given the coarse-grained nature of the bed material, this portion of the river is probably strongly supply-limited in at least the sand and finer size-ranges; thus, the transport capacity relationships will provide estimates of the potential amount that could be moved by the river assuming an unlimited supply, and this is likely an order of magnitude or more higher than the actual supply, even if the dam were to be removed. The extent to which individual subreaches of the LPD to San Clemente Reservoir reach is supply-limited or hydraulically-controlled with respect to spawning-sized gravel is a function of the local hydraulic conditions and bed material gradations. Similar relationships are available, or can be developed from the available information, for the portion of the reach downstream from the head of the former San Clemente Reservoir.
5. Continuity and bed material evolution analysis on a subreach-basis [minimum of four subreaches: LPD to head of former San Clemente Reservoir, San Clemente Reservoir to Camp Stephani, Camp Stephani to the Narrows (RM 9.8), and the Narrows to the coast]. This analysis will consist of a comparison of the upstream supply for each alternative with the transport capacity within each subreach to assess how the overall sediment balance would change. Because of the supply-limited nature of most of the reach, it is not anticipated that changes in the sediment supply will have a significant effect on the overall stability of the channel; however, increases in the both the sand and gravel supply under some alternatives could alter the gradation of the bed material, particularly on gravel bars that are key instream (primarily spawning) habitat. The bed load transport relationships will be used to assess how the bed gradations are likely to change and the potential implication to spawning gravel quality under these conditions. The analytical techniques and results from this task can also be used to inform sediment disposal options for alternatives that involve mechanical removal and downstream placement of sediment to restore the sediment supply in an effort to correct the sediment imbalance and improve instream habitat. The suspended sediment estimates for each alternative can also be used to assess the potential

deleterious effects of increased suspended sediment loads on native fish using criteria specified by the fishery biologists (e.g., Newcombe and Jensen, 1996).

6. Channel geometry and flood elevation analyses to estimate the potential effects of the alternatives on channel capacity and stability. In general, unless an alternative involves release of a large sediment pulse, such as would occur if the dam is removed without moving or stabilizing the stored sediment, downstream impacts to overall channel stability and channel capacity are likely to be relatively subtle. Nonetheless, it will be important to critically evaluate any potential effects to insure that unintended consequences do not occur. The analysis will primarily focus on the portions of the reach where even modest decreases in flood capacity could impact developed properties (i.e., downstream from Camp Stephani). Because detailed modeling is not envisioned for this analysis, locations where channel aggradation could be significant will be identified and the implications of such aggradation qualitatively evaluated based on the likely magnitude of the aggradation on channel capacity.



Incision at in the Upper Carmel Reach of the CRRDR project.

Deliverables: Technical Memorandum summarizing the methods, assumptions and findings from the analysis, and includes appropriate graphics and drawings to illustrate the key features of each of the alternatives that was evaluated.

Task 3 Evaluate Effects on Steelhead

The overall technical team will coordinate closely with our fishery biologists' scope regarding potential effects of the alternatives on fish passage and instream habitat (i.e., spawning gravels and suspended sediment loads), based on results from Task 2. Cramer Fish Sciences (CFS) staff will analyze available information to assess how each alternative is likely to affect S-CCC steelhead and steelhead habitat. An important aspect of the Task 3 analysis will be to provide a quantitative accounting of tradeoffs between alternative in their net benefit to Carmel River S-CCC. For example, dam removal may improve access to upstream habitats, but could degrade the quality of habitats downstream due to sedimentation or warmer water temperatures. CFS work on Task 3 will provide objective, quantitative basis for prioritizing alternatives in terms of net benefits to S-CCC steelhead. This task will include an evaluation of the impact of changes in the water supply and sediment transport associated with alternative water supply options to be provided by MPWMD, including results from the climate change study being performed by the U.S. Geological Survey and Bureau of Reclamation, if available during the time-frame of this study.

Deliverables: Technical Memorandum that summarizes the effects to steelhead of varying water supply and sediment transport.

Task 4 Identify Feasible Alternatives

This task will summarize and expand upon the data gathering, conceptual evaluation, and alternative development efforts completed to this point. The goal during this task will be to work with the TRC to further evaluate and rank alternatives via a series of workshops and a “break-out” in between to consolidate the input received. The MWH team key staff will participate in each meeting and provide input into the alternatives development, as well as provide staff support for meeting records and summarization.

Task 4-1 TRC Meeting #2

Utilizing the evaluation criteria developed during the first TRC meeting, the second meeting will review the draft evaluation matrix of alternatives submitted prior to the workshop, resulting in selection, elimination, and identification of additional analysis or development needs. The agenda outline and protocols defined in the RFP will be followed. Similar to the first workshop, this meeting is expected to be interactive and require at least ½ day for the summarization and discussion efforts.

Deliverables: Draft Evaluation Matrix of Alternatives; Workshop Agenda; and Meeting Report summarizing the selection and elimination of alternatives, conclusions, and additional analysis recommendations, as well as meeting notes

Task 4-2 Alternative Development

Task 4-3 Meeting #3

This third TRC meeting will be a continuation of the discussions held at the prior meeting, where the additional analysis and development of alternatives or criteria will first be presented along with an updated evaluation matrix. The meeting outline and protocols defined in the RFP will be followed. The meeting objective will be to reach consensus on a final list of alternatives.

Deliverables: Draft and Final Meeting Summary with content as defined in the RFP

Task 5 Final Report

This task will summarize the information developed throughout the alternatives evaluation process, develop AACEI level 5 cost estimates for alternatives that have not been eliminated, provides a final evaluation and ranking of alternatives, and presents conclusions and recommendations for further action.

Task 5-1 Prepare Draft and Final Report

It is understood that a draft outline for the final report will be developed for TRC review, where the sample outline in the RFP is provided as a guide to be developed further as information gathered during the evaluation process is incorporated. While it is not anticipated given that TRC meeting #3 will have occurred prior to development of the final report, our team will meet with the TRC or with individual commenters prior to finalization of alternatives and before the Final Report is issued. Budget is reserved for one additional meeting prior to issuance of the Final Report. Overall, the guidance for completion of the Final Report provided in the RFP will be followed.

Deliverables: Draft and Final Report

Task 6 Project Management

As defined in the RFP, this task will consist of the standard project management tasks, including scheduling, budget tracking, invoicing, progress reporting, and general project communications including agency staff. The progress reporting and invoicing effort will follow the requirements in the RFP. This task reserves budget for up to four meetings in-person by the Project Manager and up to two staff: 1) Kickoff meeting; 2) Review of proposed operations in the field; 3) Up to two meetings with regulatory agencies. Additional meetings may be held as requested where budget is available or appropriate budget adjustments or increases provided.

Deliverables: Invoices; progress reports; electronic copies of communications (i.e., email or memoranda) among agencies and consultants (if/where appropriate); meeting minutes.

OPTIONAL TASKS

Task 7 - Field Survey

In order to fill the lack of topographic and cross section data in the reach between Los Padres Dam and the former San Clemente Dam site, we propose that a limited survey to obtain representative cross sections is performed by surveyors. This task will allow for estimation of the geomorphology along this reach during the initial alternatives evaluation, as well as provide credible data for future hydraulic modeling and sediment transport evaluations. We have reserved a budget of \$10,000 for a surveying firm to conduct cross section surveys, which will be refined upon discussion and approval by the District.

Deliverables: Cross section survey data

CONFIRMATION STATEMENT

Our proposal is inclusive of all elements necessary to complete all goals, tasks, and project deliverables within 18 months of the execution of the Agreement, per the Addenda No. 1 to the RFP dated 12/27/16.



Vik Iso-Ahola
Project Manager

SECTION 7 – PRICING AND SCHEDULE

PROJECT BUDGET

MWH proposes to complete the work for the amount shown on the attached table and billing rates to be billed monthly based on progress at hourly rates. Our budget is based on the requirements stated in the RFP and the details and assumptions provided within this proposal. Our budget includes \$165,000 for driller mobilization and sampling, and a total of approximately \$273,000 for the sampling Task 2-1. This effort will be refined with MPWMD as goals for the sampling program is discussed. TRC meetings are assumed to be approximately 1/2 day in duration and include MWH PM and 4 other staff in attendance in person. In general, our stated deliverables and number of meetings provide the basis for our effort, where added revisions or iterations are not budgeted unless specifically indicated for “draft” and “final” submission (i.e., finalization of memoranda after receipt of substantial comments where no “draft” and “final” versions are indicated will incur additional effort that is not budgeted). Understanding that project requirements change, we will remain flexible and regularly discuss our budget with the District, making adjustments as necessary and where possible to meet the project’s goals.

SCHEDULE

Our schedule provided at the end of this section is based on the assumptions herein and the draft schedule proposed in the RFP. Given the duration required to gather and develop the project background information, including the field sampling in the reservoir which is dependent on unknown permitting durations and requirements, we propose to complete the project within 18 months from execution of the agreement. Our schedule in fact shows about a 15 month duration, but this may extend depending on the investigation duration (e.g., permitting issues), TRC requirements for additional study, general scheduling conflicts/issues for meetings, etc. As the project develops, we will remain flexible with our schedule and revise as necessary as information is made available and requirements updated. In order to allow for sufficient time to complete the initial data gathering, criteria development, and field sampling, our first TRC meeting is proposed for early June 2017. Upon completion of the first phase of work and TRC meeting, the remaining schedule and level of effort will be clarified and our schedule updated accordingly. In general, we would expect the last two TRC meetings to occur in the second half of 2017 and the Final Report completed in early 2018.

CONFIRMATION STATEMENT

Our proposal is inclusive of all elements necessary to complete all goals, tasks, and project deliverables within 18 months of the execution of the Agreement, per the Addenda No. 1 to the RFP dated 12/27/16.



Vik Iso-Ahola
Project Manager

2017 HOURLY RATE SCHEDULE

The basis of payment will be the CONSULTANT's rate schedule as set forth below. The rates provided below shall be in effect from January 1, 2017 to December 31, 2017. Rates will be escalated January 1 of each year utilizing CPI or other agreed upon index.

Hourly Personnel Charges

	<u>Hourly Rate</u>
TECHNICAL/ADMINISTRATIVE STAFF	
Junior Technician or Drafter	\$ 111
Technician or Drafter	126
Designer	142
Clerk Typist/Data Processor	95
Project Administrator	101
PROFESSIONAL STAFF (Engineer, Geologist, Scientist, etc.)	
Assistant Professional (Intern)	\$113
Associate Professional	127
Professional	137
Senior Professional I	149
Senior Professional II	170
Supervising Professional I	184
Supervising Professional II	204
Principal Professional I	237
Principal Professional II	268
Senior Company Officer	319

All personnel time involving expert or witness testimony, or other participation in a judicial proceeding involving the Client, as requested by Client, or compelled by subpoena or otherwise, during or after completion of the scope of services, will be charged at 1.5 times the hourly rates stated herein. Compilation of data and documents, review and preparation time will be charged at the normal hourly rates in effect at time such services are rendered.

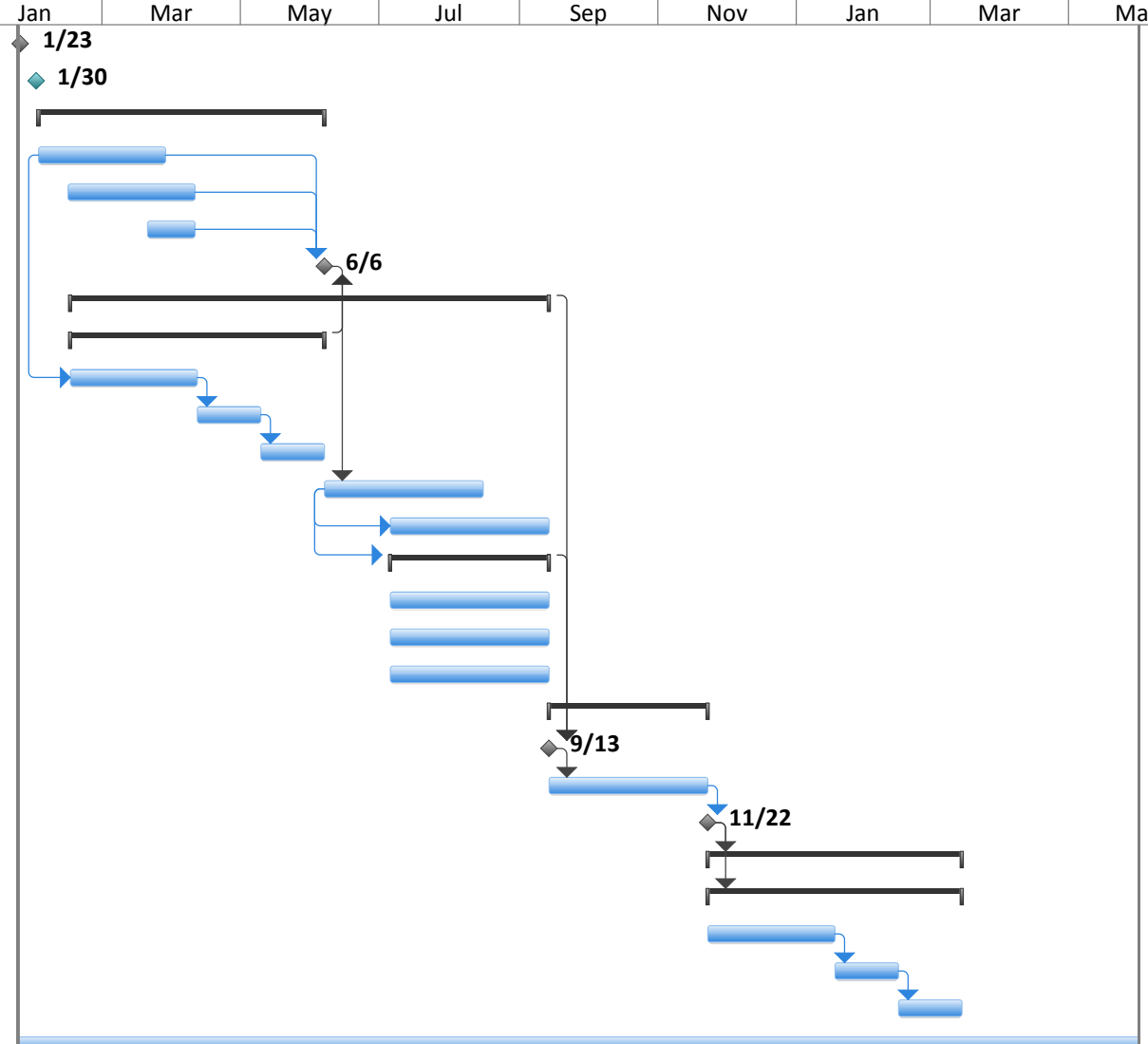
Charges for contract personnel using Stantec facilities will be made according to the hourly rate corresponding to their classification. Special project accounting report and financial services, including submission of invoice support documentation, which are not normally provided to Client, will be charged at the rate of \$60 per hour.

Expenses

1. Project related expenses are charged at cost plus 10 percent.
2. Project subcontracts are charged at cost plus 10 percent.
3. Other expenses directly identifiable to the project, including but not limited to the following examples, will be charged at cost plus 10 percent: equipment or sample shipping; special supplies (drafting and printing, photos, reference materials, expendable materials such as containers and chemicals); personal expenses (such as travel, personal vehicle mileage, subsistence and vehicle rental costs incurred on project activities); outside report reproduction; and licenses, permits, insurance, special fees, etc.
4. Field or specially equipped vehicles are charged at an hourly rate of \$12.00.
5. Associated Project Costs (including general computer equipment, word processing equipment and software, telephone, telex, facsimile, general photocopying, and postage) will be charged at \$11.50 per labor hour.
6. When required, per diem will be charged at the prevailing geographic rate.
7. Use of computer and Computer Aided Drafting/Design (CADD), Geographic Information Systems (GIS), and similar specialty modeling and computer applications for engineering and scientific analyses will be charged at \$18.00 per hour.

Los Padres Dam and Reservoir Alternatives and Sediment Management Study - Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors	2017												2018		
						Nov	Jan	Mar	May	Jul	Sep	Nov	Jan	Mar	May					
1	Notice to Proceed	1 day	Mon 1/23/17	Mon 1/23/17			1/23													
2	Kickoff Meeting	1 day	Mon 1/30/17	Mon 1/30/17			1/30													
3	1.0 Feasibility Study Preparation	90 days	Wed 2/1/17	Tue 6/6/17																
4	1.1 Compile Background Information	2 mons	Wed 2/1/17	Tue 3/28/17																
5	1.2 Prepare Evaluation Criteria	2 mons	Tue 2/14/17	Mon 4/10/17																
6	1.3 Identify Critical Data Gaps	3 wks	Tue 3/21/17	Mon 4/10/17																
7	1.4 TRC Meeting 1	0 days	Tue 6/6/17	Tue 6/6/17	4,5,6,9															
8	2.0 Sediment Management Options	151 days	Wed 2/15/17	Wed 9/13/17																
9	2.1 Obtain Reservoir Sediment Samples	80 days	Wed 2/15/17	Tue 6/6/17																
10	2.1.1 Permitting/Work Plan	2 mons	Wed 2/15/17	Tue 4/11/17	4SS+10 days															
11	2.1.2 Investigation	1 mon	Wed 4/12/17	Tue 5/9/17	10															
12	2.1.3 Lab Testing & Report	1 mon	Wed 5/10/17	Tue 6/6/17	11															
13	2.2 Describe Alternatives	2.5 mons	Wed 6/7/17	Tue 8/15/17	7															
14	2.3 Evaluate Geomorphic Effects of Changes in Sediment Load	2.5 mons	Thu 7/6/17	Wed 9/13/17	13SS+21 days															
15	3.0 Evaluate Effects on Steelhead	50 days	Thu 7/6/17	Wed 9/13/17	13SS+21 days															
16	3.1 Increased Sediment Transport	2.5 mons	Thu 7/6/17	Wed 9/13/17																
17	3.2 No Increase in Sediment Transport	2.5 mons	Thu 7/6/17	Wed 9/13/17																
18	3.3 Incorporate Data from Alternative Water Supply Options	2.5 mons	Thu 7/6/17	Wed 9/13/17																
19	4.0 Identify Feasible Alternatives	50 days	Wed 9/13/17	Wed 11/22/17																
20	4.1 TRC Meeting 2	0 days	Wed 9/13/17	Wed 9/13/17	8,15															
21	4.2 Alternative Development	2.5 mons	Thu 9/14/17	Wed 11/22/17	20															
22	4.3 Meeting 3	0 days	Wed 11/22/17	Wed 11/22/17	21															
23	5.0 Final Report	80 days	Thu 11/23/17	Wed 3/14/18	22															
24	5.1 Prepare Draft and Final Report	80 days	Thu 11/23/17	Wed 3/14/18	22															
25	5.1.1 Draft Report	2 mons	Thu 11/23/17	Wed 1/17/18																
26	5.1.2 TRC Review	1 mon	Thu 1/18/18	Wed 2/14/18	25															
27	5.1.3 Final Report	1 mon	Thu 2/15/18	Wed 3/14/18	26															
28	6.0 Project Management	354 days	Mon 1/23/17	Thu 5/31/18																



Project: LPD Schedule Date: Fri 12/23/16	Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
	Split		External Tasks		Inactive Summary		Manual Summary		Progress	
	Milestone		External Milestone		Manual Task		Start-only		Manual Progress	
	Summary		Inactive Task		Duration-only		Finish-only			

Los Padres Dam and Reservoir Alternatives and Sediment Management Study - Cost Estimate

	Senior Company Officer	Principal Professional II	Principal Professional I	Supervising Professional II	Supervising Professional I	Senior Professional II	Senior Professional I	Designer	Professional	Associate Professional	Technician or Drafter	Assistant Professional (Intern)	Junior Technician or Drafter	Project Administrator	Clerk Typist/Data Processor	Labor Cost	Subcontractor (IT)	Subcontractor (CFS)	Subcontractor (Drilling)	Subcontractor (Lab Testing)	Direct Costs	Total by Task
	\$319	\$268	\$237	\$204	\$184	\$170	\$149	\$142	\$137	\$127	\$126	\$113	\$111	\$101	\$95							
1.0 Feasibility Study Preparation																						
1.1 Compile Background Information		7	14		6				24							\$9,586	\$21,039	\$1,130				\$31,755
1.2 Prepare Evaluation Criteria		25	18	4	18				32							\$19,478	\$4,037	\$1,930			\$330	\$25,775
1.3 Identify Critical Data Gaps		4	6		4				18							\$5,696	\$1,914	\$1,130				\$8,740
1.4 TRC Meeting 1		24	16		8	4			16					2		\$14,770	\$8,106	\$2,565			\$825	\$26,266
Subtotal Task 1	0	60	54	4	36	4	0	0	90	0	0	0	0	2	0	\$49,530	\$35,096	\$6,755	\$0	\$0	\$1,155	\$92,535
2.0 Sediment Management Options																						
2.1 Obtain Reservoir Sediment Samples																						
2.1.1 Permitting		7	24						36							\$12,496						\$12,496
2.1.2 Investigation		8	40	8					244							\$46,684			\$165,000		\$3,850	\$215,534
2.1.3 Lab Testing & Report		14	56						104							\$31,272	\$620			\$11,000	\$550	\$43,442
2.2 Describe Alternatives		17	36	4	22	8			48				40			\$30,328	\$7,986	\$565				\$38,779
2.3 Evaluate Geomorphic Effects of Changes in Sediment Load		4	6		4	16										\$5,950	\$41,589	\$2,965				\$50,504
Subtotal Task 2	0	50	162	12	26	24	0	0	432	0	0	0	40	0	0	\$126,730	\$50,195	\$3,530	\$165,000	\$11,000	\$4,400	\$360,855
3.0 Evaluate Effects on Steelhead																						
3.1 Increased Sediment Transport		4	5		6											\$3,361	\$4,114	\$8,650				\$16,125
3.2 No Increase in Sediment Transport		4	5		6											\$3,361	\$4,114	\$8,650				\$16,125
3.3 Incorporate Data from Alternative Water Supply Options		4	5		6											\$3,361	\$21,696	\$8,650				\$33,707
Subtotal Task 3	0	12	15	0	18	0	0	0	0	0	0	0	0	0	0	\$10,083	\$29,924	\$25,949	\$0	\$0	\$0	\$65,957
4.0 Identify Feasible Alternatives																						
4.1 TRC Meeting 2		28			4				24					2		\$11,730	\$3,155	\$2,895			\$825	\$18,605
4.2 Alternative Development		33	23	8	28	8			88				40			\$38,935	\$3,828	\$2,095				\$44,858
4.3 Meeting 3		40			4				40					2		\$17,138	\$3,155	\$2,895			\$825	\$24,013
Subtotal Task 4	0	101	23	8	36	8	0	0	152	0	0	0	40	4	0	\$67,803	\$10,138	\$7,885	\$0	\$0	\$1,650	\$87,475
5.0 Final Report																						
5.1 Prepare Draft and Final Report		44	200	8	84	16			132				80			\$105,964	\$14,969	\$6,780			\$550	\$128,263
Subtotal Task 5	0	44	200	8	84	16	0	0	132	0	0	0	80	0	0	\$105,964	\$14,969	\$6,780	\$0	\$0	\$550	\$128,263
6.0 Project Management																						
6.0 Project Management		160			56									100		\$63,284						\$63,284
Subtotal Task 6	0	160	0	0	56	0	0	0	0	0	0	0	0	100	0	\$63,284	\$0	\$0	\$0	\$0	\$0	\$63,284
TOTAL HOURS (2,233)	0	427	454	32	256	52	0	0	806	0	0	0	160	106	0							
TOTAL COST	\$0	\$114,436	\$107,598	\$6,528	\$47,104	\$8,840	\$0	\$0	\$110,422	\$0	\$0	\$0	\$17,760	\$10,706	\$0	\$423,394	\$140,322	\$50,899	\$165,000	\$11,000	\$7,755	\$798,369
7.0 Optional Task																					\$11,000	

SECTION 8 - EXCEPTIONS

MWH requests the consideration of the proposed revisions to the MPMWD, Agreement for the execution of this work. In accordance with the RFP our Exceptions will be included on the following pages.

Changes to the Sample Agreement included in the RFP beginning on Page 62 of 71.

1. In Section II.B second paragraph, strike the first sentence.
2. Strike all of Section II.D
3. In Section V strike “and late performance shall result in a waiver of part of the fees payable to pursuant to the terms of this Agreement.”
4. In Section VI.F replace “who may be” with “to the extent” and strike the note at the end of the section.

MWH requests that the following four provisions be added to the Agreement based on the nature of the work included under the Agreement:

- A. MPWMD shall furnish to Consultant all applicable information and technical data in MPWMD’s possession or control reasonably required for the proper performance of the Services. Consultant shall be entitled to reasonably rely upon the information and data provided by MPWMD or obtained from generally acceptable sources within the industry without independent verification except to the extent such verification is expressly included in the Services.
- B. The standard of care applicable to Consultant’s Services will be the degree of skill and diligence normally employed by professional consultants performing the same or similar services at the time and location said Services are performed.
- C. Consultant’s opinions, recommendations and assessments are limited by a) the accuracy and completeness of information upon which it may reasonably rely, b) schedule constraints or scope limitations, c) unknown or variable site or other conditions, d) other factors beyond Consultant’s control. Any estimates as to construction costs are limited by a lack of control over financial and/or market conditions, including the future price of labor, materials, and prospective bidding environments and procedures. Consultant does not warrant or guarantee the accuracy or completeness of its Services to the extent impacted by these limitations and MPWMD should limit its reliance on the Services in like manner.
- D. To the fullest extent permitted by law, the Parties agree to limit the aggregate liability of Consultant to the amount of fees paid to them under the Agreement. In no event shall either party be liable for any indirect, incidental, special or consequential damages whatsoever (including but not limited to lost profits or interruption of business).

SECTION 9 - APPENDIX

PROJECT TEAM RESUMES

Team Resumes are presented in the following order:

PROJECT MANAGER & DSOD COORDINATOR

Vik Iso-Ahola, PE, PMP – Project Manager and DSOD Coordinator

RESERVOIR OPERATIONS / HYDRAULICS

Eric Clyde, PE, WRE, *Reservoir Operations/Hydraulics*

FISHERIES

Michael Beakes, PhD - Cramer Fish Sciences

GEOMORPHOLOGY

Bob Mussetter, PhD, PE – TetraTech

HEALTH & SAFETY

Stephen Young, *Health & Safety*

TECHNICAL REVIEWERS

Peter Dickson, PhD, PG, *Geotechnical/Geology*

John Haapala, PE, *Hydraulics*

Michael Chelminski, PE, *Geomorphology* - Stantec

Dennis Dorratcague, *Fish Passages*

SUPPORTING RESOURCES

Engineering

Nelson Kawamura, PhD, PE, GE, *Geotechnical Engineering*

Martina Gelo, PE, *Civil Engineering*

Connie Wong, PE, *Civil Engineering*

Mohammadreza Mostafa, PhD, PE, *Structural Design*

Scott D. Peyton, PE, *Stream Restoration* - Stantec

Mike Vukman, *Stream Restoration* – Stantec

Environmental

Meredith Parkin, JD, PMP, *Environmental*

Fisheries

Stephanie Theis, *Fisheries Biologist*

Joseph Merz, Ph.D. – *Fish Biologist* – Cramer Fish Sciences

Fish Passage

Clint Smith, PE, *Fish Passage*

Cost Estimating

James Loucks, CCP, PMP, *Cost Estimating*

Geomorphology/Sediment Transport

Stuart C. Trabant, PE, *Sediment-Transport* - TetraTech

Michael F. Adams, Jr. PE, *Geomorphology/Sediment Transport* - Stantec

Geology

Jim Herbert, PG, CEG, *Geologist*

Jennifer Van Pelt, PG, *Field Investigation*

Vik Iso-Ahola, PE, PMP

Project Manager – DSOD Coordinator

In 19 years of professional experience, Mr. Iso-Ahola has developed a range of capabilities in water-resources and dam projects involving geotechnical, civil, structural, and construction engineering & planning. He is adept at leading large multi-disciplinary teams to deliver complex engineering designs and has led project teams in all phases, including field investigations, inspections and studies of facilities, in-depth stability analyses, preparation of plans and specifications, scheduling, cost estimating, and design report preparation. Mr. Iso-Ahola's project experience includes rehabilitation and design for dams and spillways, including managing multiple disciplines for gate structures, outlet works, valve and electrical rehabilitation design, slope stability analyses; hydraulic modeling; foundation grouting; three dimensional finite element analyses; groundwater seepage modeling; seismic analyses; logging, sampling, field testing; and laboratory testing of soils, rock, grout, and concrete. He has published papers on spillway modification, dam removal issues, concrete thermal analysis, liquefaction evaluation, dam rehabilitation, and structural design optimization for dam raising and dam retrofit using FEM analysis.

Relevant Project Experience

Los Padres Dam Sediment Removal Feasibility Study, California America Water Company

Project Manager for the initial conceptual assessment and feasibility evaluation of sediment removal at Los Padres Dam and Reservoir. The objective of the study was to facilitate the long-term planning for management of the reservoir and sediments. The scope of work for the study included assessment of existing reservoir conditions and data; conceptual evaluation of methods for reservoir sediment removal, transport and disposal; identification of potential commercial use and preliminary selection of disposal sites for the removed sediment; identification of potential environmental issues and permitting requirements for removal and disposal of the sediment; description and cost estimate for three conceptual alternatives based on feasible methods removal, transportation and disposal of the sediment.

Los Padres Dam Spillway Capacity Study, California America Water Company

Project Manager for an independent three dimensional (3D) Computational Fluid Dynamics (CFD) analysis for the Los Padres Dam Spillway located on the Carmel River in Monterey County, California. The CFD was performed on the existing spillway and reservoir. MWH's study results allowed Cal-Am to negotiate a delay to necessary spillway changes with **DSOD** and revisit the use of the fish collector, saving Cal-Am substantial unbudgeted expenditure.

San Clemente Dam Removal Study, California America Water Company

Project Manager for the dam removal/modification feasibility study and EIR/EIS engineering support of San Clemente Dam, a 100-foot-high concrete arch dam. Project involved feasibility of dam strengthening, dam removal, sediment removal and disposal concepts (slurry, conveyor, and trucking), including preparation of conceptual plans and drawings, cost estimating, scheduling, and description of alternatives report preparation. The scope of feasibility study involved identifying problems, constraints, and formulating the dam/sediment removal and dam strengthening alternatives, including performing seepage and slope stability analyses to evaluate feasibility of conceptual design components. The feasibility report established qualitative and quantitative benefits of each alternative and cost estimates to implement each alternative. Cost estimating for each alternative included inventorying, forecasting, analyzing future project conditions (e.g., operating costs, escalation, etc.) and conducting comparative cost analyses. The effort also included engineering support for the project draft and final environmental impact review/statement (EIR/EIS).

Carmel River Re-Route and Dam Removal Basis of Design, San Clemente Dam, California State Coastal Conservancy

Project Manager for development of the initial basis of design for the Carmel River Re-route and Removal (CRRDR) of San Clemente Dam, a 100-foot-high concrete arch dam. The basis of design document was developed to

EDUCATION

MBA, Finance and Accounting, University of California at Davis

BS, Civil Engineering, University of Maryland

LICENSES/ REGISTRATIONS

Professional Engineer –
Civil: California No. 62772

Certified Project
Management
Professional, Project
Management Institute

establish criteria to be utilized in the CRRDR design effort, and included a geotechnical investigation and analysis of the bypass cut between the Carmel River and San Clemente Creek.

Englebright Dam Removal Studies, Yuba Salmon Forum/Yuba County Water Agency

Lead engineer providing engineering assessment of dam removal or notching options for the Englebright Dam, including AACE Level 5 cost estimates. Mr. Iso-Ahola's role was to advise on engineering feasibility of alternatives, regulatory requirements for dam removal, and impacts of sediment disposal or discharge. Identified and defined critical parameters for dam removal and/or notching options (e.g., construction methodologies, max. fish ladder height, required downstream or upstream mitigations, sediment placement sites, etc.) Work culminated in a high level breakdown of each Dam Removal or Notching option, listing major construction work items, planning and design requirements, and regulatory requirements. Each item was evaluated in regard to additional study and overall information gathering that would be required during subsequent development phases of each option. Provided presentations of alternatives and cost estimates to the Yuba Salmon Forum which consisted of numerous stakeholders such as CA Dept. of Fish and Game, NOAA National Marine Fisheries Service, CA Regional Water Quality Control Board, and several NGOs.

L. L. Anderson Dam Spillway Modifications, Placer County Water Agency

Project Manager for design modifications to the spillway of the 251-foot high rockfill dam. The spillway modification project required an upgrade to spillway capacity due to increased PMF. He managed initial studies, geotechnical investigation, physical model, and final design process for widening rock channel spillway. His team optimized rock slope stability and excavation design to eliminate benches in the granitic bedrock structure, saving approximately \$900 K in excavation costs; used digital photogrammetry to map and evaluate the spillway channel rock slopes. Other design components included grout curtain design, hydraulic modeling (HEC-RAS HEC-1), 1:20 scale physical model, and structural, electrical, mechanical design of new radial gate structure. Design features included a nominal dam raise, new concrete parapet wall, and rock spoils disposal. Work included cost estimating using MCACES, and development of plans, specifications, and design report. The foundation design included consolidation grouting, rock bolts and anchors, shotcrete-reinforced rock fill bank protection, natural slope embankment protection, rock excavation and blasting, flow containment structures, and hydraulic energy dissipation steps and riprap. All work was reviewed and accepted by regulatory agencies including FERC, **DSOD**, USFS, USFW, USCOE, CDFG, SWRCB, and SHPO.

Big Tujunga Dam Stability Evaluation and Rehabilitation Design, LA County Department of Public Works

Project Manager and Engineer for stability evaluation and rehabilitation design of the Big Tujunga Dam, a 251-foot high concrete arch dam. Included a \$1M geotechnical and geophysical investigation for siting of the new dam buttress foundation, new overtopping spillway, and replacement of all outlet valves with fixed cone, jet flow, butterfly, and ball valves. Performed seismic dynamic finite element analyses (3-D FEM) of the dam using ground motion records modified to match a target spectrum. Performed Rock Mass Rating and liquefaction evaluation utilizing the investigation results from the \$1M geotechnical investigation. Involved in all stages of rehabilitation design, such as, estimating, mix design, general civil design, preliminary and detailed plans, structural design, permitting, project controls, scheduling, and CADD, which was reviewed and approved by **DSOD**. Project Manager for Engineering Services during Construction (ESDC), coordinating overall engineering support for the \$100 million dollar construction project. The Big Tujunga Dam Seismic and Flood Rehabilitation Project was awarded the 2011 National Dam Rehabilitation Project of the Year by the ASDSO (Association of State Dam Safety Officials) and the U.S. Society of Dams (USSD) Award of Excellence – Constructed Project in 2012, which is an award presented to project designers for outstanding design and innovation in the dam industry.

Santa Anita Dam Spillway Modification Project, LA County Department of Public Works

Project Manager for re-analysis of Santa Anita Dam, a 225-foot high concrete arch dam built in 1924-27. The primary issues of concern include Alkali-Silica Reaction (ASR) within the dam concrete, seismic stability to withstand the current Maximum Credible Earthquake (MCE), and hydraulic adequacy of the existing spillway to handle updated Probable Maximum Flood (PMF). Performed linear-elastic finite element analyses (3-D FEM) to assess the seismic stability of the dam and to develop rehabilitation concepts. Currently leading design for the preferred rehabilitation concept, which includes a stepped spillway notch, spillway extensions, and modified risers. The project rehabilitation design also includes valve replacement, helipad, generator building, shotcrete armoring, new lighting and electrical, remote operation and sensing of valves, CCTV, replacement cableway hoist, water system upgrade, and new bridge across notch cut into dam. All rehabilitation design work was reviewed and approved by **DSOD**.

San Vicente Dam Raise Structural Evaluation, *San Diego County Water Authority*

The San Vicente Dam (concrete gravity dam) was raised by 117 feet to about 337 feet high, creating an approximately 242,200 acre-foot reservoir. Project included design of raised dam, new spillway, modified intake tower, and new valves. Involved as senior structural engineer on team performing staged construction thermal and structural FEM analyses to predict concrete temperatures in the dam and to estimate the stress state along the interface of the existing concrete and the new RCC during and after construction, including under maximum credible earthquake (MCE) loading. The normal and shear stress at the interface of the existing concrete and new RCC were investigated at several stages of construction and after the dam has reached steady state temperatures.

Spaulding Dams No. 1, 2, & 3 FERC Part 12D Inspection, *PG&E*

Project Manager and FERC-approved Co-Independent Consultant for FERC 5-year Part 12 Inspection of the Spaulding Dams, which include a thick arch dam, concrete gravity dam with radial gates, and rockfill dam with concrete core. Also included inspection of two powerhouses and associated penstocks. Scope included site inspection, STID update, and development of the FERC Part 12 Inspection Report. Inspection required review of site geotech/geology, updated hydrology, structural stability, gates and valve condition, instrumentation performance and readings, and current seismic loading assumptions.

Olivenhain Dam, *San Diego County Water Authority*

Engineer for analysis review team for new \$140M, 318-foot-high RCC dam that creates a 24,000-acre-foot reservoir, providing 90,100 acre-feet of emergency water storage. Performed 2-D finite element analyses to evaluate foundation shear feature, optimizing design of the dam foundation concrete shaping block used to bridge the foundation shear feature. The project received numerous awards including 2004 Outstanding Civil Engineering Project, 2004 Project of the Year, Environmental Category for project over \$10M, 2004 Outstanding Engineering Project and the Charles Pankow Award.

Panama Canal Third Set of Locks Project, *Panama Canal Authority*

Lead for structural engineering services for 2-D FEM thermal analysis of 100+ feet high lock wall and lock head structures for the \$3B Panama Canal expansion. Thermal analysis evaluated varied mix designs, where analysis results were used to optimize mass concrete placement temperatures and perform cracking evaluation using strain calculations. Utilized ACI 207 guidelines and finite element analysis to predict peak temperatures and potential for cracking.

Eric Clyde, PE, WRE

Reservoir Operations and Hydraulics Lead

Mr. Clyde is a Principal Engineer with over 39 years of experience in water resources engineering, storm drainage and flood control, reservoir operations modeling, computer modeling of hydrology, storm drainage, reservoir operations, and open channel hydraulics. He has supervised and participated in hydrologic and water resources projects throughout the United States. His computer modeling experience includes HEC-HMS, HEC-RAS, RESSIM, DSS, SWMM, InfoWorks, UNET, HEC-FDA, and many other hydraulic, and hydrologic programs. Mr. Clyde served on the Board of Directors of the Floodplain Management Association for 14 years, including 2 years as Chair, and is currently serving as Chair of the Professional Development Committee and as Senior Advisor to the Board.

Relevant Project Experience

PG&E Dambreak Analysis and Mapping, Camanche Dam, 2016

Mr. Clyde was the project technical lead for the extension of the existing Upper and Lower Bear River and Salt Springs Dambreak Analyses and Inundation Mapping for the PG&E. This study extended the previous studies that developed theoretical dambreaks at the dams impounding Upper and Lower Bear River and Salt Springs lakes, which are power generation facilities for PG&E. The hydrographs from the previous HEC-RAS models were passed to a HEC-RAS 5.0 two-dimensional model of Camanche Reservoir, the downstream Mokelumne River, and the valley (nearly 600 square miles), including Lodi and Stockton, to determine the limits of inundation resulting from the potential breaching of Camanche Dam. Inundation mapping and other data were displayed using RAS Mapper and GIS software.

USACE Joint Base Elmendorf-Richardson (JBER) Upper South Fork Chester Creek Hydrology, AK, 2015

Mr. Clyde was the project technical lead for the JBER Upper South Fork Chester Creek Hydrology Study for the Alaska District of the U.S. Army Corps of Engineers. This study developed HEC-HMS hydrologic models and HEC-RAS hydraulic models of the Upper South Fork of Chester Creek watershed using available LiDAR and GIS data to develop models that describe the current conditions including the quantity and distribution of surface water, geologic and topographic conditions, soil and vegetation characteristics, and other information pertinent to watershed hydrology. The models were then used to simulate the watershed with the addition of a proposed road from the Geronimo Drop Zone to the Bulldog Trail Road. Based on the results of the modeling, it was concluded that the new road would have less than significant impacts on downstream areas.

PG&E Dambreak Analysis and Mapping, Fordyce and Spaulding Dams, 2014

Mr. Clyde was the project technical lead for the Fordyce and Spaulding Dambreak Analysis and Inundation Mapping for PG&E, which developed theoretical dambreaks at the dams impounding Fordyce and Spaulding lakes. An HEC-RAS hydraulic model of the dams and downstream channels of Fordyce Creek and the South Yuba and Yuba rivers simulated the sequential dambreaks and routed the flows through Englebright Reservoir and down the Yuba River. The hydrographs from the HEC-RAS model were passed to a FLO-2D two-dimensional model of the valley, including Marysville and Yuba City, to determine the limits of inundation resulting from the dambreaks. Inundation mapping and other data were displayed using GIS software.

USACE Joint Base Elmendorf-Richardson Floodplain Mapping, AK, 2014

Mr. Clyde was the project technical lead for the JBER Floodplain Mapping for the Alaska District of the U.S. Army Corps of Engineers. This study developed HEC-RAS hydraulic models of the portions of Eagle River and Ship Creek that flow through JBER. LiDAR data collected by JBER in 2009 was used to define the floodplain areas, and field surveys were made at each of the bridges crossing Eagle River and Ship Creek to define the stream channels. Based on the results of the HEC-RAS modeling, mapping showing the 100-year floodplains for Eagle River and Ship Creek was developed using ArcGIS.

EDUCATION

MS, Civil Engineering,
Colorado State University,
1977

BS, Civil and
Environmental
Engineering, Utah State
University, 1975

LICENSES/ REGISTRATIONS

Professional Engineer
(Civil) in California,
Virginia, and Texas

PROFESSIONAL AFFILIATIONS

American Society of Civil
Engineers

Diplomate, Water
Resources Engineer,
American Academy of
Water Resources
Engineers

Floodplain Management
Association – Past Chair

American Water
Resources Association

Tau Beta Pi Engineering
Honor Society

California DWR, Central Valley Flood Management Planning Program (CVFMP), CA, 2013

Mr. Clyde managed multiple tasks in the CVFMP for DWR. The tasks included: the State Plan of Flood Control (SPFC) Descriptive Document, program management and support services, and Supporting Technical Analyses. He was the technical lead for the CVFPP, and as such lead the hydrologic and hydraulic evaluations, including reservoir operations, flow and stage modeling for all major rivers and tributaries (more than 700 rivermiles), Paradise Cut Bypass assessment, economic modeling, life safety analysis, and development of levee performance curves. He was instrumental in development of the CVFPP and technical attachments for approval in June 2012.

Oroville Dam River Valve Outlet System (RVOS) Rehabilitation and Operation for California Department of Water Resources, CA, 2015

Mr. Clyde was the Project Technical Lead for the development of three Technical Memoranda for DWR on Rehabilitation and Operation of the RVOS at Oroville Dam. The RVOS is the low-level outlet for Oroville Dam and was in need of rehabilitation after an operational incident in 2009. TM-9 provided Hydraulic Modeling Results and 2014 Drought Emergency RVOS Operation Considerations that allowed DWR to get approval from Division of Safety of Dams and OSHA to operate the RVOS for the 2014 Drought Emergency. TM-10 documented the 2014 RVOS Validation Testing and Operational Commissioning. TM-11, RVOS Capacity Restoration Re-Evaluation, looked at alternative modifications to the RVOS to allow operation at design discharges and recommended a preferred alternative for design and construction. TM-12 documented the 2016 RVOS Baffle Ring Testing and Operation Commissioning.

USACE and California DWR, Sacramento-San Joaquin River Basins Comprehensive Study, CA, 2002

Mr. Clyde was a project manager for task orders from the U.S. Army Corps of Engineers as part of the Sacramento – San Joaquin River Basins Comprehensive Study. This study is the largest of its kind in the world – involving flood management planning for a combined watershed of nearly 60,000 square miles and including hydraulic modeling of hundreds of rivermiles. He led many of the hydraulic and hydrologic engineering tasks including the UNET Modeling of the Sacramento River and Tributaries (500 rivermiles); Hydraulic Analysis of Concept Plans; Hydrodynamic Analysis of Lower Sacramento and San Joaquin Rivers; Channel Capacity Analysis for the Sacramento River and Tributaries; UNET Model Documentation for the Sacramento River; and Hydraulic and Hydrologic Documentation Support. Flows from the dams on the Sacramento River and major tributaries were developed using HEC-5 reservoir operations modeling software.

Joint Use Fish Screen Project River Hydrology and Hydraulic Study for West Stanislaus Irrigation District, CA, 2015

Mr. Clyde was the technical lead for hydrology and hydraulic analysis to determine design water surface elevations at a proposed West Stanislaus Irrigation District (WSID) diversion and fish screen on the San Joaquin River at the existing site. The hydrology at the diversion site is complicated by the fact that it is located 1 mile upstream from the Tuolumne River confluence. He developed a HEC-RAS hydraulic model of the San Joaquin River for the reach from the Newman gage to the Stanislaus River and coupled that with the hydrology to determine water surface elevations at the proposed intake site. He also developed the statistics needed to determine 10% and 90% exceedence and 100-year flood flows to evaluate operation of the intake.

Friant-Kern and Madera Canals Capacity and Reverse-Flow Assessment for U.S. Bureau of Reclamation, CA, 2011

Mr. Clyde was the MWH project manager for the analysis of modifications required for the Friant-Kern (151 miles) and Madera Canals (36 miles) Capacity and Reverse-Flow Assessment, being conducted for U.S. Bureau of Reclamation. Since the two canals were built nearly 60 years ago, changes have occurred that have reduced the capacity of the canal below the designed capacity, by as much as 10 percent. As part of the San Joaquin River Restoration Program, these capacity deficiencies are to be removed. The purpose of this analysis was to determine where the flow deficiencies exist and then develop appraisal-level designs for their removal and return of the canals to original design capacity. The study included hydraulic modeling (led by Mr. Clyde); development of designs, and preparation of a design report including conclusions, drawings, and costs; and preparation of an Environmental Assessment. In addition, the use of pumps to provide reverse flow of up to 500 cfs in the lowest 4 reaches of the canal was modeled.

California DWR, Analysis of Modifications Required for Enlargement of East Branch of the California Aqueduct, CA, 2008

Mr. Clyde was the MWH project manager for the analysis of modifications required for the Phase II enlargement of the East Branch of the California Aqueduct, conducted for DWR. In order to meet projected future delivery needs, the East Branch canal must be enlarged, and one or more existing flow constrictions must be removed. The purpose of this analysis was to determine where and why the flow constrictions exist and then develop feasibility-level designs for their removal and enlargement of the canal. This analysis involved both reconnaissance studies and feasibility studies. The reconnaissance study included data review, field investigations, and development of a detailed work plan for the feasibility study. For the feasibility study Mr. Clyde was technical lead for HEC-RAS hydraulic modeling of 95 miles of the canal, development of alternative designs, and preparation of a feasibility report including conclusions, drawings, costs, and schedules for subsequent work.

Coachella Canal Lining Project for U.S. Bureau of Reclamation, CA, 2005

Mr. Clyde conducted the hydraulic computer modeling for the Coachella Canal Lining Project for the Coachella Valley Water District. Much of the Coachella Canal had been lined previously, but 33.2 miles remained unlined. The project involved the design of the lined replacement for the unlined section of the canal. This section of canal included 26 siphons and six check structures. The computer modeling helped determine the most efficient section for the two alternatives for the new concrete lined canal. One alternative was to construct the lined canal in the existing canal alignment, requiring the new canal section to function with the existing canal siphons that go under major drainage features along the canal. The second alternative, that was ultimately selected, was to construct the new lined canal adjacent to the existing canal, with all new canal siphons at the major drainage features.

MICHAEL BEAKES, PH.D.

Fisheries Lead

3300 Industrial Blvd, Suite 100

West Sacramento, CA 95691

V 916.231.1681

michael.beakes@fishsciences.net

Years of Experience

- 13 years. Professional start date: June 2003

Education

- PhD, Biology, Simon Fraser University, Burnaby, British Columbia, Canada. 2014.
- BSc, Biology – Fish & Wildlife Management Emphasis, Northern Arizona University, Flagstaff, AZ. 2002.

Dr. Beakes joined Cramer Fish Sciences in April, 2016 and brings over 13 years of research experience and a strong combination of field-based and quantitative research experience to the team. By coupling field data with quantitative modelling techniques Michael enhances the Cramer Fish Sciences team's ability to advance fisheries science by improving understanding of how stream and river ecosystems function and providing insight into how best to manage them. Michael's primary role at Cramer Fish Sciences as a senior biologist out of the West Sacramento office is to develop, coordinate, and implement a broad range of habitat restoration projects and monitoring throughout the California Central Valley. Michael received a BSc in Biology with an emphasis in Fish and Wildlife Management from Northern Arizona University in 2002, and received his Ph.D. in Biology from Simon Fraser University in Vancouver, British Columbia, Canada in 2014.

While at SFU Michael's research was focused on examining the dynamics of large-scale natural and anthropogenic disturbance in stream and river ecosystems across large spatiotemporal scales. His research experience includes studies on the effects of wildfire on stream temperatures and food webs in a small California coastal watershed, flow regulation on California Central Valley rivers, salmon life-cycle models and habitat capacity in California and Washington State, and climate change on the Fraser River in British Columbia, Canada.

Employment History

Senior Biologist, Cramer Fish Sciences, West Sacramento, CA. 2016 - present.

Postdoctoral Scholar, NOAA Southwest Fisheries Science Center, Santa Cruz, CA. 2015 - 2016.

National Research Council Research Associate, NOAA Northwest Fisheries Science Center, Seattle, WA. 2014 - 2015.

Doctoral Candidate, Simon Fraser University, Burnaby, British Columbia, Canada. 2011 - 2014.

Doctoral Student, University of California, Santa Cruz, CA. 2009 - 2010.

Lab Assistant III, NOAA Southwest Fisheries Science Center, Santa Cruz, CA. 2006 - 2009.

Biologist, Pacific States Marine Fisheries Commission, Umatilla, OR. 2005.

Biologist, Washington Department of Fish and Wildlife, Pasco, WA. 2005.

Field Research Assistant, Pacific States Marine Fisheries Commission, Portland, OR. 2004.

Field Research Assistant, U.S. Fish & Wildlife Service, Flagstaff, AZ. 2003.

Field Research Assistant, Arizona Game & Fish Department, Flagstaff, AZ. 2003.



Selected Publications

- Jonathan W. Moore, **M.P. Beakes**, H.K. Nesbitt, J. Yeakel, D.A. Patterson, L.A. Thompson, C. Phillis, D. Braun, C. Favaro, D. Scott, C. Carr-Harris, W. Atlas. 2015. Emergent stability in a large free-flowing watershed. *Ecology* 96: 340-347.
- Corinna Favaro, J.W. Moore, J.D. Reynolds, **M.P. Beakes**. 2014. Potential loss and rehabilitation of stream longitudinal connectivity: fish populations in urban streams with culverts. *Canadian Journal of Fisheries and Aquatic Sciences* 71: 1805-1817.
- Michael P. Beakes**, J.W. Moore, S.H. Hayes, and S.M. Sogard. 2014. Wildfire and the effects of shifting stream temperature on salmonids. *Ecosphere* 5: 63.
- Michael P. Beakes**, S. Sharron, R. Charish, J.W. Moore, W.H. Satterthwaite, E. Sturm, B.K. Wells, S.M. Sogard, and M. Mangel. 2014. Using scale characteristics and water temperature to reconstruct growth rates of juvenile steelhead (*Oncorhynchus mykiss*). *Journal of Fish Biology* 84: 58-72.
- Michael P. Beakes**, J.W. Moore, N. Retford, R. Brown, J.E. Merz, and S.M. Sogard. 2014. Evaluating statistical approaches to quantifying juvenile Chinook salmon habitat in a regulated California river. *River Research and Applications* 30: 180-191.
- Brett Favaro, D.C. Braun, and **Earth2Ocean Research Derby**. 2013. The ‘Research Derby’: a pressure cooker for creativity and collaborative science. *Ideas in Ecology and Evolution* 6 (1).
- Andrew O. Shelton, W.H. Satterthwaite, **M.P. Beakes**, S.P. Munch, S.M. Sogard, M. Mangel. 2013. Separating intrinsic and environmental contributions to growth and their population consequences. *American Naturalist* 181: 799-814.
- Corey C. Phillis, S.M. O’Regan, S.J. Green, J.E.B. Bruce, S.C. Anderson, J.N. Linton, **Earth2Ocean Research Derby**, and B. Favaro. 2013. Multiple pathways to conservation success. *Conservation Letters* 6: 98-106.
- Susan M. Sogard, J.E. Merz, W.H. Satterthwaite, **M.P. Beakes**, D.R. Swank, E.M. Collins, R.G. Titus, and M. Mangel. 2012. Contrasts in habitat characteristics and life history patterns of steelhead in California’s central coast and Central Valley. *Transactions of the American Fisheries Society* 141: 747-760.
- Michael P. Beakes**, W.H. Satterthwaite, E.M. Collins, D.R. Swank, J.E. Merz, R.G. Titus, S.M. Sogard, and M. Mangel. 2010. Smolt transformation in two California steelhead populations: Effects of temporal variability in growth. *Transactions of the American Fisheries Society*. 139: 1263-1275.
- William H. Satterthwaite, **M.P. Beakes**, E.M. Collins, D.R. Swank, J.E. Merz, R.G. Titus, S.M. Sogard, and M. Mangel. 2010. State-dependent life history models in a changing (and regulated) environment: Steelhead in the California Central Valley. *Evolutionary Applications*. 3: 221-318.
- William H. Satterthwaite, **M.P. Beakes**, E.M. Collins, D.R. Swank, J.E. Merz, R.G. Titus, S.M. Sogard, and M. Mangel. 2009. Steelhead life history on California’s central coast: Insights from a state dependent model. *Transactions of the American Fisheries Society*. 138: 532-548.

Dr. Mussetter has over 35 years of experience in analysis and design for a broad range of water-resource and civil engineering projects, including numerous hydraulic and sediment transport projects on the Carmel River over the past approximately 15 years. His primary area of expertise involves integration of hydrology, hydraulic engineering, and river mechanics with fluvial geomorphology to solve river stability, flooding, and environmental problems. Dr. Mussetter is nationally recognized as an expert in hydraulic and sediment-transport analysis. His experience includes projects throughout the United States and internationally involving a broad range of stream types and physical environments, varying in scope from collection and analysis of field data through development and application of mathematical models to evaluate sediment transport in both sand- and gravel-bed systems. He has extensive experience with the full suite of hydrologic, hydraulic and sediment- transport models, including HEC-HMS, HEC-RAS, HEC-6 and HEC-6T, RMA-2V, FLO-2D, and SRH-2D, and many other similar models.

Dr. Mussetter has particular experience in analyzing and predicting sediment transport and fluvial processes in natural streams, including the effects of human-induced and natural disturbances such as reservoirs, diversions, landslides and rare floods on channel stability and instream aquatic habitat. He also has considerable experience in developing measures to mitigate the potential adverse impacts of these disturbances, including channel stabilization measures using natural materials, sediment flushing flows, and sediment augmentation. His experience includes collection and analysis of substrate data, analysis of aerial photographs, flood inundation studies, and preparation of sediment budgets. Dr. Mussetter has authored or co-authored several manuals and design guides relating to river stability, erosion control and surface erosion. In addition, he has been an instructor for the National Highway Institute-sponsored "Stream Stability and Scour at Highway Bridges" training course and was involved in preparation of the Federal Highway Administration documents HEC-18, "Evaluating Scour at Bridges" and HEC-20, "Stream Stability at Highway Structures." This training course and the related documents describe the current standard of engineering practice for evaluating stream stability and scour in the riverine environment.

RELEVANT EXPERIENCE

San Clemente Dam Retrofit Study, Carmel River, Carmel, California, 2007 - Principal Engineer and Project Manager for a detailed study of the potential impacts on flooding, river stability and instream habitat in an 18-mile reach of the Carmel River associated with various options for retrofitting San Clemente Dam to meet seismic safety standards. Project responsibilities included study plan development, supervision of subcontractors for topographic and bathymetric surveys and reservoir sediment sampling, collection of sediment and other physical data, hydraulic (HEC-RAS) and sediment transport (HEC-6T) modeling, and interpretation of model results. His responsibilities also included extensive coordination and communication with agencies and interest groups concerned with public safety, water supply, instream habitat and endangered species issues. The study was performed for the California Department of Water Resources and American Waterworks Company.

Carmel River Reroute and Dam Removal Design-Build Project, California, 2016 - Principal Engineer and Project Manager for a detailed study of the potential impacts on flooding, river stability and instream habitat in an 18-mile reach of the Carmel River associated with various options for retrofitting San Clemente Dam to meet seismic safety standards. Project responsibilities included study plan development, supervision of subcontractors for topographic and bathymetric surveys and reservoir sediment sampling, collection of sediment and other physical data, hydraulic (HEC-RAS) and sediment transport (HEC-6T) modeling, and interpretation of model results. His responsibilities also included extensive coordination and communication with agencies and interest groups concerned with public safety, water supply, instream habitat and endangered species issues. Tetra Tech is

Education:

Ph.D./1989/Civil Engineering
M.S./1982/Civil Engineering
B.S./1976/Civil Engineering

Registrations/Certifications:

Registered Professional Engineer:
1983/Colorado, 1984/Arizona,
1984/Montana, 1994/New Mexico,
1998/Idaho, 1995/South Dakota,
1999/ California, 2002/Texas,
2005/Wisconsin, 2014/Nevada

Professional Affiliations:

American Society of Civil Engineer

American Water Resources
Association

American Academy of Water
Resources Engineers (Diplomate)

American Geophysical Union

Office:

Fort Collins, Colorado

Years of Experience:

39

Years with Tetra Tech:

21

currently part of a design-build team for the CRRDR, led by Granite Construction, which is under contract to California American Water, the owner of the dam. Tetra Tech is a subconsultant to Kleinfelder (Lead Designer) and is responsible for hydrologic and hydraulic analyses, and design of the stable stream channel that provides upstream and downstream passage for steelhead in the rerouted section of the Carmel River. Tetra Tech recently completed 2-dimensional hydraulic flow analyses for the proposed confluence of the reroute channel and the Carmel River at the current dam site and is coordinating with the California Division of Safety of Dams (DSOD) on the results. The modeling was performed using Bureau of Reclamation SRH-2D software for the 100- and 1,000-year frequency events, and the Probable Maximum Flood.

Sleepy Hollow Raw Water Intake and Water Supply System Upgrade, Monterey Peninsula Water Management District (MPWMD), Ongoing – Technical Manager for hydraulic, geomorphic and sediment transport analysis to support design of a new raw water intake on the Carmel River for the Sleepy Hollow Steelhead Rearing Facility, a key objective for which is to minimize sedimentation issues at the fish screen. The work involved coordination with MPWMD staff, field reconnaissance to assess conditions in the river adjacent to the site, management of hydraulic and sediment transport analysis to identify an appropriate location to limit sedimentation issues, and ongoing discussions and assistance to the design team.

River Restoration Engineering Services for the San Joaquin River Restoration Program, California, Ongoing - Project Manager and Principal Engineer for a multi-year series of water resources, river restoration, and geomorphic analyses to support the San Joaquin River Restoration Project between Friant Dam and the confluence with the Merced River for the California Department of Water Resources (DWR) in accordance with an existing multi-jurisdictional Settlement Agreement. Project responsibilities include hydrologic analysis, geomorphic analysis, steady and unsteady one-dimensional and two-dimensional hydraulic modeling (HEC-RAS, SRH-2D), sediment transport modeling, restoration design for the improvement of riparian and aquatic habitat and fish passage, and development of appraisal-level cost estimates for 150 miles of river and up to 60 miles of the flood bypass system.

Two-dimensional Hydrodynamic, Bank Erosion and Sediment-transport Analysis of the Sacramento River in the Vicinity of the M&T Pump Intake and Fish Screens at RM192.5 (CALFED and Ducks Unlimited), Ongoing - Principal Hydraulic Engineer for a study to evaluate bank erosion processes and sediment transport processes and identify alternative for protecting the pumping plant, located at RM 192.5 on the Sacramento River near Chico, CA, that are acceptable to both the plants owners and the resource agencies charged with protecting instream and riparian habitat and water quality. The study included 2-dimensional hydraulic and sediment transport analysis, oversight of a physical modeling study, and design of habitat-friendly bank protection measures. Bank protection measures modeled and designed included spur dikes to change sediment deposition patterns at the pumps, and a rock toe and vegetation revetment to prevent further bank erosion and channel migration.

Windy Gap Reservoir Modification Study, Grand County, CO, 2015 – Principal Engineer for a study was to assess alternatives for improving the health of the river by constructing a river bypass, or providing some means of connectivity through or around the reservoir. Dr. Mussetter provided river engineering and fluvial geomorphology analyses and review of the detailed hydraulic and sediment-transport assessment, habitat assessments, review and assessment of the reservoir, pumps and operational procedures, preparation of conceptual plans and construction cost estimates.

Platte River Recovery Implementation Program, Kearney, Nebraska, Ongoing – Project Manager and Principal Engineer for a multi-year study for field data collection and analysis, including: bathymetric surveying, stream gaging, bar and vegetation mapping, and sediment sampling. The analysis is for the recovery of pallid sturgeon, piping plover, least tern and whooping crane by giving recommendations for the management of flows, sediment augmentation and mechanical changes to the river channel. The study has included development of 2-D models for the purpose of sediment augmentation, quantifying sand bars and vegetation and predicting how they respond to short-duration-high-flow events in tandem with mechanical removal of bars and vegetation.

Stephen Young, CSP, CHMM

Health & Safety

Mr. Young has more than 28 years of experience in industrial hygiene, safety, environmental and construction. He has done various short courses and certifications: 30 Hour OSHA Construction Safety and Health, Rocky Mountain Education Center, OSHA Region VIII Training Institute, Red Rocks Community College, Lakewood, Colorado. He has worked with various MNCs like Groundwater Technology, Inc., Maecorp Environmental, Roux Associates, Inc., Apex Environmental, Inc., Apex Companies, LLC (Apex Environmental, Inc.) and MWH.

Relevant Project Experience

Safety and Health Manager, Price Pit Superfund Site, Pleasantville, NJ

Provided direction and oversight for remedial Operations & Maintenance (O&M) activities which included groundwater sampling, confined space entry, groundwater extraction and treatment of 300 gallons per minute (gpm) of contaminated groundwater and landfill leachate at the onsite waste water treatment plant (WWTP). Prepared Activity Hazard Analyses (AHAs), developed and provided Confined Space Entry / Rescue training and annual 8-hour OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) refresher training. Conducted a site health and safety audit against OSHA and U.S. Army Corps of Engineers (USACE) Safety and Health (EM 385-1-1) requirements.

Safety and Health Manager, Silresim Superfund Site, Lowell, MA

Developed, maintained, and implemented an Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP) following OSHA and USACE Safety and Health (EM 385-1-1) requirements. Remedial activities included operation of a groundwater extraction system and O&M of a waste water treatment plant and air pollution controls. Conducted seven quarterly health and safety audits to assess the effectiveness of the SSHP. Provided annual HAZWOPER refresher training to project personnel.

Safety and Health Manager, Formerly Used Defense Site (FUDS), Birdsboro, PA

Developed, maintained, and implemented an Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP) following OSHA and USACE Safety and Health (EM 385-1-1) requirements. Remedial activities included the removal of USTs, ASTs, product piping, impacted soil and 50 aged drums of calcium carbide.

Program Manager, EHS Resident Consultant, Lockheed Martin, NJ, PA

Provided 14 years of onsite support with the EHS Departments at the following Lockheed Martin facilities: IS&GS / Space Systems, Valley Forge, PA, Commercial Space Systems, Newtown, PA and Missiles and Space, East Windsor, NJ. Primarily responsible for integrating EHS programs into production areas, laboratories, clean rooms, testing facilities, warehouses, data centers and office environments. Provided safety engineering and compliance reviews for operations involving high and low explosives, thermal batteries and other power systems, cryogenics and compressed gases, flammable liquids, vapor degreasers, RF radiation, fire protection systems, scaffolding, fall protection, confined spaces, powered industrial trucks, aerial lifts, cranes and rigging, machine guarding, and use of various toxic chemicals.

Health and Safety Assessments at Hydroelectric Power Plant Sites

Completed Health and Safety assessments at four run-of-the-river hydroelectric power plants under various phases on construction at existing dams along the Ohio River in Ohio, Kentucky and West Virginia. Completed a Health and Safety assessment at a hydropower site on the Columbia River in Washington.

EHS Trainer, Various Locations

Over 1300 contact hours of EHS training in a variety of topics including hazardous waste management, HAZWOPER, confined space entry, chemical hygiene/lab safety, hazard communication, bloodborne pathogens, excavation and trenching, lock-out / tag-out, hot work, fire extinguishers, compressed gases, PPE, asbestos awareness, construction safety, ladder safety, overhead crane operation, aerial lift operation, forklift operation, explosives handling, first aid/CPR/AED and USDOT Hazardous Materials Transportation regulations.

EDUCATION

MS/MSc, Environmental Protection & Safety Management, Saint Josephs University, Pennsylvania
 BS/BSc, Natural Resource Management, The University of Maryland, Maryland

LICENSES/REGISTRATIONS

Certified Safety Professional (CSP), No. 18553 (since 2005)
 Certified Hazardous Materials Manager (CHMM), No. 3582 (since 1992)

SPECIALIZED TRAINING

OSHA 30-hour Construction Safety
 OSHA 40-hour initial Hazardous Waste Operations and Emergency Response (HAZWOPER) and 8-hour Supervisor
 Fall Protection Competent Person, Competent Equipment Inspector (3M)
 Confined Space Entry and Operations (MSA)
 Mine Safety and Health Administration (MSHA) 32-hour New Miner training
 Medic First Aid, CPR and AED Instructor (HSI)
 Tunneling/Underground Construction Safety r

EHS Auditor, Various Locations

Completed EHS audits at dozens of facilities in a variety of sectors including electronics, pharmaceutical, aerospace, specialty chemical, network television stations, secondary lead recycling, hazardous waste treatment facilities, active remediation sites, metal pipe and bar manufacturing, foundries, wastewater treatment plants, oil and gas equipment servicing, warehousing, R&D facilities, decontamination and demolition sites and large office complexes.

Health and Safety Plan Preparation and Implementation, Various Locations

Prepared and implemented OSHA HAZWOPER Health and Safety Plans (HASPs) for:

- The decontamination of a metallo-organic pesticide manufacturing facility in northern New Jersey. Contaminants of concern included elemental mercury, benzene, acetic acid and phenylmercuric acetate. Health and safety activities included a PPE assessment; preliminary lockout/tagout survey; confined space entry procedures; air monitoring using mercury vapor analyzers, photoionization detectors, dust/particulate monitors and colorimetric tubes; operation of a personnel decontamination trailer; and hazardous waste handling. All work was performed in Level C or B protection.
- Site-wide investigation activities at a 1,200-acre explosives manufacturing plant in northern New Jersey. The Health and Safety Plan was developed to ensure safe collection, handling and transport of energetic and reactive sediment and soil samples. Contaminants of concern included TNT, nitroglycerin, nitrocellulose, HMX, RDX and smokeless powder. Served as site safety officer during field activities.
- On-site and off-site investigation activities at heavily contaminated wetland and upland areas at a former waste disposal facility in southern New Jersey (Superfund NPL site). Drilling activities were performed in Level B PPE. Contaminants of concern included PCBs, chlorinated solvents, benzene and vinyl chloride.
- The US Army Corps of Engineers (USACE) using OSHA and USACE Safety and Health (EM-385) requirements at the New Bedford/Fairhaven Hurricane Barrier in Massachusetts. This project included repairs to sector gates and rehabilitation (sand-blasting and re-painting) of barrier structures over/in water of the New Bedford Harbor. Also prepared Safety Plans for excavation and drilling at sites along the Delaware River in Philadelphia and Pennsville, NJ for evaluation of potential dredge material disposal facilities.
- Remediation activities at petroleum refineries, terminals, pipeline release sites, and other industrial sites.

Site Manager/Site Health and Safety Officer, Various Locations

Prepared plans and specifications, procured required permits, coordinated bidding process, and served as Site Manager/Site Health and Safety Officer on the following remedial construction projects:

- Excavation of 4,300 tons of metals-impacted wetland soils at a battery manufacturing facility (CERCLA site) in southern New York. Project activities included dewatering of the wetlands, operation of a batch flocculation/sedimentation wastewater treatment system, and sediment drying/bulking.
- Excavation of 4,500 tons of PCB-contaminated soils from residential and industrial properties adjacent to an active electric rail car maintenance facility (CERCLA site) in southeastern Pennsylvania.
- Excavation of 5,900 tons of PCB-contaminated soil to a depth of 27 feet below grade at a former chemical plant (ISRA site) in northern New Jersey. The project required the installation of steel-sheet piling to 55 feet, localized dewatering of two aquifers, operation of a 100 GPM groundwater treatment system, and installation of a 3-acre asphalt cap.
- Excavation of 3,600 tons of petroleum-impacted soils at a lubrication oil processing facility in central Connecticut. Impacted soils were excavated from beneath building floors and foundations and vactored from drainage structures.
- Processing of 8,100 tons of petroleum-contaminated soils at an active union refinery in Montreal, Quebec. Processing included amending the soils with drying agents, bulking agents and nutrients; pugmill blending; and particle sizing. Processed soils were loaded into aerated treatment cells to enhance bioremediation.
- Excavation of 4,600 tons of pesticide and metals-impacted soils from a former agrochemical research facility in northern Delaware. Project activities included decontamination, demolition and removal of PCB-impacted floors and drainage structures, and disposal of hazardous and non-hazardous wastes.
- Excavation of 1,000 tons of petroleum-impacted soils to a depth of 20 feet below grade at a former chemical plant in Southern New Jersey. This was a fast-tracked project that was completed in 8 weeks.

Peter Dickson, PhD, PG

Technical Reviewer

Dr. Dickson has 40-years of broad experience on a large variety of water resource projects in many parts of the world including dams for water supply and hydroelectric projects, power plants, penstocks, tunnels, caverns, pumping stations, and flood control structures. His experience includes project screening and ranking; design and supervision of geological, geotechnical, and hydrogeologic investigations; siting of project features and developing layouts and arrangements; dam type selection (fill dams, CFRD, RCC, gravity, arch dams), slope stability evaluations and slope design; landslide studies; technical training and technology transfer; determining criteria for planning, design and construction of tunnels, caverns, and dams; detailed design and contract document preparation. His work includes assessment of risk, identification and evaluation of mitigation options and alternative project arrangements, development of project cost parameters, independent technical review, and constructability review.

Relevant Project Experience

Neelum-Jhelum Hydroelectric Project, Water and Power Development Authority (WAPDA) of Pakistan

Member of senior technical review team during detailed design and construction of 960-MW hydroelectric project scheme in Himalaya foothills, Jammu-Kashmir northern Pakistan. Responsible for site visits, value engineering and technical advice to design team, technical review of underground works (28-km-long headrace and 3.5 km tail tunnels, underground powerstation complex, 300-m-high surge shaft, access tunnels), and concrete gravity dam, de-sanding chambers. Severe project challenges include major earthquake hazard (within zone of catastrophic 2005 earthquake, $M=7.6$), weak foundation materials, active fault crossings for tunnels, highly deformed and complex tunnel geology. Technical lead in evaluation of earthquake hazard using DSHA and PSHA methods for project including evaluation of reservoir triggered seismicity (RTS). Results used for development of seismic design parameters for final design including ground motion estimates, response spectra and time histories. Lead in rock stress testing, design of concrete-lined high-pressure manifold, foundation treatment and design for active fault at dam site, headrace tunnel crossing of active fault, powerhouse 3-D modeling and stress analysis.

Cerro Corona, Goldfields, Cajamarca, Peru

Member of independent technical review panel responsible for review of design, plans, and specifications for construction of 225-m-high tailings dam and related works located in high seismic hazard region in Andes. Visited project site to conduct field inspections, participated in technical review meetings with client and design team, participated in Failure Modes and Effects Analysis (similar to PFMA) of project as part of on-going Risk Analysis and Management.

Susitna Watana, Alaska Energy Authority

Advisory Input to and Review of Seismicity and Seismic Hazard, Geotechnical Investigations and Site Characterization, Reservoir Slope Stability, Geological Engineering, Rock Mechanics, and Development of Site Arrangements.

Panama Canal Third Set of Locks Projects, Panama Canal Authority (ACP)

The project consists of construction of two new lock complexes on either side of the Panama Canal (Atlantic and Pacific complexes), consisting of three new lock chambers plus an innovative water saving basin system to reduce water consumption for lock operations. The Pacific complex entrance from Gatun Lake will be formed by the construction of four zoned earth and rockfill embankment dams, each approximately 25 m high. Dr. Dickson serves as member of Independent Technical Review Board, participating in review of foundations and seismic aspects, design criteria, design procedures and analytical approaches, and submittals. From 2009-2010, Peter served as Quality Lead for Chicago Design Centre. He helped write and establish quality management procedures and processes for the design team. Prior to construction he served as the Owner's independent consultant and peer reviewer in the development of seismic criteria and assessment of risk for the project, participating in risk workshops and discussions.

EDUCATION

PhD, Geology, University of Pittsburgh

MS, Geology, University of Manchester

BS, Geology, University of Leeds

LICENSES/REGISTRATIONS

Professional Geologist:
Virginia, Wyoming,
Indiana, Georgia

Curibamba Hydroelectric Project, EDEGEL and Endesa

Served on Board of Consultants as technical expert on foundations and underground structures. Assignment involved review of hydroelectric project in final stage of design and soon entering into tender stage. Project involves two dams and intakes, combined headrace tunnel system totaling 9.6 km (either TBM or drill-blast), underground powerhouse cavern with 195-MW installed capacity. Reviewed and advised on design, construction approach and methodology. Review activities included site visit and detailed inspection of investigations and design review with Owner and its design team.

Iowa Hill Pumped Storage Project, Sacramento Municipal Utilities District (SMUD)

Lead geological engineer in re-examination of project layouts and construction costs. Prepared new revised layouts for underground works including powerstation complex, high pressure and low pressure waterways, power shaft, and upper reservoir. Participated in preparation of estimates of construction costs, constructability analysis, and scheduling. Advised on development of scope of additional site investigations. Previous work included serving as lead geologist studying the Iowa Hill Pumped-Storage scheme using existing Slab Creek Reservoir, American River, as lower reservoir. Also lead geologist studying the expansion of Icehouse Reservoir and pumped-storage development in connection with Union Valley Reservoir. Conducted field reconnaissance, developed geologic investigation program, and assisted in developing preliminary layouts and strategies for minimizing environmental impact.

Tekeze Dam, Ethiopian Electric Power Corporation

Responsible for technical review and field inspection of project works and seismic hazard on 190-high thin-arch concrete dam under construction, special focus on foundation and rock slope stability assessment, rock mechanics evaluations (including 3-D rigid block and kinematic analyses, block theory, 2-D and 3-D FEM stress and deformation analysis), rock fall simulation, rock reinforcement and anchor design, including participation in thrust-block design and left abutment remedial works (abutment replacement), review of underground works (power tunnel system and powerhouse cavern); QA of site engineering.

Dasu Hydroelectric Project, Water and Power Development Authority (WAPDA) of Pakistan

Lead geological engineer in feasibility study and design of major hydroelectric project on Indus River (4000-MW installed capacity powerhouse, 200-m-high dam). Responsible for geotechnical investigations, development of design criteria for dam, and design of underground facilities. Also responsible for direction and review of seismic hazard and geotectonics investigations and determination of seismic parameters for design, including reservoir triggered seismicity (RTS). Supervised evaluation of rock fall onto Karakoram Highway under various loading conditions including earthquake using various rock slope stability methods and rock fall simulation programs. Lead risk assessment workshop during constructability evaluation and cost estimation.

Shandong Taian Pumped-Storage Project, Shandong Taian Pumped-Storage Power Station Co. Ltd.

Consultant responsible for review and technical advice on design and construction of underground features including powerhouse cavern, transformer hall, water conveyance tunnels, power shafts, and surge chambers. Responsible for review of geology, tunnel design, assessment of stability of caverns and tunnels, and shafts; numerical analysis, excavation and support design of caverns, overall review of cavern design and construction methods; review and advise construction design of underground works, including review construction procedures and specifications; check of project construction schedule, implementation plan, and construction cost estimates. Also responsible for technical advice and review of geomembrane lining system for upper reservoir.

John C. Haapala, PE

Technical Reviewer

Mr. Haapala has 42 years of specialized experience in hydrology, hydraulics, flood studies, dam-break inundation studies, reservoir operation and power studies, engineering economics, and fisheries issues with an emphasis on computer applications. He is adept at the usage and adaptation of many existing standard hydrologic and hydraulic computer programs, and has developed a number of new application programs. He has been the hydrology lead on numerous hydrology and hydraulics studies for hydroelectric power developments worldwide. Throughout his career, he has performed Probable Maximum Flood studies and other floods studies in diverse locations including Alaska, Florida, California, Washington, and Indiana. He has performed power and operation studies of more than 100 reservoirs and power plants including complex multi-reservoir, multi-use systems. The studies were performed to determine firm water supply yield, hydroelectric generation, benefits of component sizing and the effects of alternative instream flow requirements. A normal part of the reservoir operation studies has been to determine the hydraulic losses in the penstock and tunnel conduit system. His hydrologic and hydraulic analysis experience also includes reservoir and channel flood routing, spillway sizing, gated spillway flood operations, freeboard analysis and riprap sizing for shore protection. Hydraulics experience includes the design of hydraulic structures such as spillways, energy dissipaters, developing spillway rating curves, and the static and hydraulic transient analysis of pipelines and tunnels. He has performed dam-break studies to develop inundation maps and inflow design floods for several projects including using HEC-RAS as the dam-break model with multiple downstream dams from the failed dam.

While at MWH, he has authored or co-authored 15 professional papers on hydrology, hydraulics, dam safety, and hydroelectric development topics. His broad experience in hydrology and hydraulics has been recognized at MWH with his selection as the dams and hydropower technical practice lead for hydrology and hydraulics. He has recently contributed to writing best practice guidelines for the flood hydrology dams and the hydraulic design of spillways.

Relevant Project Experience

Big Tujunga Dam Seismic Rehabilitation and Spillway Modification Project, Los Angeles Department of Public Works

Performed flood routings with HEC-1 modeling to determine the maximum reservoir level during PMF passage for this \$88M project. Performed detailed hydraulic analysis of the proposed emergency spillway including both stepped spillway and flip bucket alternatives. Estimated erosion potential below the spillway for the spillway alternatives. The final design met client needs, was accepted by the California Division of Safety of Dams and is under construction.

San Vicente Dam Design, San Diego County Water Authority

The existing 220-ft high concrete dam will be raised by 117-ft. Hydraulic design of a new stepped spillway with ogee crest and flip bucket terminus was performed. Riprap sizing and plunge pool erosion was determined. Inundation maps were developed with HEC-RAS for the 100-year flood and the PMF. Construction flood analysis was performed.

Santa Anita Dam, Los Angeles Department of Public Works

Santa Anita Dam is a 225-foot high concrete arch dam near Los Angeles built in the 1920's for flood control. Investigations were conducted to determine the adequacy of the existing spillways. Rating curves were developed for the existing spillways and routing of flood hydrographs through the reservoir was performed. The trajectory of spill and the downstream impact points were determined.

Susitna-Watana Hydroelectric Project PMF Study, Alaska Energy Authority

Watana Dam is a proposed new 700-ft-high dam on the Susitna River in Alaska that would also include a 600 MW new powerhouse. Because of the large size of the watershed (5,180 sq. mi.), a site-specific PMP was necessary

EDUCATION

MS, Civil Engineering
University of Washington

BS, Civil Engineering
University of Washington

LICENSES/ REGISTRATIONS

Professional Engineer
California No. 27907

Professional Engineer
Washington No. 19661

YEARS OF EXPERIENCE

42

and a Board of Consultants and FERC representatives reviewed the study. Because of the cold weather climate, development of the 100-year snowpack with seasonal and areal variations was necessary. A probable maximum snowpack case was also considered for the PMF. The all-season PMP included variable glacier melt contributions based on variations in temperature and wind. Unit hydrograph calibration and verification was performed. The PMF resulted from the most critical combination of the PMP and snowmelt. Hydraulic analysis of the gated spillway and outlet structures was performed. The spillway was sized to pass the most critical of all PMF cases. A climate change analysis of hydroelectric generation was performed using historic data and stochastic analysis techniques.

White Rock Penstock and Tunnel Capacity Analysis, Sacramento Municipal Utility District

This study involved performing a detailed hydraulic analysis of the White Rock power conduit system for the Sacramento Municipal Utility District. The White Rock power conduit includes 25,000 feet of both unlined and lined tunnel and about 1,500 feet of penstock of varying diameter and several other hydraulic elements including a wye branch, reducers, and valves. The hydraulic analysis resulted in a determination of the loss in full load output on the powerhouse under revised flow conditions.

Crow Dam Rehabilitation Project, Confederated Salish and Kootenai Tribes

Crow Dam is a 90-ft high embankment dam administered by the Bureau of Indian Affairs. Dam safety evaluations for this high hazard dam determined that the low-level outlet and the spillway required rehabilitation. Seasonal construction diversion floods were routed for various cofferdam heights and pumping capacities. Using risk assessment methods, the spillway design flood was selected as the 10,000-year flood. A reservoir inflow volume frequency analysis and flood routing was used to determine the risk of hazardous spillway operation prior to repairs.

Big Creek Expansion Project (BICEP), Southern California Edison

An assessment was performed of several concepts for expansion of the existing Big Creek Project. The expansion would provide additional hydroelectric generation capacity that could be used for peaking energy during peak periods of high flows and/or electrical demands. The hydraulic capacities and conduit sizes were estimated for alternative configurations that would provide additional generation. A site visit to the Big Creek facilities was also performed.

Lake Dorothy Hydroelectric Project, Alaska Electric Light and Power

The available hydrologic data was reviewed and extended by correlation after an evaluation of alternative methods of data extension. A reservoir operation model was developed to simulate operation of the storage reservoir, the tunnel and conduit system, and the powerhouse for a period of 65 years. A series of operation model runs were performed to determine the effects of alternative installed capacities and alternative reservoir operation modes.

Oroville to 39-01, Harza/Edaw Joint Venture

Hydroelectric power studies were performed at a feasibility level for five alternatives that would add new units to an existing hydroelectric project.

Upper San Joaquin River Basin Storage Investigation Feasibility Study and Environmental Impact Study/Report, USBR - Mid-Pacific Region

Reviewed model development and provided alternative ideas for model development based on extensive modeling experience. Additional improved methods were incorporated into the model. IDIQ for Water Resources Planning and Engineering - Bureau of Reclamation, Mid-Pacific Region (01CS20210B and BRPS/06CS204097B)

Snettisham Hydroelectric Project Surplus Study, Alaska Electric Light and Power, Alaska

The Snettisham Hydroelectric Project supplies a majority of the electric energy used by Juneau. The firm energy generation capability of Juneau's hydroelectric resources is about equal to the electric load. The city wanted to consider supplying various substantial amounts of electricity to a new mining operation. A power study model of the city's electric loads and hydroelectric resources was developed. The hydraulics of the two power tunnels, each over 6,000 feet long, was determined for each of the two powerhouses. The effects of supplying different amounts of electricity in different months to the mine on firm and average hydroelectric energy availability to the city were analyzed.

New Spicer Meadow and McKays Point Dam PMF Study, Northern California Power Agency

The Probable Maximum Flood (PMF) was developed at New Spicer Meadow Dam on Highland Creek, and at McKays Point Dam on the North Fork Stanislaus River. The 72-hr PMP was developed for each month at each dam using HMRs 58 and 59. The 100-yr snow water equivalent available by 1,000-ft elevation band for each month was developed based on data from several snowpack stations and a probability analysis. Unit hydrographs were

developed that resulted in excellent calibration and verification between simulated and recorded flood hydrographs. Spillway rating curves were determined for each dam. The Probable Maximum Flood was developed for all potentially critical months and routed through the reservoirs with the HEC-1 Flood Hydrograph Package.

Susitna-Watana Hydroelectric Project Operation Studies, Alaska Energy Authority

Susitna-Watana is a proposed hydroelectric project in Alaska that is currently in the project optimization and FERC licensing stage. It would include a 700-ft to 800-ft high dam, a 600 MW to 800 MW powerhouse and a reservoir with 4 to 6 million acre-feet of storage. A power study and reservoir operation model was developed in support of FERC Pre-Application Document (PAD) and project optimization and environmental studies. The model included development of 61-years of natural inflows and reservoir operations on an hourly basis to include the potential for a load-following operation. Power studies included integration of Susitna-Watana with other resources to maximize usable generation in the Anchorage to Fairbanks Railbelt area. Stochastic hydrology was used to show the range of values that is possible for firm energy and to include the potential impacts of climate change.

Selected Publications

Haapala, John C., and Bryan Carey. "Susitna-Watana Hydroelectric Project Firm Energy Analysis Under Historic and Climate Change Scenarios", HydroVision 2012 Conference Proceedings, Louisville, Kentucky, July 2012.

Haapala, John C., and Gregory L. Tate. "Conjunctive Use of Florida's Ground & Surface Waters Solves Source Water Cost Issues", *Florida Water Resources Journal*, Vol. 62, No. 2, February 2010.

Haapala, John C., and Hayes, Stan J. "Streamflow Trends and Hydropower Production in the Ohio River Basin", Waterpower XII Conference Proceedings, 2001.

Haapala, John C., and van Donkelaar, Catrin. "Long-Term Hourly Simulation of a Peaking Hydropower Project with Application to Federal Relicensing", HydroVision 2008 Conference Proceedings, Sacramento, California, July 2008.

Haapala, John C., "Forest Cover, Wind Speed, Snowmelt, and Overestimation of the Probable Maximum Flood", Association of State Dam Safety Officials Dam Safety 2004 Conference Proceedings, Phoenix, September 2004.

Haapala, John C., and Finis, Mario, "The Neglected Cool Season PMF", Association of State Dam Safety Officials Dam Safety 2006 Conference Proceedings, Boston, September 2006.

Iso-Ahola, Vik, Haapala, John C., and Lindell, James. "Physical Model Confirms Spillway Modification for Passing Increased PMF", Association of State Dam Safety Officials, Dam Safety 2008 Conference Proceedings, Indian Wells, California, September 2008.

Bernedo, Carmen E., Haapala, John C. and Arnold, Terrence A. "1-D or 2-D? That's the Dam-Break Question!", Association of State Dam Safety Officials Dam Safety 2007 Conference Proceedings, Austin, Texas, September 2007.

Mr. Chelminski is responsible for technical aspects of ecological evaluation, mitigation, and restoration analyses and designs. His work includes the development of hydrologic and hydraulic studies for integration with Stantec's skills in the ecological and biological sciences. A licensed engineer, his project experience includes ecological restoration design and monitoring, fish passage assessments, effluent mixing analyses, and dam safety evaluations, and is the engineer-of-record for more than a dozen completed small dam removal projects. He has worked on watersheds including the Allegheny, Connecticut, Deerfield, Delaware, Housatonic, Hudson, Ohio, Potomac, and Penobscot Rivers in the United States; and projects in Alberta, British Columbia, New Brunswick, Newfoundland and Labrador, and Saskatchewan, Canada.

PROFESSIONAL EXPERIENCE

- Stantec. 2007-present. Principal, Ecological Restoration Services; Restoration Engineer
- Woodlot Alternatives, Inc. 2002-2007. Division Director, Ecological Restoration Services; Restoration Engineer
- Earth Tech. 1999-2002. Water Resources Engineer
- US Army Corps of Engineers, Fairbanks, Alaska. 1995-1997. Construction Management Engineer

EDUCATION

MS, Civil Engineering, Utah State University, Logan, Utah, 1999

BS, Civil Engineering, University of Connecticut, Storrs, Connecticut, 1994

REGISTRATIONS

Professional Engineer #47167, Commonwealth of Massachusetts

Professional Engineer #PEN 0026319, State of Connecticut

Professional Engineer #10320, State of Maine

Professional Engineer #10677, State of New Hampshire

PROJECT EXPERIENCE

Dam Removal and Related Projects

Third-Party Peer Review for Pond Lily Dam Removal Project, West River, New Haven, Connecticut
Performed third-party review and owner-consultant consultation for proposed removal of Pond Lily Dam on the West River in New Haven, Connecticut. Project work included review and reporting on design and bid documents and coordination with owner, design consultant, and others to identify potential means to reduce project costs.

Third-Party Peer Review for Dam Removal Studies, Saranac River, New York

Technical lead for a peer review of sediment transport evaluations and proposed sediment management plans for removal of Imperial Dam on the Saranac River in Plattsburg, New York. Work was contracted to the State of New York.

Preparation of White Paper on Dam Removal, Confidential

Technical lead for development of a white paper presenting opportunities and constraints for dam removal as part of ongoing work on a CERCLA site.

Development of Dam Removal and Bypass Channel Fact Sheets and Construction BMPs, Fisheries and Oceans, Canada

Contributor for development of fact sheets and construction best management practices for dam removal and bypass channels at small dams in Ontario, Alberta, Saskatchewan, and Manitoba.

Peer Review and Comment for Downstream Fish Passage as Part of Proposed Hydroelectric Development, South Fork Skykomish River, Washington

Peer review and comment on evaluation of downstream fish passage at proposed Sunset Fish Passage and Energy Project. Services were performed under contract to a stakeholder and included review, evaluation, and commenting on three-dimensional, computational fluid dynamics model developed by others.

Michael R. Chelminski PE

Technical Reviewer

Dam Removal Evaluation and Design, CFB, Gagetown, New Brunswick

Performed evaluations and developed preliminary design for removal of a dam in the Canadian Forces Base Gagetown in New Brunswick. Work included a site visit, participation in dam owner meetings, and development of preliminary design materials and reporting.

Roughbark Dam Removal Evaluation, Saskatchewan

Technical lead for evaluation for removal of Roughbark Dam in Saskatchewan, Canada. Project work included site visit, owner consultation, and reporting.

Third-Party Review for Post-Dam Removal Evaluation of Impact to Infrastructure, Quinnipiac River, Connecticut

Technical lead for third-party review of potential impacts to a utility crossing following a dam removal and development and evaluation of conceptual alternatives to mitigate impacts.

Ballville Dam Removal, Ohio

Responsible for study scoping, field assessment, sediment transport and hydraulic evaluations, and support for preparation of an environmental impact statement for the proposed removal of Ballville Dam on the Sandusky River.

Phillipston Reservoir Dam Removal Project, Phillipston, Massachusetts

Engineer of record and technical lead for dam removal as part of fish habitat restoration project. Project work included design, permitting, and construction-phase services for dam removal completed in 2012.

Milbournie Dam Removal, North Carolina

Performed field assessment, preliminary assessment, and preliminary design review for the proposed removal of Milbournie Dam on the Neuse River near Durham, North Carolina.

Sackett Brook Restoration Project / Gravesleigh Pond Dam Removal, Pittsfield, Massachusetts

Technical lead for design, permitting, and construction-phase support for aquatic and riparian habitat restoration project involving the removal of a dam and bridge. Dam removal was completed in 2013.

Due Diligence Evaluation of Fish Passage at Hydroelectric Generating Facilities, Canada

Technical consultant for due diligence evaluation of technical and regulatory evaluation of upstream and downstream fish passage and associated regulatory issues at multiple existing hydroelectric facilities.

Bartlett Rod Shop Company Dam Removal, Pelham, Massachusetts

Lead engineer for scoping and design for removal of a 20-ft tall dam on Amethyst Brook. The project dam is privately owned and in poor condition; removal was selected by the dam owner. Project work included development of detailed engineering plans, specifications, bid documents, and bidding services. Project dam removed in 2012. Performed post-action monitoring and construction contract close-out through 2014.

Penobscot River Dam Removals: Great Works Dam Removal Fish Passage Study, Maine

Project manager and technical lead for numerical modeling and fish passage evaluation during and after staged (multi-year) removal of Great Works Dam. Project work included development of two-dimensional hydraulic models of nine removal scenarios.

Penobscot River Dam Removals: Howland Dam Bypass Channel Fish Passage Study, Maine

Project manager and technical lead for evaluation of upstream fish passage at a proposed bypass channel. Project work included development of two-dimensional hydraulic model, bathymetric surveys, tidal and riverine stage data acquisition, and wetland impacts assessment.

Penobscot River Wetland Resources Restoration Assessment, Maine

Project manager and technical lead for evaluation of post-action restoration of wetland resources in two former impoundments following dam removal and a third impoundment where a hydroelectric generating facility will be decommissioned, thereby altering impoundment hydrologic regime.

Michael R. Chelminski PE

Technical Reviewer

Reconnaissance Surveys and Reporting for Dam Removal, Massachusetts Division of Ecological Restoration, 2006-2015, Massachusetts

Performed reconnaissance surveys and associated reporting at over 50 dams to evaluate potential for dam removal under contract to the Massachusetts Division of Ecological Restoration.

Peer Review of Fish Passage Design, New Brunswick

Performed peer review and site visits for a fish passage facility that was constructed as HADD compensation on a tributary to the Magaquidavic River in New Brunswick.

Royal River Restoration Studies, Yarmouth, Maine

Project manager and technical lead for multiple studies evaluating the potential for restoration of aquatic resources and potential impacts to infrastructure associated with two dams on the Royal River in Yarmouth, Maine. Study components included delineation of natural resources, assessment and review of existing infrastructure, sediment sampling, hydraulic modeling, reporting, and stakeholder engagement, including presentations at multiple public meetings. Evaluated alternatives to date have included no action, improved technical fish passes, and dam removal.

Montsweag Brook Restoration Project, Wiscasset, Maine

Project manager and technical lead for dam removal and native diadromous fish species habitat restoration project as part of Natural Resource Damage Restoration Plan and Settlement Agreement for closure of the Maine Yankee nuclear power facility. Project work included preparation of a feasibility study incorporating a full range of biological and engineering evaluations, public participation, impact assessments, restoration options, fish pass studies, hydraulic modeling, and permit planning. Dam removal construction was initiated in September 2010.

Rattlesnake Brook Dam Removal Study, Freetown, Massachusetts

Project manager and technical lead for preliminary dam removal design study for removal of a dam on Rattlesnake Brook in Freetown, Massachusetts. Project work included field studies to evaluate existing conditions, collection of tidal stage data seaward from the dam, and development of preliminary design materials for removal of the dam and integration of a new stream channel with downstream infrastructure constraints.

Orland Village Dam Alternatives Feasibility Study, Orlando, Maine

Project manager and technical lead for feasibility study for evaluation of potential actions related to a deteriorated dam in Orland, Maine. Project work included field assessment, desktop studies including hydrodynamic analyses, preliminary regulatory agency coordination, reporting, and stakeholder coordination. Evaluated alternatives included no action, reconstruction of the dam, modifications to existing fish passage systems, and preliminary design of improved fish passage systems.

Thunder Brook Restoration Project, Cheshire, Massachusetts

Project manager and technical lead for dam removal and culvert replacement for fish habitat restoration project. Project work included a full range of biological and engineering evaluations, public participation, impact assessments, restoration options, fish pass evaluations, hydraulic modeling, permit planning, and construction observation. Project completed in 2012.

Little River Dam Removal, Lisbon Falls and Topsham, Maine

Responsible for conceptual design through final design and permitting for removal of a remnant industrial water supply diversion dam, allowing native fish species access to historical spawning and rearing habitat. This work included coordination of a site survey and the preparation of a Phase 1 environmental site assessment. Dam was removed in 2009.

Ox Pasture Brook Dam Removal, Rowley, Massachusetts

Project manager and technical lead for dam removal feasibility study including development and analysis of proposed conditions using unsteady-state HEC-RAS model. Work included scoping and execution of all components of study. Dam removal was complete in 2009.

Sediment Capping and Dam Removal Design, Massachusetts

Project hydraulic engineer for development and evaluation of riverine sediment cap design and conceptual dam removal scenario for a contaminated site restoration. Performed hydraulic analysis to determine riprap sizing, channel morphology, and dam breach size using Flow-3D.

Michael R. Chelminski PE

Technical Reviewer

PUBLICATIONS

Presentation: Interpretation and Analysis of Tidal Stage Data for Tidal Restriction Project. *Restore America's Estuaries Conference*, 2009.

Presentation: Hydraulic and Fish Passage Modeling of a Proposed bypass Channel on the Piscataqua River at Howland Dam. *Diadromous Species Restoration Research Network Symposium*, University of Maine, Orono, Maine, 2009.

Presentation: Integration of CAD Design with Multi-Dimensional Hydraulic Modeling for Stream Restoration. *Southeast Regional Stream Restoration Conference*, 2009.

Dennis E. Dorratcague, PE

Technical Review

Mr. Dorratcague has over 40 years of specialized experience in fish passage projects on the west coast for irrigation, power, and municipal projects. Mr. Dorratcague was the key developer of the Vee-type fish screen for screening large canal diversions. Working with Milo Bell in the mid-1980's, he developed the concept and led the design of the first two Vee-shaped structures that were constructed in the early 1990's. He is past president of the Bioengineering Section of the American Fisheries Society. Mr. Dorratcague has been working in the field of hydrology and hydraulics since 1972. His main areas of concentration have been hydraulic structures, fisheries engineering, computer modeling of hydrology and hydrodynamics.

Relevant Project Experience

Steelhead Fish Passage Study, United Water Conservation District, Santa Paula, CA

The United Water Conservation District was sued by California Trout concerning passage of endangered steelhead at Freeman Dam on the Santa Clara River near Ventura. As part of the litigation agreement, a group of independent experts was convened to provide fish passage concepts at the dam. Mr. Dorratcague was a member of the panel of experts. Through deliberations and meetings with the District and NMFS, a series of possible solutions were proposed and was a report written. The report and its findings were adopted by both parties.

California Delta Fish Facilities, California Department of Water Resources. Mr. Dorratcague served as a member of the Clifton Court Forebay Fish Facilities Technical Advisory Team (CCFTAT) since 1997 and the North Delta Cross-Channel Technical Team. In these positions he worked with other experts to advise DWR in the design of the up to 15,000 cfs fish intakes on the Sacramento River for the Delta Conveyance project. He also provided concept designs for a Low-Flow Fish Screen at Clifton Court Forebay for California DWR and a group of state water contractors.

Los Padres Dam Sediment Removal Study, CalAm

Mr. Dorratcague provided input to the study team concerning fish passage issues and facilities during the study.

Banta Carbona Fish Screen Project, Banta Carbona Irrigation District. Technical Manager for the fish screen feasibility study for a 250 cfs Vee-shaped fish screening installation on a diversion off the San Joaquin River near Tracy, California. In addition to screening for chinook juvenile salmon, other endangered or proposed for listing species were considered. In addition to three screening alternatives, the study included consideration of obtaining water from other sources during critical fish migration periods. Meetings were held with federal and state fisheries agencies to discuss criteria and design specifics. The project was designed and built taking into account the special designs to alleviate the sedimentation problem at the screens. The project was tested with juvenile salmon and delta smelt with no effects on these fish. The facilities have been operating successfully and protecting migrating fish for the last six years.

Technical Reviewer, Intakes for the City of Sacramento, CA. Mr. Dorratcague provided technical review for the two intakes for the City of Sacramento. One is an expansion of an existing 310 cfs intake on the American River to meet new fish protection criteria. The second intake is on the Sacramento River and has a 280 cfs capacity. Both intakes are towers built in the rivers containing pumps and their controls.

Glenn-Colusa Fish Screen Project, Glenn-Colusa Irrigation District. Glenn-Colusa Irrigation District (GCID) representative on the Constructability Committee for the design and construction of the 3,000 cfs GCID fish screens on the Sacramento River in California. This three-member committee was charged with reviewing the design and construction of the \$70 million project. He also wrote the initial fish screen evaluation plan for the project.

EDUCATION

MS/MSc, Civil Engineering, Colorado State University

BS/BSc, Aerospace Engineering, University of Notre Dame

LICENSES/REGISTRATIONS

Professional Engineer – (Civil) CA, WA

MEMBERSHIPS/AFFILIATIONS

American Fisheries Society

American Society of Civil Engineers

White River Fish Screen Project, Puget Sound Energy. Project Manager for the hydraulic modeling, preliminary and final designs, and construction services of a 2,000 cfs fish screen on a power canal on the White River in Western Washington. The project consists of a Vee screen structure 250-feet long 70-feet wide and 20-feet high. The bypass system incorporates a chute and a high-density polyethylene bypass pipeline to carry fish back to the White River. The White River drains the White Glacier on Mt Rainier and carries large quantities of sediment. In addition to the sedimentation basins, the design included a sediment re-suspension system in the fish screen area.

Lake Cushman Floating Surface Collector, Tacoma Power. Project Manager. MWH was responsible for design of the guide nets, net transition structure (NTS), and 244 cfs floating surface collector (FSC). The full-depth guide net is over 200 feet deep and 1,400 feet long. It is designed to guide fish to the entrance of the NTS. The NTS accelerates flow to capture the fish at full flow in the NTS and is over 100 feet long and 34 feet wide. The FSC is 91 feet long and 48 feet wide and weighs about 350 tons. Mr. Dorratcague led the team that produced plans and specifications for these facilities and worked with Tacoma Power who designed some mechanical equipment and shore-side facilities.

Cowlitz Falls Fish Passage Concept Design Report, Tacoma Power. Member of an expert panel led by Tacoma Power to develop concept designs and a Concept Design Report for new downstream fish passage at Cowlitz Falls Dam in Washington. Working with Tacoma Power, he developed fish passage concepts including vertical plate screens, floor screens, and a weir box fish attraction concept. He managed the design of two experimental weir boxes for installation in spillways on the dam, attended meetings and negotiations with the resource agencies for final passage concepts.

Landsburg Fish Passage Project, Seattle Public Utilities. Technical manager for the preliminary and final designs of the fish passage facilities at the Landsburg dam and intake on the Cedar River. This work for Seattle Public Utilities included a 425 cfs automated Vee fish screen facility, a fish ladder over Landsburg Dam, an adult sorting and holding facility, and a rock weir passage over the aqueduct crossing. Design features included intake improvements with sediment exclusion, dam stability upgrades and seismic strengthening of the aqueduct crossing. An overflow tilting weir gate was also designed to pass juvenile salmonids over the 14-foot high Landsburg Dam. Passage facilities were designed for coho, sockeye, steelhead and endangered Chinook salmon and bull trout.

Clallam-Cline Intake and Fish Screen, Jamestown-S'Klallam Tribe. Project Manager for the design and construction of a new intake and fish screen structure on the Dungeness River in Washington replacing an infiltration type intake. The project was sponsored by the Jamestown S'Klallam Tribe, local irrigation companies and the Washington Department of Fish and Wildlife, who designed and furnished two belt screens. Services included the design of the river intake and pipeline modifications and construction support services.

Wapatox Canal (Naches) Fish Screen, PacifiCorp. Project Manager for the preliminary and final design of a fish screen facility for Pacific Power and Light Company. The 500 cfs capacity screen is located in the Wapatox Canal on the Naches River in Washington. The facilities included vertical wedgewire screens, automatic cleaning systems, trashrack and automatic rake, fish bypass system, and an expanded river intake. Unique design features include special cold weather protection and mining a new tunnel conduit under a State highway embankment.

A-Canal Fish Screen, Klamath Irrigation District. Project Manager for the feasibility study, design and construction support services of a 1,100-cfs vee-shaped fish screen on the A-canal diversion for Klamath Irrigation District in Southern Oregon. The screen design consisted of primary and secondary screens, automated cleaning systems and two fish bypasses. One bypass included a fish friendly pump and bypass back to Upper Klamath Lake. The other bypass required a 2400-foot long gravity flow pipeline carrying the fish to below Link River Dam. A fish evaluation station was incorporated into the pumped bypass line. An automated headgate system for the canal was also designed to automatically control flows into the irrigation canal. The screen and bypass system was tested and found to keep fish out of the canal and have no effect on fish transiting the screen and bypass system.

Walterville Fish Screen and Tailrace Barrier, Leaburg Ladder, Eugene Water and Electric Board
Technical Manager for the design of a new fish screen, ladder, and tailrace barrier in Western Oregon. The screens were designed in a three-Vee layout to screen salmonid fry from a 2,575 cfs flow in a power canal. The ladder project involved replacement of a non-functioning ladder over the dam with a vertical slot fish ladder. The tailrace barrier work involved studying a number of options to prevent migrating adults from traveling up a 2-mile long

tailrace to the power plant. Fixed, floating, and movable pickets and a velocity barrier were studied as well as auxiliary water facilities to attract the fish back to the river. The fish screen and bypass have been tested and found safe for juvenile salmonids passing through them.

Cabinet Gorge Fish Passage Facility, AVISTA Energy

Project Manager for the preliminary and final design of the adult fish passage trapping and collection facility at Cabinet Gorge Dam on the Clark Fork River in Idaho. The facility is design to trap endangered bull trout and other species, separate the species, and transport bull trout to their native streams upstream. The structure is located near the spillway and specifically designed to withstand the turbulence and wave action during flood conditions. The works that were designed included a fish ladder and trap structure, 35 by 80 feet by 28 feet high, a crane and bucket system for transferring fish to a tanker truck, and a holding and sorting facility located at an exsisting hatchery a mile away.

Quality Control Reviews at Fish Hatcheries, Washington Department of Fish and Wildlife and US Fish and Wildlife Service

Mr Dorratcague provided the quality control reviews for the designs at three fish hatcheries. These were Keta Crisp Creek Hatchery, Devils Pupfish Refugium, and Voights Creek Fish Hatchery Replacement

Nelson Kawamura, PhD, PE, GE

Geotechnical Engineering

Dr. Kawamura has 39 years of experience as a geotechnical engineer in civil, mining and geo-environmental engineering projects in the U.S. and abroad, including 30 years of experience in dams and appurtenant structures, hydropower facilities and tunnels; possesses experience in subsurface investigations, analysis and design, and construction QA/QC; worked on all design phases of dam, spillway, powerhouse and tunnel rehabilitation projects; is experienced in dynamic analysis of tunnels and dams; led design and quality control of earthwork projects including compaction control of embankment fill materials. Has expertise in dam safety engineering in conformance with FERC and DSOD requirements.

Relevant Project Experience

Priest Rapids Dam Project – Grant County Public Utility District, WA

Lead Geotechnical Engineer/Project Technical Lead – Reviewed scope of geotechnical services for Phase IV liquefaction potential and post-earthquake stability and deformation analyses of a zoned earth embankment composed of a central vertical impervious core flanked by pervious shells founded on potentially liquefiable granular alluvial deposits located on the right abutment. Developed guidelines for dynamic FLAC 2D analysis on the 25-foot tall right embankment dam to estimate seismic displacements at the end of ground shaking and post-liquefaction reconsolidation settlement. Supervised and reviewed liquefaction potential analysis, numerical modeling and geotechnical report. Reviewed pre-conceptual level alternatives proposed for seismic mitigation. Led the feasibility study of six seismic mitigation alternatives for the right embankment dam, including design criteria, seepage analysis, static and seismic analyses, drawings and feasibility report in conformance with the requirements by the owner, owner's Board of Consultants and FERC (Board members are Ross Boulanger, Lee Harder and Lelio Mejia). Currently is developing alternatives of connection details of the existing and new embankment dams in consultation with specialty contractors and cofferdam alternatives.

Wanapum Dam Project – Grant County Public Utility District, WA

Geotechnical Reviewer/Lead Geotechnical Engineer – Reviewed scope of geotechnical services for Phase IV liquefaction potential and post-earthquake stability and deformation analyses of a 100-foot tall zoned earth embankment composed of a central vertical impervious core founded on basalt flanked by pervious shells founded on potentially liquefiable granular alluvial deposits located in the river-closure section. Reviewed liquefaction potential analysis, dynamic FLAC 2D seismic deformation analysis and geotechnical report. Evaluated spillway foundation conditions using available borings and reviewed geological and geotechnical investigation program.

L. L. Anderson Dam - Spillway Modification, Placer County Water Agency, CA

Geotechnical Reviewer - Assessed and performed internal technical review of geotechnical data report, geotechnical interpretive report, geotechnical baseline report, and slope stability analysis for \$2.9M of engineering services. Checked if documents met or exceeded the scope of work and design criteria approved by the client. Work met project schedule and budget. Dr. Kawamura reviewed geotechnical design of spillway modification on granodiorite. He provided technical oversight for rock excavation design, development of geotechnical parameters, slope stability analysis, nominal dam raise, parapet wall design along the 2,700-foot long dam crest, compaction requirements, and grout curtain design.

Power Tunnels, Ruskin Powerhouse Improvements – BC Hydro, Canada

Geotechnical Task Leader - Dr. Kawamura developed guidelines for dynamic FLAC 2D analysis on transverse sections of power tunnels and uncoupled FLAC 2D and SAP2000 3D analyses on longitudinal section. He supervised numerical modeling of 21-foot ID concrete lined sections in massive diorite and 19-foot ID steel lined sections in highly fractured diorite and glacial deposits. He prepared technical memorandum on liner leakage analysis and leakage repair with fiber reinforced polymer sheets and sub-drainage. He prepared technical memorandum on permanent seismic deformations in concrete and steel liners, and seismic liner retrofitting. He prepared drawings for tunnel liner leakage repair, and reviewed seismic stability analysis of cut slope and intake structure, and geotechnical specifications including earthworks and compaction requirements. Is currently providing technical support for the BC Hydro representative on-site for soil excavations and compaction of drainage blanket materials.

EDUCATION

PhD, Civil Engineering,
University of Illinois, 1998

MS, Civil Engineering,
University of Illinois, 1991

BE, Civil Engineering,
University of Sao Paulo,
1977

LICENSES/ REGISTRATIONS

Professional Engineer,
Civil, California No. CE
65685, 2003

Professional Engineer,
Civil, Michigan No.
6201048591, 2002

Professional Engineer –
Geotechnical, California
No. GE 2868, 2010

Big Tujunga Dam Seismic Rehabilitation and Spillway Modification – Los Angeles County Department of Public Works, CA

Geotechnical Reviewer - Dr. Kawamura reviewed seismic rehabilitation design of a 250-foot-high arch dam for flood control founded on jointed granite. The project included concrete buttress on downstream face of the existing dam, new spillway at the dam crest, and downstream slope stabilization. He reviewed optimization of rock anchor design based on geological mapping of the exposed rock surfaces, assessed dam foundation capacity, and evaluated consolidation grouting program within the footprint of concrete buttress. He also reviewed geotechnical reports and memoranda.

Shasta Dam Raise Impacts on PG&E's Pit 7 Development – USBR, CA

Lead Geotechnical Engineer - Evaluated potential adverse effects of the Shasta reservoir raise between 8.5 and 20.5 feet on PG&E Pit 7 project using available drawings, boring logs, photographs and publications. Evaluated at conceptual level 3 possible impacts of the reservoir raise on Afterbay reservoir shoreline between Pit 7 Dam and Afterbay Dam located some 1.8 miles downstream of Pit 7 Dam, i.e., surface erosion along the Afterbay reservoir shoreline; slope instability over the Afterbay reservoir shoreline due to rapid drawdown of Shasta reservoir; and instability of Pit 7 powerhouse due to increase in uplift pressure.

Wanapum Spillway Repair Project – GCPUD, WA

Lead Geotechnical Engineer - Dr. Kawamura evaluated spillway foundation conditions using available borings and reviewed geological and geotechnical investigation program. He reviewed new boring logs in rock and concrete, results of laboratory tests in rock cores and water samples, and geotechnical report. He prepared technical memoranda on post-tensioned 2,144-kip multi-strand anchors and 581-kip bar anchors grouted in basalt for spillway monolith stabilization. He evaluated potential grout curtain deterioration, analyzed geotechnical instrumentation data, and reviewed drawings. The work was done working closely with FERC and owner's Board of Consultants.

Santa Anita Dam Spillway Modification Project – Los Angeles County Department of Public Works, CA

Geotechnical Reviewer - Reviewed geotechnical design criteria, geotechnical investigation program, geotechnical investigation report, geotechnical engineering calculations, drawings and specifications for the proposed generator, fuel and garage building. Reviewed site reconnaissance memorandum, surface erosion mitigation alternatives and geotechnical engineering calculations for high water tank erosion evaluation.

Calaveras Dam Replacement – San Francisco Public Utilities Commission, Sunol, CA

Senior Geotechnical Engineer - Dr. Kawamura designed initial ground support systems consisting of steel plates, shotcrete layer, and dowels for a 22-foot-diameter inlet/outlet shaft and 10-foot-diameter adits in Temblor sandstone and underlying Franciscan Melange formation. He supervised and reviewed analysis and design of a 26-foot-high shotcrete-faced retaining structure anchored in Franciscan formation. He also supervised and reviewed dynamic (FLAC 2D) analysis and foundation design of a 46-foot-high spillway gravity wall anchored in rock to resist seismic effects. He reviewed dynamic FLAC analysis of 200-foot deep permanent spillway excavation. He prepared technical memoranda and supervised preparation of civil design drawings.

Rio Blanco Dam – Puerto Rico Aqueduct and Sewer Authority, PR

Senior Geotechnical Engineer/Geotechnical Resident Engineer – Supervised subsurface investigation program consisting of borings, field and laboratory tests, and piezometer installation. Analyzed slope stability of a 115-foot deep excavation in weathered granodiorite for construction of spillway. Performed independent technical review of off-stream reservoir project (layout and cross-section optimizations) consisting of a compacted earth dam of 4,300 feet in crest length and 65 feet in maximum height founded on alluvial deposits with artesian groundwater sitting on residual soil of granodiorite. Reviewed design of intake tower on weathered volcanoclastic rocks. Assessed geologic faults crossing the reservoir area. Performed finite element dynamic deformation analysis to evaluate the benefits of stone columns to minimize liquefaction and reduce permanent seismic deformations. Conducted finite element seepage analysis to evaluate the benefits of cutoff slurry trench to reduce flow rates through alluvial sand. Served as a geotechnical resident engineer during foundation treatment and embankment dam construction.

Australia Pacific Liquefied Natural Gas (APLNG) Upstream Phase 1 – Origin Energy, Australia

Geotechnical Reviewer – Reviewed boring and laboratory test program for embankment foundations, bottom of reservoir and borrow areas at the Reedy Creek site. Directed and reviewed limit equilibrium slope stability and finite element seepage analyses of 30-foot tall pond earthfill embankments at the end of construction, maximum normal operation, rapid drawdown and during design earthquake in Condabri, Reedy Creek, Talinga and Spring Gully sites including development of geotechnical input parameters. Supervised and reviewed preparation of technical memoranda on geotechnical data and analysis. Performed technical review of earthwork specifications, geotechnical

drawings and technical memorandum on stabilization of dispersive soils derived from residual soils of sandstone/siltstone/mudstone/claystone, and alluvial deposits. Reviewed text for geotechnical sections of design plan reports.

RS-Sta 1W Expansion #1 Project – South Florida Water Management District, FL

Geotechnical Reviewer – Provided guidance to the technical staff on seepage analysis and limit equilibrium stability analysis of 15-foot deep canal slopes and 10-foot tall pond embankment slopes in peat, loose sand and limestone totaling 60,000 feet in length each at the end of construction, normal operation, maximum flood with hurricane, and rapid drawdown. Reviewed calculations of seepage rates, exit hydraulic gradients, and uplift pressures, liquefaction potential analysis, and settlement calculations. Reviewed seepage and stability analyses technical memoranda.

Thornton Composite Reservoir – MWDGC, Chicago, IL

Senior Geotechnical Engineer - Dr. Kawamura supervised finite element transient seepage analysis to characterize the seepage regime in a 2,700-foot long dam comprised of a wall of in-situ dolomitic limestone during cyclic reservoir operation. He assessed piezometric heads on upstream face of the dam to be used in stability analyses of individual joint-bound rock blocks identified by geologic mapping. He evaluated the effect of reservoir drawdown downstream of the drainage curtain.

Los Padres Dam Sediment Removal Feasibility Study – California American Water, CA

Geotechnical Reviewer – Provided geotechnical support for earthworks including soil properties and required embankment slopes.

Martina Gelo, PE

Civil Engineering

Martina Gelo is civil/structural engineer with 15 years of experience in structural design and analysis for water resources, mining, and natural gas engineering projects. She is proficient in civil/structural analysis, calculations, design; drafting, material take offs and cost estimating. Her experience includes design and analysis of variety concrete foundations (equipment foundations, building foundations, pipe support foundations), concrete retaining walls, culverts, bridges, concrete boxes, pump intake structures, structural steel platforms and support structures. Martina also has experience with open channel and pipe hydraulics, hydrology analysis, grading design, and piping design.

Relevant Project Experience

WATER RESOURCES ENGINEERING

Moccasin Penstock Rehabilitation Project, Tuolumne County, California

Client Name: San Francisco Public Utilities Commission

Engineer responsible for existing concrete saddles and coating rehabilitation as well as project constructability assessment.

Don Pedro Project, Stanislaus County, California

Client Name: Turlock Irrigation District

Structural engineer for stability evaluation of existing Powerhouse.

Santa Anita Dam Spillway Modification Project, Los Angeles County, California

Client Name: Los Angeles County Department of Public Works

Structural engineer for detail design and retrofit of dam outlet platform, retaining wall, and building foundations in high seismic area.

River Intake Structure, Sweeny, Texas

Client Name: Phillips 66

Structural engineer for preliminary and detail design of 60 ft high concrete pump intake structure on the bank of Saint Bernard River, Sweeny, Texas.

Burdelj Reservoir Project– Basic Engineering, Croatia

Client Name: Country of Croatia

Responsible for design of dam structures (body of dam, spillway, drop inlet spillway, conduit, chute spillway, stilling basin and other structures).

Developed similar project in 2004. Slanac Reservoir and Lipovacka Gradna Reservoir and Rudarska Gradna Reservoir in 2005.

Londza Reservoir – Phase 2– Detailed Engineering, Croatia

Client Name: Country of Croatia

Responsible for structural analysis of dam reinforced concrete parts, as well as for designing and drafting of all structures, made all quantity calculations and cost estimates in project, also worked on phase 1 of this project in 2004.

CIVIL/STRUCTURAL MINING ENGINEERING

Homestake-McLaughlin Mine, Water Management, Pump-back System, Trade off Study, Lake County, Northern California

Client Name: Barrick Gold

Responsible for developing trade off study of feasible options for retrofitting pump back system from existing mine pit, over existing dam to tailings lake in high seismic area.

EDUCATION

MEng, Civil, University of Zagreb, Faculty of Civil Engineering, Croatia

LICENSES/ REGISTRATIONS

P.E. California (C 83278)

ISO 9001:2000 Quality System Auditing

YEARS OF EXPERIENCE

15

Homestake-McLaughlin Mine, Mine Closure Water Management, Barker Pump-back System Design, Lake County, Northern California

Client Name: Barrick Gold

Responsible for detail design and retrofitting of pump back system in high seismic area. Project involved seismic evaluation and retrofitting of existing structures (tank, access bridge, pump station) as per current California seismic code requirements.

Quebrada Blanca Phase 2 Tailings - Detailed Engineering, Chile

Client Name: Teck

Structural discipline lead for tailings disposal and reclaim systems design in high seismic area. The project involved the structural design and analysis of tank foundation, tailings distribution boxes, pump intake structures, pump foundations, pipe supports, and structural steel platforms.

Relincho Project Feasibility Study, Chile

Client Name: Teck

Structural discipline lead for tailings disposal and seepage water reclaim systems design in high seismic area. Also responsible for tailings disposal and seepage water reclaim systems process area drawings. The project involved the structural design of tank foundation, tailings distribution box, pump intake structure, pump foundations, pipe supports, structural steel platforms and cyclone support structure.

Barrick Cortez Hills Tailings Pumping and Piping Project– Detailed Engineering, Nevada, USA

Client Name: Barrick Gold

Civil/Structural engineer for civil and structural detail design of pump station, tailings and reclaim water pipelines. The project involved the structural design of pump foundations and pipe supports, building foundations, procurement of structural steel pump building, pipelines design.

Khouribga Phosphate Ore Pipeline System– Basic Engineering, Morocco

Client Name: OCP Group

Civil/Structural engineer for civil and structural design of pump stations, head stations, valve Stations and terminal station.

Connie Wong, PE

Civil Engineering

Ms. Wong is a civil engineer with over five years of project experience. She assists in the civil design of wet infrastructure projects involving dams, powerhouses, and canals. Ms. Wong also has a focus in geotechnical engineering and assists in the geotechnical and slope stability analyses of projects involving landslide mitigation, water treatment pond design, reservoir evaluation, and sediment storage facilities.

Relevant Project Experience

Santa Anita Dam Spillway Modification Project, Los Angeles County Department of Public Works, California

Civil/Geotechnical Engineer - This project features the augmentation of the spillway capacity of Santa Anita Dam to meet the requirements of the upgraded Probable Maximum Flood, valve replacement, water system replacement, and a new garage, generator, and fuel supply tank. Ms. Wong assisted in the civil design of various features including the hoist tail tower platform, construction vehicle ramps, spillway notch, spillway impact area armoring, access road drainage and expansion and prepared design drawings in AutoCAD. Ms. Wong also helped develop the geotechnical report for the new garage, generator, and fuel supply buildings and performed geotechnical calculations for the scarp repair gabion wall design.

Big Tujunga Dam Seismic Rehabilitation and Spillway Modification, Los Angeles County Department of Public Works, California

Civil Engineer - This project features the seismic retrofit of an existing concrete arch dam including placement of mass concrete to thick arch section, construction of a new valve, and installation of new outlet penstocks and valves. Ms. Wong redesigned the drainage grading plan for the powerhouse patio, reviewed project submittals, assisted in the analysis and design of drill holes, revised design drawings in AutoCAD and MicroStation to incorporate as-built details, and developed the construction summary report. Ms. Wong also performed civil design for the underground utility improvement, including the design of the new water routing system and the alignment of the trench for the electrical and water lines. Ms. Wong developed the civil drawings in AutoCAD and Civil3D for the underground utility improvement, assisted in writing specifications, and developed the bill of materials for the civil work.

Tulloch Hydroelectric Project 3rd Unit Addition, Tri-Dam Project, California

Civil Engineer - The project at Tulloch Dam features a new powerhouse with a 7-MW turbine-generator, penstock bifurcation at the existing outlet valves and access road which includes the installation of 3 culverts. The powerhouse covers an area of 32 ft. by 48 ft. and a depth of 73 ft. into the rock. Ms. Wong assisted with writing weekly reports, performing tests, analyzing monthly pH data, reviewing and processing submittals and RFIs, crack mapping of the access road, and revised design drawings to incorporate as-built details.

Waste Management Unit 32 Closure Studies and Interim Corrective Action, Avon Remediation Team, Tesoro Golden Eagle Refinery, California

Civil/Geotechnical Engineer - MWH performed investigations to collect soil and groundwater treatability information to support closure of Waste Management Unit 32 (WMU 32) in order to evaluate the feasibility of closure alternatives, develop a design basis and process design report for the most cost-effective approach, and finalize the closure design. MWH also developed a corrective action approach to treat the contaminated soil underneath the site. Ms. Wong helped developed general, civil, and mechanical design drawings in AutoCAD and helped design the final grading plan for the project. Ms. Wong assisted in the geotechnical investigation, analyzed boring logs, CPTs, and laboratory tests to determine material properties, and performed calculations for primary and secondary consolidation for the waste management unit.

Willow Island Hydroelectric Project, American Municipal Power, West Virginia

Civil/Geotechnical Engineer - Willow Island is one of four hydroelectric plants along the Ohio River that MWH has designed for American Municipal Power. A cofferdam was constructed to allow dry excavation and construction of the Willow Island powerhouse. Ms. Wong helped perform the slope stability computations for the rock anchor load analysis for excavation support to determine the difference in required rock anchor force due to the difference in rock strengths assumed by MWH and the design-build contractor.

EDUCATION

BS, Civil Engineering,
University of California,
Berkeley

LICENSES/ REGISTRATIONS

Professional Engineer
(PE) - California – C83417

Moccasin Penstock Rehabilitation Project, San Francisco Public Utilities District, California

Civil Engineer – This project consists of rehabilitation work to an existing penstock for the Moccasin Hydroelectric Project. Ms. Wong assisted with the design of civil drawings, analyzed the material property analysis results for the existing penstock and determined the feasibility of using a helicopter to bring the new penstock bifurcation up to the site.

Hell Hole Dam Outlet Works Upgrade, Placer County Water Agency, California

Civil Engineer – This project consists of upgrading the outlet works at Hell Hole Dam to be able to meet the daily instream flow, spring time pulse flow, and down ramp of spill flow goals and license conditions mandated by FERC, as well as other requirements stated by PCWA. Ms. Wong performed a HEC-RAS hydraulics analysis for the downstream channel to determine the discharge rate and other conditions that lead to backwater and fixed cone valve inundation, in order to determine the flow limitations of the existing channel and to determine the channel recontouring required to discharge the FERC license target flow and keep the backwater curve below the finished floor elevation of the existing powerhouse.

Ruskin Powerhouse Improvements Project, BC Hydro, Canada

Civil Engineer – This hydropower plant was built in 1930. MWH is to evaluate if the powerhouse structure and 3 power tunnels meet the current seismic design criteria and to detail seismic retrofitting solutions as needed. Ms. Wong assisted with the review of dynamic stress and displacement calculations.

Pine Flat Dam Slope Failure Design Investigation and Mitigation Design, U.S. Army Corps of Engineers (USACE), California

Civil/Geotechnical Engineer - This project involves the investigation and mitigation of a slow-moving landslide sliding onto Pine Flat Dam in Fresno, CA and blocking access to a gallery adit. Mitigation involves drainage of the sliding mass and the design of a structure allowing year-round access into the adit. Ms. Wong assisted with the geotechnical investigation, performed slope stability and parametric sensitivity analyses on SLOPE/W, analyzed the inoperable drainage pipes previously built into the sliding mass, developed design drawings, and reviewed RFIs.

Tank 1002 Liner System Design, Phillips 66, San Francisco Refinery, California

Civil Engineer - This project involves the design of an HDPE liner system to prevent future leakage from a fuel tank storage containment site, which had been leaking pooled rainwater. Ms. Wong assisted in the design of the liner system, including the anchor trench into the berm and ground surface, anchorage onto wing walls and stairs, liner protection, and site drainage. Ms. Wong also developed all design drawings.

APLNG Pond Design, Origin Energy, Australia

Civil/Geotechnical Engineer - MWH designed the feed, brine, effluent, and permeate ponds associated with the existing and planned water treatment facilities for the water discharge from coal seam gas extraction in Queensland. Ms. Wong assisted in the development of the geotechnical analysis and detailed design report. Ms. Wong performed seepage and slope stability analysis on SEEP/W and SLOPE/W and assisted in the analysis of the geotechnical investigation and soil properties.

Priest Rapids Right Embankment Mitigation Design, Grant County Public Utility District, Washington

Civil/Geotechnical Engineer – This project consists of providing engineering services related to the design of mitigation measures associated with liquefaction potential, foundation seepage and embankment stability for the Priest Rapids Dam right earth embankment. Ms. Wong assisted with the preliminary design of the new cofferdam required for excavation of the existing embankment, back-calculated the friction angle of the existing soil using SLOPE/W, and assisted with developing soil profiles of the existing site.

Stormwater Treatment Area STA-1W Expansion Area No. 1, South Florida Water Management District, Florida

Civil/Geotechnical Engineer - This project is a component of the Restoration Strategies projects identified to work in conjunction with the existing Everglades Stormwater Treatment Areas to meet the Water Quality Based Effluent Limit that would achieve compliance with Florida's phosphorus criterion in the Everglades Protection Area. Ms. Wong assisted with the geotechnical investigation, performed uplift calculations, and performed seepage and slope stability analyses of the embankments and canals using SEEP/W and SLOPE/W.

DeSabra Powerhouse ARV and De-Excitation System, Pacific Gas & Electric Company (PG&E), California

Civil Engineer - This project at the DeSabra powerhouse features the replacement of an existing voltage regulator system with a new automatic voltage regulator and the installation of a new exciter contactor and an outdoor power

transformer. Ms. Wong designed the concrete pad for the new transformer box and designed the lateral seismic support structure for the bus duct. She also developed design drawings in MicroStation.

Los Padres Dam Sediment Removal Study, California American Water

Civil Engineer - MWH performed a feasibility study for the removal of 2 million cubic yards of sediment from the Los Padres Reservoir. The study includes the investigation of alternative methods for sediment removal, transportation, and disposal, identifying potential commercial uses or disposal sites for the sediment, and preparing conclusions and recommendations. Ms. Wong compared sediment disposal site location alternatives, calculated their sediment volume capacities, assisted in the preliminary design of the disposal sites, analyzed and compared 1947 and 2008 reservoir bathymetry data, identified potential access roads, determined quantities for project cost estimation, developed drawings and figures for the final report, and assisted in preparing the project execution plan.

L.L. Anderson Dam Spillway Modification Project, Placer County Water Agency, California

Civil Engineer – Prior to modification, studies indicated that the LL Anderson Dam spillway did not have enough capacity and the dam would fail under extreme flood conditions. MWH modified the rock channel spillway to bring the dam into compliance with current standards. Modifications include widening the upper spillway channel, adding a new gate structure downstream of the existing structure, adding new gate controls and adding a parapet wall along the dam crest. Ms. Wong revised design drawings to incorporate as-built details.

Lake Eleanor Dam Condition Assessment, San Francisco Public Utilities Commission, California

Civil Engineer – Lake Eleanor Dam in Yosemite National Park shows signs of cracking and deterioration. MWH inspected the dam and developed a Needs Assessment Report to evaluate the condition of the existing dam and facilities, define the gap between the current condition and operations and maintenances' requirements, and provide recommendations on the rehabilitation necessary to meet requirements and extend the service life of the facility. Ms. Wong helped to write, edit, and compile photos for the Inspection Report that summarizes the findings and conclusions of the inspection, which was later used to develop the Needs Assessment Report.

Helms Sewage Treatment Plant Overflow Tank Improvements, PG&E, California

Civil Engineer - This project features a tank to capture and quantify the overflow from the water treatment plant. Ms. Wong assisted with the design of the overflow tank system and details, prepared design drawings, and assisted in overseeing the construction process.

Lyons Dam Instream Flow Release and Canal Flow Automation, PG&E, California

Civil Engineer - MWH designed a system to automate instream flow releases, as well as canal flows to Phoenix Powerhouse and Columbia Canal on the Stanislaus River. Ms. Wong updated civil drawings in MicroStation and assisted in the design of an outdoor stairway configuration near the generator building.

Mohammadreza Mostafa, PhD, PE

Structural Design

Dr. Mostafa has more than 15 years of consulting experience in seismic analysis and design of various steel, concrete, and masonry structures. He has experience managing a design team working on appurtenant structures to dams, such as underground and surface hydropower plants, dry and pressurized tunnels and shafts, intake, outlet structures and residential and industrial buildings. He is experienced in seismic evaluation of existing structures, as well as in structural design of Water/Wastewater facilities. He has extensive knowledge of current design codes: CBC, IBC, ACI 318, ASCE 7, ACI 350, AISC 360, AISC 341, AISC 358, API, USACE, AWWA D10 and PTI.

He is skilled in dynamic analysis (response spectrum and nonlinear time history) of building and hydraulic structures using relevant commercial software and design codes (US Army Corps of Engineers' engineering manuals and FERC publications). He has also experience on seismic analysis and design of different concrete and steel bridges based on AASHTO LRFD design code.

Software Experience:

Structural Analysis: ANSYS, ADINA, ABAQUS, SAP2000, ETABS, SAFE, Sigma/W and PLAXIS.

Structural Design: SP Column, ENERCALC, WIND SIMPLE, HILTI AND SIMPSONS Anchor Design software.

Relevant Project Experience

Rio Bravo Hydro Electric Project, *Catalyst Energy Development*

Served as structural engineer performing the stress analysis of the Diversion Dam due to the proposed modifications to the dam. These modifications include adding two piers on the crest of the dam to support the access bridge and adding two holes through the dam for sluicing the sediments

Lake Eleanor Needs Assessment, *San Francisco Public Utilities commission*

Served as lead structural engineer performing the Finite Element Analysis of the Lake Eleanor multiple arch dam, preparing the inspection report and the Needs Assessment Report. The project include updatring the seismicity and PMP/PMF of the project.

Santa Anita Dam, *LA Department of Public Works*

Served as structural engineer performing complementary Time-History Finite Element Analysis of the dam considering the effect of the spillway notch. The main goal was to compute the reponse of the slender block next to the spillway notch.

Monticello Dam Blind Prediction, *United States Society on Dams,*

Served as structural engineer performing Time-History Finite Element Analysis of the dam and comparing the results with the accelerometer recordings from a recent earthquake with $PGA=0.01g$.

North Fork Dam Spillway, *Pacific Corps Energy*

Served as structural engineer performing the earthquake and post-earthquake analyses of the North Fork spillway using nonlinear FE methods. Performed the stability check of the structure for the operational, earthquake flood and post-earthquake load cases.

Tulloch Dam Spillway, *TRI-DAM*

Served as structural engineer performing the earthquake and post-earthquake analyses of the Tulloch spillway using nonlinear FE methods. Performed the stability check of the structure for the operational, earthquake and post-earthquake load cases. Moreover, served as the assistant project manger on this job.

EDUCATION

Ph.D., Structures,
University of Colorado,
Boulder, 2011

M.S., Structures,
University of Colorado,
Boulder, 2010

M.S., Hydraulic
Structures, Amirkabir
University of Technology
(Tehran Polytechnic),
Tehran, Iran, 2003

B.S., Civil Engineering,
Amirkabir University of
Technology (Tehran
Polytechnic), Tehran, Iran,
2001

LICENSES/ REGISTRATIONS

Registered Professional
Civil Engineer: California,
Washington and Oregon

Registered Structural
Engineer, Iran (Since
2003)

Member of USSD
Committee of Concrete
Dams Chapter as of 2016

Member of ASDSO

Poe Dam Project, Radial Gate Replacement, Pacific Gas & Electric

Served as structural engineer for performing the nonlinear stress analysis of the existing trunnion yoke and hub using Finite Element Methods (ADINA software). The analysis also included designing new yoke and hub assemblies that comply with the relevant design codes for trunnion structure (USACE engineering manuals). The analysis results were published in USSD 2014.

Kelly Ridge Powerhouse TSV Replacement, South Feather Water and Power Agency

Served as structural engineer for the stress analysis of the existing reducer spool of the penstock, connected to the butterfly valve.

Hadly Dam, Holyoke Gas and Energy

Performed the independent analysis and design for the plunge pool and the anchorage system. Also checked the adequacy of the dowels that were used to stabilize the slopes of the plunge pool

Robbs Peak Weir, Sacramento Municipal Utility District

Served as structural engineer designing a weir on the downstream of the dam. The design involved the stability analysis of the structure and nonlinear Finite Element analysis to design the reinforcement

Don Pedro Dam and Appurtenant Structures, Turlock Irrigation District

Prepared a condition assessment report on the dam and all appurtenant structures. This report included the assessment of the bulkheads, radial gates, powerhouse structure, power intake structure and etc.

Bowman Penstock, Nevada Irrigation District

Served as structural engineer for the analysis and design of the reinforced concrete encasement around the existing penstock bifurcation which was broken. It also included designing a thrust block and Prestressed anchors per PTI code.

Kwoiek Penstock Design, Kwoiek Creek Resources Limited Partnership (CANADA)

Served as structural engineer conducting the analysis and design for the KWOIEK penstock. The analysis was done using nonlinear Finite Element method to model the 3D alignment of the penstock as well as the Soil-Structure interaction.

Linville Dam project, Penstock Encasement, Duke Energy Corporation

Served as structural engineer for the analysis and design of the concrete encasement for the existing penstock that will be exposed to the increased overburden pressures associated with placement of the downstream earthen stability berm.

Coleman-Asbury Penstock, Pacific Gas & Electric

Served as structural engineer designing the 36" diameter steel penstock for the project using the ASCE Manual 79 for steel penstocks

Hyatt Powerhouse, Department of Water Resources (DWR)

Served as the structural engineer designing the egress structure inside the powerhouse as well as checking the existing powerhouse structure against the new loads per the relevant codes.

Davis-Woodland project, Woodland-Davis Clean Water Agency

Served as the structural engineer designing the operation building as well as the pump station building.

Mr. Peyton is a project manager with experience in a variety of water resource and design projects. He has direct project experience with ecosystem and stream restoration and enhancement projects including conceptual level planning, preliminary and final design, permitting, assistance during construction, and post construction monitoring. Mr. Peyton also has experience in hydrologic and hydraulic modeling, performing floodplain analysis and delineation, water quality studies, and a variety of storm water and water resources projects including watershed management and planning. He is a proficient user of many hydrologic, hydraulic, and GIS applications, including RIVERMorph, HEC-HMS, HEC-RAS, ArcView, and ArcInfo. In addition, he has experience in water resources planning projects including EPA NPDES Phase II programs and permit applications, hazard mitigation planning, and watershed planning and improvement projects.

EDUCATION

BS, Civil Engineering, University of Dayton, Dayton, Ohio, 2002

River Restoration and Natural Channel Design, Wildland Hydrology, Gunnison, Colorado, 2007

River Morphology and Applications, Wildland Hydrology, Davis, West Virginia, 2006

Applied Fluvial Geomorphology for Engineers, Wildland Hydrology, Davis, West Virginia, 2006

Wetland Delineation and Management, Richard Chinn Environmental Training, Columbus, Ohio, 2005

River Assessment and Monitoring, Wildland Hydrology, Missoula, Montana, 2007

REGISTRATIONS

Professional Engineer #27304, Commonwealth of Kentucky

Professional Engineer #71790, State of Ohio

PROJECT EXPERIENCE

Geomorphologic Assessments

Whitewater Canal Rehabilitation, Metamora, Indiana (Senior Project Engineer)

The Town and IDNR propose to rehabilitate the Whitewater Canal to improve water delivery into the town's historic district and create a hiker/biker trail along the rail/canal route. As Senior Project Engineer, Mr. Peyton conducted a field review of the project site in October 2004 to identify the watershed sedimentation problems, examine historic structures, characterize the sedimentation in the existing canal, and to propose alternatives at the West Fork of the Whitewater River diversion dam to manage flows and sediment. The project went into the study phase in May 2006, when Mr. Peyton lead the fieldwork in the watershed to qualify sediment sources, classify the streams, and examine alternatives for their effectiveness at solving the sediment source problems to the canal. The EPA WARSS based study report was provided to IDNR in August 2006.

Little Miami River Geomorphic Assessment, Hamilton & Clermont Counties, Ohio

Hamilton and Clermont counties conducted feasibility studies to introduce a multi-modal transportation network through the Eastern corridor to the City of Cincinnati. As part of this study, alternative alignments over the state and national scenic Little Miami River and the adjacent farm lands were investigated. The unique designation and quality of this stream presented an added intricacy to the project. Stantec was charged with providing geomorphic analyses of several reaches of the Little Miami River associated with the transportation alignment alternatives as well as providing findings and recommendations. Mr. Peyton performed field work including field reconnaissance, surveying profile and cross sections of the stream, installing erosion and scour monitoring devices, and collecting particle data from the stream bed and banks.

Scott D. Peyton PE

Stream Restoration

County-wide Geomorphic Study, Harris County, Texas (Project Manager)

Stream channels in Harris County are subject to extensive erosion which is filling in shipping channels at the Port of Houston. To address this problem, Harris County is developing the tools to make natural channel design a more commonly used design approach. The work conducted for this study included developing regional curves, collecting reference reach data, developing dimensionless ratios, developing BEHI and NBS erosion rate curves, and developing suspended sediment rating curves.

Stream Restoration

Buffalo Bayou Stream Restoration, Houston, Texas (Project Manager)

Mr. Peyton is the Project Manager for the largest stream restoration and natural channel design project ever undertaken in Houston. Buffalo Bayou is a special stream – one of the last left unchannelized by past flood control efforts. Many banks along the bayou were eroding badly, threatening millions of dollars in public and private infrastructure. Stantec is working with the Bayou Preservation Association and the Harris County Flood Control District to development the design for the project. The project is scheduled for construction in 2013 at a capital cost of approximately \$6,000,000.

Chevron Facility on the Great Miami River Hydraulic Modeling and Scour Remediation, Cincinnati, Ohio

Stantec performed hydraulic modeling from river mile 7.0 to river mile 16.1 above the confluence with the Ohio River to determine the impacts the remedial measures might have on 100-year flood elevations and performed scour depth calculations on the exposed riverbank to support sheet pile wall design. Stantec also proposed alternatives for bank and floodplain restoration and re-vegetation following construction of the cut-off wall. The project addressed the erosion of the bank and potential impacts on the floodplain and scour from the proposed conditions. Lowering the floodplain next to the river and the vegetation restoration will place riparian forest, and their protective roots, close to the waterline. Placement of silty soil behind the proposed sheet pile wall will help seal the sand & gravel layer under the proposed riparian planting zone.

AMPGS Stream Relocation, Racine, Ohio (Project Engineer)

In anticipation of the construction of a new power plant, an existing stream needed to be relocated and reconstructed as a natural channel. As Project Engineer, surveyed the typical channel characteristics of the stream, obtained sediment samples, and located a reference reach that was intensively surveyed using Rosgen methods.

Seltzer Park Riparian Restoration, Shelby, Ohio (Project Engineer)

Served as a Project Engineer providing construction assistance to the contractor. The project involved the restoration of an existing stream using natural channel design techniques while maintaining the aesthetics of the park setting.

Gilmers Creek Stream Restoration Project, Madison County, Tennessee (Assistant Project Manager)

Gilmers Creek, a sandbed stream, located near Jackson, Tennessee, has been channelized to accommodate agricultural fields in the vicinity of the stream. The stream is incised and levees have been constructed on both sides of the creek, preventing access to the floodplain. Stantec was retained by White Lake Waterfowl to perform stream restoration of 8,000 feet of Gilmers Creek for the purpose of a mitigation bank. The natural channel design included restoring Gilmers Creek to a natural meandering pattern through an adjacent farm field. Because the sediment being transported by the stream is highly erosive, an important aspect of the design was to ensure that sediment stability was achieved. A FLOWSED/POWERSED analysis was performed to determine if the design would adequately transport the sand load. Mr. Peyton performed the geomorphic surveying of the impacted and reference reaches for the project. He also completed the natural channel design of Gilmers Creek.

* denotes projects completed with other firms

Scott D. Peyton PE

Stream Restoration

Cypress Creek Stream Restoration, Houston, Texas (Project Engineer)

The Harris County Flood Control District proposes a second phase of stream restoration on Cypress Creek in western Houston, with Stantec being a subconsultant to Geomatrix, Inc. As Project Engineer, Mr. Peyton proposed to concentrate on grade stabilization for the Creek, while restoring an open floodplain. He led to the effective discharge analysis that was used to size the channel. Additional surveying lead by Alan identified the downstream channel constraints for the design. A HEC-RAS model was created by Geomatrix, with the preliminary design from the RiverMorph analysis conducted by Stantec. Mr. Peyton directed the modification of the design in the model for the purpose of identifying flow conditions necessary for the sizing of the rock for the control structures.

Furnace Branch Stream Mitigation, Wayne County, Tennessee (Sr. Water Resources Engineer and QA/QC)

On site stream mitigation was required as part of the widening of SR-15 and subsequent encapsulation of a "Tennessee Exceptional Waterway." Mr. Peyton assisted with geomorphic assessment of the impaired stream for the restoration of an entrenched reach of Furnace branch. Completed the design of a priority three incised stream restoration for a total of 1200 feet of channel. A sediment transport model was developed using the Flowed/Powersed module of the RIVERMorph© Natural Stream Design software to evaluate bed stability. Additional tasks included: the identification and geomorphic survey of a reference reach, sediment samples and sieve analysis, construction quantity calculations, and hydraulic calculations. Further challenges included the channel design through bedrock constraints.

Willows Branch Stream Enhancement, Warren County, Tennessee (Sr. Water Resources Engineer and QA/QC)

This project included the relocation of 1,100 feet of Willows Branch as on-site mitigation for stream impacts at SR-1 highway. Mr. Peyton performed conceptual design and then reviewed the detailed stream design and geomorphic assessment of the impaired reach, sediment transport calculations, construction quantity calculations, and channel design using RIVERMorph© Natural Stream Design software. This stream enhancement was one of the first restoration designs bid through the roadway contract and demonstrates a turning point in the management of stream relocations in Tennessee. Mr. Peyton also reviewed the monitoring of Willows Branch for two successful years of the monitoring reports to comply with 401 and 404 water quality permits.

Tributaries to the Hatchie River Watershed Assessment, Various Counties, West Tennessee (Project Manager)

Stantec was contracted by the Nature Conservancy to conduct an abbreviated watershed assessment and prepare three conceptual designs for the Clover, Richland Creek and Bear Creek watersheds in West Tennessee, located within the Hatchie Watershed. The main purpose of this project was to assess the watershed for potential stream restoration projects, identify potential funding and prepare conceptual designs and cost estimates. Mr. Peyton was responsible for field assessments, project sites selection, report preparation, and development of conceptual and final designs.

Unnamed Tributary to the Wolf River Stream Restoration, La Grange, Tennessee (Project Manager)

The UT Wolf stream restoration project included the restoration of approximately 10,000 feet of stream. The project was completed by the design/build team of Stantec and Mid Tennessee Sediment and Erosion Control and was initiated by the Tennessee Stream Mitigation Program (TSMP). The project included Priority I and II restoration techniques and the re-meandering of UT Wolf. Mr. Peyton provided final design assistance and managed construction oversight of the project.

* denotes projects completed with other firms

Scott D. Peyton PE

Stream Restoration

Tributary to Mill Creek Stream Restoration, Cleveland, Ohio (Project Manager)

The Tributary to Mill Creek was a degraded headwater stream on the Highland Hills Golf Course. Mr. Peyton performed stream assessments and prepared a conceptual design. Mr. Peyton then led an effort to educate more than a dozen stakeholders to gain project support and held multiple public education field days for the high profile project. Final design and construction services were also Mr. Peyton's responsibility for this design-build project. Approximately 2,300 feet of stream was restored and enhanced using Priority I, II and III natural channel design techniques. The City of Cleveland, the North East Ohio Regional Sewer District, and the Cuyahoga County Board of Health now have a stream restoration showpiece for northeast Ohio.

Dry Fork Creek Bank Stabilization and Stream Restoration, Whitewater Township, Ohio (Principal-in-Charge)

Mr. Peyton was the design engineer and Principal-in-charge for bank stabilization and stream restoration work in Dry Fork Creek within the Miami-Whitewater Forest. The restoration reach was approximately 2,200 feet long and included the use of j-hooks to reduce lateral erosion and promote pool formation and the use of toe wood and live brush layering along steep erosional stream banks. Permitting activities included preparation of NWP 27 under Section 404 of the Clean Water Act, correspondence with the Ohio Historic Preservation Office on issues related to Section 106 of the National Historic Preservation Act, and agency coordination as required under Section 7 of the Endangered Species Act. The federally threatened running buffalo clover is known to occur in the Miami-Whitewater Forest and the endangered Indiana bat had been captured within two miles of the project area. Field surveys concluded that these species were not present within the project area and consequently formal consultation with USFWS was not necessary. The project was built on-time and within budget and withstood the third wettest month on record (April 2011) without damage despite having been constructed only months five months earlier.

East Fork Avey's Run Stream Restoration, Cincinnati, Ohio (Project Manager)

Mr. Peyton was responsible for all aspects of this design-build stream restoration project. He assisted the Clermont Soil and Water Conservation District and the East Fork Little Miami River Watershed Collaborative in restoring the reach using 319 Grant funds. Mr. Peyton collected and reviewed available GIS data and performed geomorphic and sediment data collection for the impacted reach and reference reach. He then prepared a conceptual design for 1,700 feet of East Fork Avey's Run including 500 feet a Priority I restoration and 1,200 feet of Priority III restoration using natural channel design techniques. The Priority I restoration included relocating the channel to and reconnecting the channel with the historical floodplain. The Priority III restoration included adding in channel grade control and habitat structures to raise the channel bottom to decrease the degree of incision. In-situ, native materials were used in the design to reduce construction costs and improve aesthetics of the completed project. He worked with the design-build contractor throughout the project on constructibility and budget issues to deliver an innovative and stable stream system.

* denotes projects completed with other firms

Scott D. Peyton PE

Stream Restoration

Muddy Creek Stream Restoration, Mason, Ohio (Senior Project Engineer)

Muddy Creek was threatening homes, driveways and sanitary sewer infrastructure in the City of Mason, Ohio due to scour and lateral stream migration. The City of Mason's primary concerns were an exposed length of 21" sanitary sewer and scour at a concrete encased sewer crossing. Mr. Peyton was responsible for stream restoration and stabilization of 1,600 feet of stream. Mr. Peyton defined a clear picture of existing stream conditions utilizing RIVERMorph, photographs, GPS, survey data and a GIS. He then implemented the appropriate design based on the collected data. The key project components were identifying problems caused by existing drainage system conditions and recommending natural channel design solutions. Specific tasks included geomorphic survey and analysis, stream walk and analysis, interviewing and educating residents, analyzing model results, GIS data collection and mapping, and cost analysis. After design alternatives were analyzed, Mr. Peyton executed the preferred design option. He created construction plans suitable for bidding, including plans, profiles, cross sections, specifications, details and an engineer's estimate. As part of this project, Stantec also designed a replacement of approximately 1,800 linear feet of replacement sanitary sewer. Mr. Peyton played a key role in project management and coordination to deliver both stream and sewer construction drawings on time. Mr. Peyton assisted the City with construction administrative tasks and was on site during stream construction and structure installation.

Over his career, Mr. Vukman has been able to compile a diverse set of skills as a project manager, including skills obtained while facilitating large stakeholder groups in an effort to restore greenways along riparian corridors. Experienced in stream restoration, Natural Channel Design, fluvial geomorphology, biotechnical streambank erosion control methods, and trail alignment, design, construction, and maintenance, Mr. Vukman's involvement within these projects has included management of subcontractors, budget tracking, grant writing, facilitation of community meetings, preparation of required permits, data gathering and processing, construction, post-project maintenance and monitoring, and final report writing. His interpersonal skills have allowed him to successfully manage several diverse stakeholder groups whose goals were based on prevention of private property loss through the design and implementation of comprehensive stream restoration projects. Furthermore, Mr. Vukman is trained as a fluvial geomorphologist, having completed Levels I-IV of Dr. David Rosgen's Wildland Hydrology short courses. With approximately 17 years of experience designing and implementing numerous biotechnical streambank erosion control projects, he is an expert practitioner of soil bioengineering and other biotechnical erosion control methods and is often called upon by local agencies for advice and guidance. His expertise also includes long-term maintenance and monitoring of riparian restoration and trail construction projects. Additionally, he draws on leadership skills honed by years of experience managing conservation corps crews and serving as a Sergeant in the US Army.

EDUCATION

BA, Environmental Studies, California State University, East Bay, California, 1995

Applied Fluvial Geomorphology, Wildland Hydrology, Pagosa Springs, Colorado, 2004

River Morphology and Applications, Wildland Hydrology, Pagosa Springs, Colorado, 2006

River Assessment and Monitoring, Wildland Hydrology, Pagosa Springs, Colorado, 2009

River Restoration and Natural Channel Design, Wildland Hydrology, Pagosa Springs, Colorado, 2009

MEMBERSHIPS

Member Representative, Society of American Military Engineers, Sacramento Post

Point of Contact, Society of American Military Engineers, San Francisco Post

PROJECT EXPERIENCE

Soil Bioengineering Erosion Protection

Willow Brush Mattress Project, Codornices Creek*, Berkeley, California (Project Manager)

Mr. Vukman successfully designed and constructed a willow brush mattress on a spring-fed stream that contains a State and Federally- listed threatened Steelhead Trout Distinct Population Segment (DPS). Set within a completely engineered concrete reach, he pushed the known slope ratios (horizontal to vertical) of this soil bioengineering technique.

Biotechnical Streambank Stabilization*, Martinez, California (Project Manager)

After numerous traditional engineering attempts were made to protect an outside bend of Alhambra Creek from eroding (i.e., gabions, riprap), Mr. Vukman successfully stabilized this piece of property by designing and installing a biotechnical streambank erosion control project that utilized soil brush layering and other soil bioengineering techniques. He managed this project in a timely and cost-effective manner without the use of more traditional engineering approaches.

* denotes projects completed with other firms

Mike Vukman

Stream Restoration

Biotechnical Streambank Erosion Control Projects*, Multiple Locations, California (Project Manager)

Funded through the US EPA, Mr. Vukman led the design of two biotechnical streambank erosion control projects along private property within the San Francisco Bay Area. As project manager, he was responsible for data gathering and processing, design, and composition of the final report. Geared towards providing a cost-effective and ecologically-based solution, each design used various soil bioengineering techniques in an effort to reduce existing erosion rates while increasing the habitat for local flora and fauna.

Stream/River Restoration

Pipeline Stream Crossings*, Various Locations, California (Project Manager)

Working for Kinder Morgan, Mike led the geomorphic assessments and survey on more than 15 stream channels, determining the potential for channel downcutting, headcutting, and lateral streambank migration. Assessments were all in the areas of currently exposed pipelines. Led the effort to quantify and document risks to the pipeline due to channel instability.

Pipeline Stabilization/Stream Restoration Project, Tahoe National Forest, Placer County, California (Construction Oversight)

Mike provided construction oversight during the restoration of approximately 150-linear feet of stream bed in the Tahoe National Forest. The stream had re-aligned itself to follow parallel a pipeline corridor that was constructed prior to 1960. As a result, the creek ran parallel/directly over the pipeline for a distance and its original natural drainage is merely a side channel. Mike provided oversight for the construction of grade control structures in the natural stream channel which were designed to direct the flow of the stream down-valley and away from the pipeline alignment. Mike was also responsible for coordinating with the construction contractor and onsite pipeline inspector to ensure that the project was completed following appropriate health and safety protocols.

Pipeline Stream Crossings, Various Locations, Minnesota (Project Manager)

Working for Magellan Midstream Partners, Mike managed the development of two pipeline stability projects after they had become exposed along their respective streams. Mike and his team determined the potential for channel downcutting, headcutting, and lateral streambank migration, helping the client to choose a cost-effective and ecologically-based long-term repair solution.

Pipeline Stream Crossings: Sandpiper / Line 3 Pipeline Geomorphic Surveys, Various Locations, Minnesota (Environmental Scientist)

Pipeline Stream Crossings: Sandpiper / Line 3 Pipeline Geomorphic Surveys, Various Locations, Minnesota (Environmental Scientist)

Assisted with the field data collection for comprehensive survey and geomorphic assessment on 61 pipeline stream crossings throughout the state of Minnesota. Effort covered around 40,000 LF streams and rivers ranging in size from bankfull width (Wbkf) less than 10 feet to the Red River of the North (Wbkf > 200 feet). Performed benchmark establishment, longitudinal profile survey, cross section survey, bed materials sampling, and particle size classification. Performed Pfankuch in-stream habitat assessment and Bank Erosion Hazard Index/Near Bank Stress (BEHI/NBS) surveys to supplement interpretation of field measurements. Results of survey and assessment used to document baseline conditions in support of an environmental permit application. Recommendations to minimize future construction disturbance and potential negative river adjustments were made based on existing conditions and stream type identified at each site.

McCosker Stream Daylighting Project, Canyon, California (Project Manager)

Led the team helping the East Bay Regional Parks District determine best options to develop an acquired tract of land into a multiple-use property. Currently, a perennial stream flows below ground through a series of culverts. Stantec explored the feasibility of removing the culverts, which total approximately 1,600 linear feet, and reconstructing a step-pool stream in its place that provided fish passage for Rainbow Trout. Stantec's Team conducted a site assessment, developed a conceptual plan and related report and created a preliminary cost estimate for the project.

* denotes projects completed with other firms

Mike Vukman

Stream Restoration

Redwood Creek Stream Restoration Project, Oakland, California ((Project Manager)

Served as project manager for this East Bay Regional Parks District effort. The District is actively attempting to restore and stabilize of Redwood Creek, located within Redwood Regional Park, to protect the public and existing infrastructure, to reduce sediment inputs from bank erosion, and to increase instream habitat values for Rainbow Trout. Working closely with EBRPD staff, Stantec conducted a site assessment and developed 30% and 60% conceptual plans for the project.

Yampa River Restoration, Chuck Lewis Area, Steamboat Springs, Colorado (Project Manager)

Led the assessment and design of over 25000 LF of restoration along the Yampa River. Project goals included improvement of trout habitat and bank stability.

Wildcat Creek Restoration Project*, San Pablo, California (Project Manager)

Identified by the City of San Pablo and the Wildcat Watershed Council as a high priority restoration project, Mr. Vukman led the design and implementation of a publicly-funded multi-objective stream restoration project that utilized natural channel design principles. This project included the design and construction of an instream grade control structure as well as several soil bioengineering techniques.

Alhambra Creek Restoration*, Martinez, California (Project Manager)

Mr. Vukman led a team that assessed restoration opportunities using Natural Channel Design principles for a 1-mile stretch of Alhambra Creek. By working with the Alhambra Creek Watershed Planning Group, he elicited the support of all adjacent private landowners. Specifically requested by the Alhambra Valley Creeks Coalition (AVCC), a group that Mr. Vukman helped to form, this project focused on addressing erosion along this stretch of Alhambra Creek. Several restoration options were presented to citizens in an open forum meeting.

Peralta Creek Restoration*, Oakland, California (Project Manager)

While working with the City of Oakland, Mr. Vukman led efforts to design and build a multi-objective stream restoration project within a recreational park. He successfully led this effort that was aimed at flood damage reduction and increased habitat for terrestrial and instream flora and fauna, while providing safe access for local environmental education efforts.

Geomorphic-based Pipeline Stabilization*, Tahoe National Forest (Project Manager)

Design and implementation of a geomorphic-based step pool project along a tributary to the North Fork of the Yuba River to protect an 8-inch section of pipeline that had become exposed at two separate locations within the stream bed. The stream had altered its path and was running parallel along the pipeline alignment. Stantec was able to increase the long-term stability of this section of pipeline and reduce its risk of exposure, while still allowing for safe fish passage and proper sediment transportation rates in a balanced manner.

Wildcat Creek Restoration and Realignment Project*, San Pablo, California (Project Manager)

Funded by a public grant, with a goal of addressing flood capacity issues caused by decreased sediment transportation rates, Mr. Vukman successfully led efforts to design and build a properly functioning bankfull channel by realigning the existing channel configuration. He submitted all required permits and served as project manager through the entire project.

Williamson River and Wetland Conceptual Restoration Design, Klamath Marsh National Wildlife Refuge, Oregon (Project Manager)

Using Natural Channel Design principles in a high meadow while working with the USF&WS staff, Stantec completed a Concept Design and Report for a restoration project in the heart of the Refuge. When implemented, the project will restore more than 8,000 acres of various types of wetlands. In addition, it will restore 3-5 miles of a single thread river channel along with approximately 70 miles of small tributaries throughout the Klamath Marsh.

* denotes projects completed with other firms

Mike Vukman

Stream Restoration

Feasibility Study

Antonio Mountain Ranch and Conservation Area Mitigation Bank Feasibility Report, Lincoln, California (Project Manager)

Served as the project manager to determine the potential to restore historic hydrologic and hydraulic functions to various stream types. The goal of the project was to restore a variety of wetland types to a property that comprises approximately 808 acres as part of a wetland mitigation bank. With the information Stantec's investigation generated, the client was able to strategically allocate resources for the Mitigation Bank where the maximum credits could be generated while at the same time minimizing the costs associated with earthwork.

Feasibility/Opportunity and Constraint Assessment for the Proposed San Leandro Creek Greenway Trail Project, Oakland, California (Project Manager)

Mike is currently working for the City of Oakland to generate a feasibility report that will assess existing conditions and opportunities/constraints as the first step in the City's planning for the proposed San Leandro Creek Greenway. The project is situated along San Leandro Creek bordering the cities of Oakland and San Leandro and is defined by the upstream limits of Lake Chabot Dam and the downstream limits of San Leandro Creek's confluence with the SF Bay at Arrowhead Marsh in Oakland. The project requires Stantec to engage with a diverse stakeholder group, including the City of San Leandro and Oakland, EBRPD, EBMUD, Alameda County Flood Control District, Friend of San Leandro Creek, and other private and public landowners within the watershed.

Arroyo Mocho Feasibility Study*, Livermore, California (Project Manager)

In an effort to determine the feasibility of modifying existing trapezoidal flood control channels to be more ecologically beneficial, Mike led a team that analyzed potential solutions throughout a 7,200-foot-long reach of Arroyo Mocho. Solutions included the modification of the stream's dimension, pattern, and profile, installation of riparian vegetation without raising flood stages, and replacement of existing grade control structures that act as fish passage barriers with more natural grade control structures.

Wildcat Creek Conceptual Restoration Plan*, Berkeley, Project Manager

Funded through an emergency FEMA Grant, Mr. Vukman led efforts to provide the East Bay Regional Park District with a conceptual restoration plan for a step pool system within an existing golf course. He met with FEMA subcontracted biological consultants to make sure this concept plan was approved.

Fish Passage Design

Codornices Creek Step Pool Project*, Berkeley, California (Project Manager)

*Mr. Vukman successfully led a team that designed and implemented a publicly-funded step pool project in the heart of Berkeley. In an effort to improve and restore fish passage for *Oncorhynchus mykiss* to a severely scoured section of Codornices Creek, he worked with local watershed groups. Additionally, Mr. Vukman also managed subcontractors whose job was to gather various hydraulic and hydrologic data. These efforts led to the successful implementation of a step pool project that eliminated the fish passage barrier adjacent to a bridge without increasing localized flooding conditions. This project was designed to be in accordance with the California Salmonid Stream Habitat Restoration Manual.*

Remedial Design and Construction

SF Bay Area, Sierra Nevada Mountains, and beyond*, California

Mr. Vukman supervised multiple trail crews who were charges with designing, building, and/or maintaining trails throughout the SF Bay Area and the Sierra Nevada Mountains, allowing him to work with numerous local, state, and federal agencies up and down the state of CA.

Naturalized Wetlands / Channels

Pipeline Stability Analysis, Various Locations, California (Project Manager)

Led the geomorphic assessments and survey on more than 15 stream channels, determining the potential for channel downcutting, headcutting, and lateral streambank migration. Assessments were all in the areas of currently exposed pipelines. Led the effort to quantify and document risks to the pipeline due to channel instability.

* denotes projects completed with other firms

Mike Vukman

Stream Restoration

Riparian Restoration

Geomorphic-based Pipeline Stabilization, Tahoe National Forest, California (Project Manager)

Design and implementation of a geomorphic-based step pool project along a tributary to the North Fork of the Yuba River to protect an 8-inch section of pipeline that had become exposed at two separate locations within the stream bed. The stream had altered its path and was running parallel along the pipeline alignment. Stantec was able to increase the long-term stability of this section of pipeline and reduce its risk of exposure, while still allowing for safe fish passage and proper sediment transportation rates in a balanced manner.

Ecosystem Restoration

Williamson River and Wetland Conceptual Restoration Design, Klamath Marsh National Wildlife Refuge, Oregon (Project Manager)

Using Natural Channel Design principles in a high meadow while working with the USF&WS staff, Stantec completed a Concept Design and Report for a restoration project in the heart of the Refuge. When implemented, the project will restore more than 8,000 acres of various types of wetlands. In addition, it will restore 3-5 miles of a single thread river channel along with approximately 70 miles of small tributaries throughout the Klamath Marsh.

Creek Rechannelization

Wildcat Creek Restoration and Realignment Project*, San Pablo, California (Project Manager)

Funded by a public grant, with a goal of addressing flood capacity issues caused by decreased sediment transportation rates, Mr. Vukman successfully led efforts to design and build a properly functioning bankfull channel by realigning the existing channel configuration. He submitted all required permits and served as project manager through the entire project.

Erosion Control Planning

Biotechnical Streambank Erosion Control Projects*, Pleasant Hill and Fairfax, California (Project Manager)

Funded through the US EPA, Mr. Vukman led the design of two biotechnical streambank erosion control projects along private property within the San Francisco Bay Area. As project manager, he was responsible for data gathering and processing, design, and composition of the final report. Geared towards providing a cost-effective and ecologically-based solution, each design used various soil bioengineering techniques in an effort to reduce existing erosion rates while increasing the habitat for local flora and fauna.

Site Assessment

San Leandro Creek Trail Feasibility Study, San Leandro, Oakland, California (Technical Advisor)

Mike served as Stantec's technical advisor to determine the feasibility of creating a multi-use trail along a riparian corridor. Mike's preliminary analysis included the following disciplines: fluvial geomorphology, geotechnical analysis, hydrology/hydraulics, in-stream fish habitat, native and non-native vegetation, recreation, environmental education, and community development.

Arroyo [MV2] de la Laguna (ADLL) Conceptual Restoration Plan*, Pleasanton, California (Project Manager)

*As an extension of the Urban Creeks Council's Streamside Management Program for Landowners (SMPL) with Zone 7 Water Agency, Mike performed initial site assessments of 28 contiguous pieces of privately held streamside properties along a potential steelhead (*Oncorhynchus mykiss*) stream named Arroyo de la Laguna. Through these transparent initial site assessments, he assisted in galvanizing a group whose shared vision includes the restoration of a 1-mile stretch of Arroyo de la Laguna. As a direct result of this group's collective efforts, Mike has worked with a team to produce a 30 percent concept design for this 1-mile of deeply incised stream. Following EPA's Watershed Assessment of River Stability & Sediment supply (WARSSS), Mike worked on a report that included the Predicted Level Assessment (PLA) and post winter flow monitoring components.*

* denotes projects completed with other firms

Mike Vukman

Stream Restoration

Site Restoration

Wildcat Creek Conceptual Restoration Plan*,
Berkeley, California (Project Manager)

Funded through an emergency FEMA Grant, Mr. Vukman led efforts to provide the East Bay Regional Park District with a conceptual restoration plan for a step pool system within an existing golf course. He met with FEMA subcontracted biological consultants to make sure this concept plan was approved.

Water Resources Management (Environmental Remediation)

Codornices Creek Step Pool Project*, Berkeley,
California (Project Manager)

*Mike successfully led a team that designed and implemented a publicly-funded step pool project in the heart of Berkeley. In an effort to improve and restore fish passage for *Oncorhynchus mykiss* to a severely scoured section of Codornices Creek, he worked with local watershed groups. Additionally, Mike also managed subcontractors whose job was to gather various hydraulic and hydrologic data. These efforts led to the successful implementation of a step pool project that eliminated the fish passage barrier adjacent to a bridge without increasing localized flooding conditions. This project was designed to be in accordance with the California Salmonid Stream Habitat Restoration Manual.*

* denotes projects completed with other firms

Meredith Parkin, JD, PMP

Environmental

Ms. Parkin has over 21 years of experience in policy, regulatory and environmental compliance, permitting, planning, and land use for various dam and reservoir, water-related, and infrastructure projects. She has assisted both public agencies and private interests in addressing regulatory challenges, with a focus on identifying challenges early through the integration of policy and compliance during all phases of project development, from planning through construction. Her experience includes environmental compliance and permitting for multi-purpose local, State and Federal projects and programs. Ms. Parkin is currently managing the CEQA and/or NEPA compliance on a variety of dam and reservoir and water-related and infrastructure projects and has managed the permitting effort for 160 infrastructure facilities in 60 different jurisdictions in CA and NV. She is also managing the acquisition of environmental permits from regulatory agencies such as the NMFS, USACE, USFWS, Regional Water Quality Control Boards, and the California Department of Fish and Wildlife.

EDUCATION

JD, Lincoln Law School of Sacramento

BS, Human Nutrition and Food Science, New Mexico State University

LICENSES/ REGISTRATIONS

Certified Project Management Professional, Project Management Institute

Relevant Project Experience

Environmental Lead, Los Padres Reservoir Sediment Removal Feasibility Study, California American Water Company (Cal-Am), Monterey County, CA.

Ms. Parkin provided Cal-Am with an environmental compliance and permitting strategy with an overview of the possible environmental and permitting requirements, challenges, and strategies associated with sediment removal from the Los Padres Reservoir. As one component of a successful project implementation approach, the TM provided a blueprint to guide the acquisition of permits, agreements and authorizations, minimize permitting surprises and delays, and maximize the timeliness of permit acquisition with acceptable permit terms.

Environmental and Permitting Specialist, Sediment Removal Project, Pleasant Grove Verona Mutual Water Company, Pleasant Grove, CA

Ms. Parkin provided the client with overall compliance and permitting strategy development for removal of sediment in the Natomas Cross Canal. She obtained the Section 404 permit, Section 401 Water Quality Certification, National Pollutant Discharge Elimination System permits, and the DFG 1600 Agreement through USACE, RWQCB, and DFW.

Environmental and Permitting Specialist, Shasta Lake Water Resources Investigation (SLWRI), US Department of the Interior Bureau of Reclamation, Central CA.

The SLWRI Environmental Impact Statement (EIS) is being prepared to evaluate the potential environmental, cultural, and socioeconomic effects of implementing the proposed action to modify the existing Shasta Dam and Reservoir. Ms. Parkin is developing the Section 404(b)(1) Alternatives Evaluation in support of Clean Water Act compliance for an USACE Individual Permit. In addition, Ms. Parkin is managing the coordination with multiple agencies to develop and implement a strategy for compliance with Federal and California Endangered Species Acts and NEPA.

Project Manager, Central Valley Flood Protection Plan, California Department of Water Resources, Central Valley, CA

Ms. Parkin was the project manager for the Program Environmental Impact Report (PEIR), a multi-million dollar effort that analyzed the broad, potential impacts associated with implementing the 2012 Central Valley Flood Protection Plan (CVFPP) at a program level of detail. The CVFPP outlines a broad range of physical improvements, policies, and institutional changes encompassing \$14 to \$16 billion in investments over the next 25 years. This PEIR effort was novel in that the geographic scope was comparable to that of the Eastern Seaboard. Ms. Parkin led a team of 50 people, providing guidance and direction to MWH and subcontractor staff on the scope of environmental resources and ensuring completeness and consistency across the over 10,000 page PEIR. She led an Environmental Coordination Team, which refined the compliance approach and discussed and resolved high-level program environmental issues, and regularly interfaced with DWR legal staff. The PEIR was developed within

an extremely compressed timeframe to meet a legislative deadline. Despite the contentious nature of the CVFPP and the aggressive timeframe, the PEIR was certified on-time and under-budget, and was unchallenged in court.

Environmental Technical Lead, Upper San Joaquin River Basin Storage Investigation, US Department of the Interior, Bureau of Reclamation, CA

MWH is the lead planning and environmental compliance consultant to Reclamation for conducting the USJRBSI, a feasibility study to formulate and evaluate alternatives that develop up to 1.3 million acre-feet of additional San Joaquin River water supply. Ms. Parkin was the CWA and NEPA specialist and providing strategy for the development of the EIS and Section 404(b)(1) Alternatives Evaluation. In addition, Ms. Parkin also coordinated with multiple agencies for compliance with CWA, NEPA, ESA, and Section 106 Consultation.

Environmental and Permitting Specialist, Waterman Water Treatment Plant (WTP), City of Fairfield, CA

Ms. Parkin assisted the City of Fairfield in obtaining (1) NPDES permits from the San Francisco RWQCB and the State Water Board, and (2) CEQA compliance to dispose of solids from the Waterman WTP processes as fill on the WTP property.

Environmental & Permitting Coordinator, Sacramento River Joint Intake, Reclamation District (RD) 2035 and Woodland Davis Clean Water Agency, Yolo County, CA

Ms. Parkin is the environmental compliance lead for construction monitoring and MMRP/environmental permit compliance the \$44 million RD2035 Joint Intake Project. She is managing the CEQA MMRP/environmental permit compliance and is coordinating with construction managers, federal and state agencies, and biologists to provide required monitoring and documentation of compliance, and provide final reporting on environmental permits.

Environmental & Permitting Lead, Oroville FERC Implementation Program, State of California Department of Water Resources, Butte County, CA

Ms. Parkin is providing the client with the overall compliance and permitting strategy for the Oroville Facility Implementation Program. In addition, she is managing environmental studies for NEPA/CEQA compliance and permits for implementation.

NEPA Specialist, Long-Term Plan for Protecting Adult Salmon in the Lower Klamath River EIS, Bureau of Reclamation, Northern California

The Bureau of Reclamation is preparing an EIS to address flow augmentation releases to prevent potential fish die-off in the lower Klamath River. Ms. Parkin is providing the NEPA strategy for the EIS. She is providing direction on the project description, alternative analysis, impact methodology and is leading the cumulative effects analysis, environmental justice resource section, and other EIS chapters. In addition, she is also providing strategic support on development of the Biological Assessment.

Environmental and Permitting Specialist, Positive Barrier Fish Screen Project Phase 1, Meridian Farms Water Company, Meridian, CA

Ms. Parkin was the project manager for development of the CEQA/NEPA and biological assessment and compliance documents for the \$25 million Meridian Farms fish screen project, being implemented in two phases. She obtained the necessary Federal and state permits, including the Section 404 permit, Section 401 Water Quality Certification, NPDES permits, and the Streambed Alteration Agreement through the USACE, RWQCB and DFW. While obtaining the Section 404 permit, Ms. Parkin worked with the USFWS, NMFS and USACE to negotiate and finalize required mitigation for the project. In addition, she prepared and submitted Water Right Petitions for a Change of Diversion and Place of Use through the State Water Resources Control Board.

Environmental and Permitting Specialist, Positive Barrier Fish Screen Project, Patterson Irrigation District, CA

Ms. Parkin prepared, submitted and obtaining the Section 404 USACE permit, Section 410 Water Quality Certification, and the DFG 1600 applications through USACE, RWQCB, and DFW.

Stephanie Theis

Fisheries Biologist

Ms. Theis is a lead fisheries biologist with over 26 years of professional experience, in both freshwater and estuarine environments, emphasizing fish ecology, Endangered Species Act (ESA) compliance, fisheries monitoring, fish passage, habitat restoration design and monitoring, and environmental impact assessment. Her experience includes a comprehensive knowledge of life history and habitat needs of anadromous and resident fishes. Ms. Theis is an expert in adaptive management as well as ESA and EFH compliance procedures and has successfully conducted numerous Section 7 consultations with NMFS and USFWS. She has led plans for fish passage in multiple watersheds and monitoring programs for habitat restoration programs.

Software Experience:

Technical Lead Shasta Dam Fish Passage Evaluation, Bureau of Reclamation.

Ms. Theis led the development of an adaptive management-focus Pilot Implementation Plan for a pilot reintroduction of winter-run Chinook Salmon in the upper Sacramento and McCloud rivers as part of the NMFS BO reasonable and prudent alternative for the CVP/SWP operations. She developed metrics for program success; options for adult, egg, and juvenile transportation and collection studies; and monitoring programs for tracking all life stages to evaluate the success. The Pilot Implementation Plan also included discussions on the overall reintroduction strategy, genetics and passage options, structural options, donor stock selection, and a description of the adaptive management approach for the program. Stephanie was responsible for reviewing agency documents, such as the Hatchery and Genetics Management Plans for Livingston Stone Hatchery, which would have implications for the Pilot Program. She worked collaboratively with multi-agency workgroups in key topic areas of public outreach, planning and policy, fish health, technology, and habitat. She actively engaged with stakeholders and landowners to gain trust and support for the program. She was responsible for the quality control and consistency for the habitat assessment report and Environmental Assessment which evaluated the impacts of implementing the Pilot Plan.

Project Manager and Fisheries Biologist, Yuba River Fish Passage Project, USACE.

Ms. Theis identified key issues and potential complications for fish passage into historic fish habitat in the Upper Yuba River watershed. She prepared a preliminary planning report describing the history of the Yuba River fisheries, the current fish passage issues, and conceptual designs for upstream adult and downstream juvenile fish passage to the Upper Yuba River watershed. This report included engineering designs as well as passage routes and potential complicating factors for reintroduced fish. This report is the first step by NMFS to determine the feasibility of fish reintroduction into the upper watershed Independent Technical Review Team.

Lead Aquatic Specialist, Stibnite Gold Project, Midas Gold Inc.

Ms. Theis is leading a long-term multi-year study to evaluate the baseline conditions of the fish abundance and distribution, stream habitat conditions, and benthic macroinvertebrate abundance and diversity. She continues to work closely with the U.S. Forest Service to establish or modify the survey protocols as needed. She conducts snorkel surveys with periodic electrofishing efficiency surveys, PIBO habitat and substrate surveys, and macroinvertebrate surveys using a Hess sampler, macroinvertebrate and soil samples for metals testing, and E-DNA sampling. She conducts the statistical analyses and prepares annual reports. Stephanie regularly coordinates with NMFS, USFWS, IDFG, EPA, IDEQ, and the Nez Perce Tribe. She also advised engineers on preliminary designs for a restored channel which would facilitate fish passage into the upper watershed.

Lead Fisheries Biologist, San Joaquin River Restoration Program, Bureau of Reclamation.

Ms. Theis was one of two fisheries consultants selected to work collaboratively with resource agency technical specialists to develop an Adaptive Management Approach and Fisheries Management Plan, and Implementation Plans, and the development of the quantitative Ecosystem Diagnosis and Treatment (EDT) model, specific for the San Joaquin River. With a very rapid program schedule, she led multiple subconsultants in the development of the fisheries impact assessments for both riverine and Delta fisheries resources at a both a program level and an interim

EDUCATION

BS/BSc, Fisheries Ecology, Humboldt State University

Graduate studies, Applied Ecology and Conservation Biology - Fish, Frostburg State University

PROFESSIONAL AFFILIATIONS

National, Western Division, Cal-Neva Chapter, Oregon Chapter, and Idaho Chapter of the American Fisheries Society

Secretary for the Cal-Neva Chapter of the American Fisheries Society

YEARS OF EXPERIENCE

26

flows level. She prepared BAs for consultation for both the program and interim flows. She assisted engineers and water planners to identify key habitat needs for successful reintroduction. She also coordinated with NMFS and USFWS to establish the reintroduced Chinook salmon as an experimental population following the Endangered Species Act (ESA) Section 10(a)(1)(A) permit application and 10(j) rule.

Lead Fisheries Biologist, Shasta Lake Water Resources Investigation, Bureau of Reclamation.

Ms. Theis was responsible for evaluating the survivorship and mortality rates of anadromous fishes in the Sacramento River between Keswick Dam and Red Bluff Diversion Dam. She prepared technical sections for the aquatic resource sections of a Plan Formulation Report, and Environmental Impact Statement and numerous technical white papers. She quantified the survival and mortality rates of anadromous salmonids in the Sacramento River between Keswick Dam and Red Bluff resulting from changes in flow and water temperature. In this technical evaluation, she used the salmon production model SALMOD, and assisted the US Geological Service in modifying the model design to be specific to the SLWRI. Results from SALMOD were used to identify fisheries benefits under the different alternatives, and present recommendations for improving alternatives. Ms. Theis identified fish habitat restoration options and locations in the upper Sacramento River (below Keswick Dam) and prepared technical papers on the fisheries effects resulting from: 1) gravel augmentation; 2) side channel, floodplain habitat, and riparian habitat restoration; 3) adaptive management; 4) climate change; and 5) varied water operations to compare flow benefits versus water temperature benefits. She was the lead author of the riverine fisheries evaluation and assisted and updated the Delta fisheries discussions and assessments.

Panel Member, Senior Fisheries Biologist, Operations Criteria and Plan (OCAP) Biological Assessment Review, Bureau of Reclamation.

Member of a review panel consisting of eight external reviewers selected for their technical expertise to assess the effect of proposed Central Valley Project/State Water Project (CVP/SWP) operations on the special status fish species identified in the draft OCAP BA. Reviewed and evaluated the validity of assessments and soundness of the logic used for the conclusions reached in the draft OCAP BA based on the data and documentation presented in the chapters and technical appendices. Reviewed the draft OCAP BA for thoroughness, use of the best available scientific information, technical accuracy, compliance with the requirements of the ESA and its implementing regulations, and compliance with the Magnuson-Stevens Fishery Conservation and Management Act with respect to Essential Fish Habitat (EFH).

Central Valley Project Improvement Act Science Integration Team, Independent Member.

Ms. Theis is a current member of the CVPIA Science Integration Team (SIT) tasked with establishing biological objectives, predicting consequences, evaluating trade-offs, and ultimately recommending priorities to guide fish habitat restoration projects or studies that work towards achieving the CVPIA doubling goals. Ms. Theis, as a member of the SIT, is helping refine and utilize decision support models to predict the outcome of alternative actions and identify the watersheds, including the Delta, in which habitat restoration priorities should be established. The recommendations are based on system needs; water quality conditions; fish life stage needs; and whether or not benefiting a specific life stage will likely result in the highest abundance, natural productivity, and life history and genetic diversity. The SIT works in a collaborative and transparent manner to ensure defensibility in their recommendations.

JOSEPH E. MERZ

Education and Training

Ph.D. Conservation Ecology. University of California, Davis. 2004.
M.S. Biological Conservation. California State University Sacramento. 1994.
Cal Poly San Luis Obispo, CA. B.S. Environmental and Systematic Biology. 1991.

Employment History

Vice-President/Principal Scientist in Restoration Ecology, Cramer Fish Sciences. 2007–present.
Adjunct Professor/Lecturer, UC Santa Cruz, Institute of Marine Sciences. 2008–present.
Lecturer, California State University, Sacramento. 2001–2008.
Fisheries Biologist II, East Bay Municipal Utility District. 1996–2007.
Aquatic Ecologist, ENTRIX INC. 1993–1996.
Contract Biologist, California Department of Fish and Game. 1991–1994.

Expertise

Over the past 23 years, Dr. Joseph Merz has worked as a fisheries ecologist, performing studies and monitoring of fish populations, on coastal and Central Valley steelhead and Chinook salmon populations. Joe teaches professional courses in salmonid ecology, habitat assessment, and fish passage. Dr. Merz has coauthored a variety of peer-reviewed publications, focusing on river rehabilitation, fish movement and reproductive success, invasive species, woody debris/redd associations, and evaluation of salmonid spawning and rearing habitat enhancement. Personally, he has been honored with multiple awards and scholarships for his performance, and has initiated numerous interagency and multidisciplinary grants totaling over US \$15 million for California salmonid restoration, life cycle modeling and habitat assessment projects. Joe has performed numerous assessments of habitat manipulation on aquatic resources including habitat enhancement, flow manipulation, invasive species, and regulation implementation, including Chinook salmon and steelhead spawning. One of Joe's unique strengths is his public outreach skills and ability to collaborate with a variety of constituents. He has taught at university and public education levels, worked with federal and state representatives, and partnered with local entities (i.e., outreach groups, planners, volunteer organizations, etc.). Recently, Dr. Merz has been part of a multiagency technical teams developing strategies for Chinook Salmon re-introduction on the Upper Columbia River watershed and providing guidance for resource management on the Lower American River during the most recent drought. He is a member of American Fisheries Society and the Southwestern Association of Naturalists, and the Ecological Society of America.

SELECTED PUBLICATIONS

Author	Publications/Reports
Merz, Joseph	<p>Del Real, S., M. Workman, J. Merz. 2011. Migration characteristics of hatchery and natural-origin <i>Oncorhynchus mykiss</i> from the lower Mokelumne River, California. <i>Environmental Biology of Fishes</i>. 94:363-375.</p> <p>Merz, J.E. 2002. Seasonal feeding habits of steelhead trout in the lower Mokelumne River, California. <i>California Fish and Game</i> 88(3) 95-111.</p> <p>Merz, J.E. 2001. Association of fall-run Chinook salmon redds and woody debris in the lower Mokelumne River, California. <i>California Fish and Game</i> 87(2):1-15.</p> <p>Merz, J.E., and L.K. Chan. 2005. Effects of gravel augmentation on macroinvertebrate assemblages in a regulated California river. <i>River Research and Applications</i> 21:61-74.</p> <p>Merz, J.E., and P. B. Moyle. 2006. Salmon, wildlife, and wine: Marine-derived nutrients in human dominated ecosystems of Central California. <i>Ecological Applications</i> 16(3):999-1009.</p> <p>Merz, J.E., G.B. Pasternack and J.M. Wheaton. 2006. Sediment budget for salmonid spawning habitat rehabilitation in a regulated river. <i>Geomorphology</i> 76:207-228.</p> <p>Merz, J.E., and J. D. Setka. 2004. Evaluation of a spawning habitat enhancement site for Chinook salmon in a regulated California river. <i>North American Journal of Fisheries Management</i> 24:397-407.</p> <p>Merz, J.E., J. D. Setka, G.B. Pasternack and J.M. Wheaton. 2004. Predicting benefits of spawning habitat rehabilitation to salmonid (<i>Oncorhynchus</i> spp.) fry production in a regulated California river. <i>Canadian Journal of Fisheries and Aquatic Sciences</i>. 24:397-407.</p> <p>Merz, J.E., P. Skvorc, S. Sogard, C. Watry, S. Blankenship, and E. Van Nieuwenhuysse. 2012. Onset of melanophore patterns in the head region of Chinook salmon- A Natural marker for the reidentification of individual fish. <i>North American Journal of Fisheries Management</i>.</p> <p>Merz, J. E., Workman, M., Threlhoff, D., & Cavallo, B. 2013. Salmon Lifecycle Considerations to Guide Stream Management: Examples from California's Central Valley. <i>San Francisco Estuary and Watershed Science</i>, 11(2).</p> <p>Miller, J.A., A. Gray, and J. Merz. 2010. Quantifying the contribution of juvenile migratory phenotypes in a population of Chinook salmon <i>Oncorhynchus tshawytscha</i>. <i>Marine Ecology Progress Series</i>. 408:227-240.</p> <p>Satterthwaite, W.H., S.A. Hayes, J.E. Merz, S.M. Sogard, D.M. Frechette and M. Mangel. 2012. State-Dependent Migration Timing and Use of Multiple Habitat Types in Anadromous Salmonids, <i>Transactions of the American Fisheries Society</i>, 141:3, 781-794.</p> <p>Satterthwaite, W. H., Beakes, M.P., Collins, E., Swank, D.R., Merz, J.E., Titus, R.G., Sogard, S.M., Mangel, M. 2009. Steelhead life history on California's central coast: insights from a state dependent model. <i>Transactions of the American Fisheries Society</i> 138: 532-548.</p> <p>Satterthwaite, W. H., Beakes, M.P., Collins, E., Swank, D.R., Merz, J.E., Titus, R.G., Sogard, S.M., Mangel, M. 2009. State-dependent life history models in a changing (and regulated) environment: steelhead in the California Central Valley. <i>Evolutionary Applications</i>. Published Online: Nov 20 2009.</p> <p>Sogard, S.M., J.E. Merz, W.H. Satterthwaite, M.P. Beakes, D.R. Swank, E.M. Collins, R.G. Titus, M. Mangel. 2012. Contrasts in habitat characteristics and Life history patterns of <i>Oncorhynchus mykiss</i> in California's Central Coast and Central Valley. <i>Transactions of the American Fisheries Society</i> 141:747-760.</p> <p>Wheaton, J.M., J. Brasington, S.E. Darby, J.E. Merz, G.B. Pasternack, D. Sear, and D. Vericat. 2009. Linking geomorphic changes to salmonid habitat at a scale relevant to fish. <i>River Research and Applications</i> DOI: 10.1002/rra.1305.</p> <p>Wheaton, J.M., G. B. Pasternack and J. E. Merz. 2004. Spawning habitat rehabilitation – I. Conceptual approach and methods. <i>International Journal of River Basin Management</i> 2(1):3-20.</p> <p>Wheaton, J.M., G. B. Pasternack, and J. E. Merz. 2004. Including Habitat Heterogeneity In Salmonid Spawning Habitat Rehabilitation Design. In: <i>Fifth International Symposium on Ecohydraulics in Madrid</i>, September 12-17, 2004.</p> <p>Zeug, S. C., K. Sellheim, C. Watry, B. Rook, J. Hannon, J. Zimmerman, D. Cox, and J. Merz. 2013. Gravel augmentation increases spawning utilization by anadromous salmonids: A case study from California, USA. <i>River Research and Applications</i>.</p> <p>Zeug, S., K. Sellheim, C. Watry, J. D. Wikert, J. Merz. 2014. Response of juvenile Chinook salmon to managed flow: lessons learned from a population at the southern extent of their range in North America. <i>Fisheries Management and Ecology</i>.</p>

Clint Smith, PE

Fish Passage

Mr. Smith has 31-years-of-experienced in civil, environmental and water resource engineering. His background includes the planning, analysis and design of water intake facilities; fish transport, passage and screening facilities; municipal water, wastewater and storm drainage conveyance and treatment systems; hydrologic and meteorological instrumentation data collection systems.

Relevant Project Experience

Project Manager, Soda Springs Fish Passage Design, PacifiCorp, Project Manager for the design of new fish passage facilities at Soda Springs Dam on the North Umpqua River, Oregon. Soda Springs dam is a 77-foot high concrete arch dam that presented a complete blockage to upstream migrating anadromous salmon, trout, and lamprey. The project features include: construction of a 1,875-cfs fish screen and fish bypass system; a half ice-harbor fish ladder; spillway modifications and appurtenant electrical and control systems. MWH provided full engineering support during construction, and startup. Fish passage facilities went online in 2014.

Project Manager, Watterville Fish Screen Facility, Eugene, OR, Eugene Water & Electric Board. This, 2,575 cfs facility is a vertical fixed-plate vee screen designed to meet current screening criteria for salmon fry and trout. Project features include 2,200 ft of 54-inch diameter pipe, development of a new river outfall, extensive analysis and design of an environmentally friendly rock weir diversion and channel stabilization system and monitoring and control systems. Designs include provisions for monitoring and enumeration equipment. Construction of the project was completed in November 2002.

Project Manager, Landsburg Fish Passage Facilities, Cedar River, WA, Seattle Public Utilities. This project included two upstream fish passage structures, a new 426 cfs fish screening facility, fish collection and sorting facility, downstream juvenile fish passage system, dam stability upgrades, automation and other appurtenant facilities. These facilities are the cornerstone of Seattle Public Utilities Habitat Conservation Plan for the Cedar River Watershed. Design development and permitting of this project required close coordination with resource agencies, tribes and special interest groups. Construction of the Landsburg Project was completed in October 2003.

Project Engineer, Clallam-Cline Intake and Fish Screen, Jamestown-S'Klallam Tribe. Project Engineer for the design and construction of a new intake and fish screen structure on the Dungeness River in Washington replacing a infiltration type intake. The project was sponsored by the Jamestown S'Klallam Tribe local irrigation companies and the WDFW who designed and furnished two belt screens. Included the design of the river intake, pipeline modifications and construction support services. The project was completed in 1995.

Task Lead, Cache County Water Restoration Project, Cache County Utah. Mr. Smith was the lead for planning and design of a new screened river diversion structure along the Logan River near Logan, UT. Work included assessment of the existing intake and development and evaluation of options to bring the facility into compliance with current fish passage requirements and with USDA Forest Service requirements. The facility included construction of fish screens, a bypass flume for downstream passage around an existing diversion dam, a new canal head gate, channel modifications, and bank stabilization and reinforcement. The intake was part of a larger project to consolidate river diversions and to restore irrigation flows to areas left isolated when the canal was destroyed by a landslide.

Project Engineer, Banta-Carbona Fish Screen Project, Tracy, CA, Banta-Carbona Irrigation District

This project was designed for a diversion of 250 cfs from the San Joaquin River and was required to meet stringent approach velocity criteria suitable for Delta Smelt. The project features were designed to operate from extreme low river flows to high flows with water depths from 2ft to nearly 30 ft. The hydraulic characteristics required the use of a fish friendly bypass system to return fish to the river. Construction was completed in 2002.

EDUCATION

BS/BSc, Civil Engineering
Washington State

LICENSES/ REGISTRATIONS

Professional Engineer –
(Civil) WA, Or, ID

Manage The Project
(MTP), MWHU

Project Engineer, Naches Fish Screen Facilities Project, Naches, WA, PacifiCorp. Work included the preparation of design and construction documents for a 500 cfs fish screening facility. Screens were designed to current criteria for salmonid fry. Vertical flat plate screens in a chevron pattern 150 feet long on each side and 5 feet high were selected as the preferred design. Special consideration was given to the accumulation of sediment and debris and to operation of the screens during severe icing conditions. The work included preliminary designs of modifications to the diversion dam and intake including: construction of an inflatable dam or bascule gates, installation of a trashrack with a cleaning rake, hydraulic improvements, and bedload handling structures.

Project Engineer, White River Fish Screen Project. The project duties for this 2,000 cfs vee screen included design of the pumping and mechanical systems for a spray backwash system and design of the panel screens and other mechanical systems. Mr. Smith designed a pressure backwash screen cleaning system with two 75-hp vertical turbine pumps, an automated screen sweeping system for the fish screens and an automatic trash rake for cleaning the trashracks. A sediment management system was included to pass significant sediment loads coming from Mt. Rainier through the White River.

Project Manager, Leaburg Fish Screen Project, McKenzie River, OR, Eugene Water & Electric Board. This 2,500 cfs screening facility, constructed the 1970's was one of the first flat panel fish screens in the United States. Although the screens have been highly effective at passing fish the Owner is required under a hydropower relicensing agreement to make improvements to the facility. Mr. Smith worked with the Owner and several resource agencies to develop numerous improvement options to improve operations and passage efficiencies. Designs were initiated and construction is scheduled for completion spring 2004.

Project Manager, Little Walla Walla Fish Screen Project, Walla Walla River ID and Hudson Bay ID
Consolidation of several unscreened irrigation intakes to the Little Walla Walla diversion and constructed a new 250 cfs fish screen, automated diversion and fish ladder. Designs were developed in close coordination resource agencies, tribal representatives and irrigation districts. The dam included both a rubber dam and adjustable crest gate for winter flood protection and summer water level control.

Project Manager, Prospect No. 3 Fish Passage Project, PacifiCorp. The work included selection and design of an inclined screening system for the 150 cfs diversion, design of the new fish screens, intake trash rack and raking system, fish ladder modifications, fish bypass pipeline, forebay dredging, new communication and control system and site restoration.

Elwha Tribal Fish Hatchery Replacement, Elwha Klallam Tribe. Project Engineer for the site planning and predesign phases for replacement of a coho and steelhead salmon hatchery owned and operated by the Lower Elwha Klallam Tribe. Duties included hydraulic design of gravity and re-use systems, site development, adult fish collection systems, mechanical system development for life support and thermal marking.

Merwin Fish Hatchery, PacifiCorp

Design Engineer for the chlorine disinfection system and water supply intake for the new hatchery facility.

James Loucks, CCP, PMP

Cost Estimating

Mr. Loucks has over 30 years of constructability, cost estimating/project management experience in civil works and process infrastructure of water treatment plants, water conveyance pipelines, water storage facilities and industrial process plants. During his career, Mr. Loucks has gained experience in multiple project delivery methods including design-build, engineer-procure-construct (EPC) and traditional design-bid-build (DBB) or hard dollar contracting. He has been associated with some of the most respected self-performing contractors in the country as well as leading international consulting engineering firms. Mr. Loucks has gained significant domestic and international experience with specific international exposure in Asia, Latin America and the United Kingdom. As Cost Management Practice Leader for MWH Americas, Mr. Loucks leads a group dedicated to total cost management which is a systematic approach to managing cost and constructability throughout a project's lifecycle. His tasks include systems integration, staff recruiting, workload resourcing, detailed and conceptual estimating, third party estimate reviews, client presentations, and quality control. Prior to joining MWH, Mr. Loucks held key estimating, project management and project engineering positions for Arizona and California based general engineering contractors.

Relevant Project Experience

San Clemente Dam Removal, Coastal Conservancy, Carmel Valley, CA.

Principal Estimator, Mr. Loucks prepared detailed Class 3 and Class 2 cost estimates were to support alternative analysis for the removal of a thin arch dam and upstream sediment deposits in the Carmel River including a river re-route bypass option.

Calaveras Small Hydro, San Francisco Public Utilities Commission

Mr. Loucks analyzed constructability impacts and provided construction cost estimates and schedules for a 1MW small hydro study for a project near Calaveras Dam.

Alameda Creek Fish Passage Facility, San Francisco Public Utilities Commission

Mr. Loucks provided Class 2 construction cost estimates and schedules for a \$35M fish ladder on Alameda Creek near Calaveras Dam. Mr. Loucks also prepared a comprehensive constructability report.

Big Tujunga Dam Seismic Rehabilitation and Spillway Modification Project, LA County Dept. of Public Works

Principal Estimator – a detailed Class 2 cost estimate was developed for the LA County Dept. of Public Works project that involves a mass concrete thickening section with related spillway modifications. In addition, significant upgrades to site infrastructure and support facilities were estimated.

Bennett Dam Riprap Upgrade Project, BC Hydro

Mr. Loucks served as proposal manger and project manager for a independent third party review of a multi-year riprap upgrade project located in northern British Columbia.

San Vicente Dam Raise, San Diego County Water Authority, CA.

QC Team Lead - As a member of the QA/QC team, Mr. Loucks is reviewing all cost opinion deliverables from MWH's teaming partner, prior to submission to the client. The \$200 M project scope consists of a major roller compacted concrete (RCC) dam raise plus related site infrastructure.

Big Creek Expansion Project, Southern California Edison, Shaver Lake, CA.

Senior Estimator, Mr. Loucks delivered appraisal level Class 4 cost estimates to support project feasibility studies for various water chain management systems associated with a 700 MW, \$1 B hydropower expansion project. Facilities included dams, tunnels, reservoirs, penstocks, and powerhouses.

EDUCATION

BS, Construction Engineering, Arizona State University

LICENSES/REGISTRATIONS

Certified Cost Professional (CCP) – Association for the Advancement of Cost Engineering

Project Management Professional (PMP) – Project Management Institute (PMI)

Upper San Joaquin River Basin Storage Investigation, U.S. Bureau of Reclamation, Millerton Lake, Fresno, CA.
Principal Estimator - As part of the California Association for Local Economic Development (CALFED) Bay-Delta program, the feasibility study evaluated several Class 4 alternatives to develop water supplies from the San Joaquin River. Mr. Loucks developed conceptual and detailed level costs for several dam raise options at Friant Dam including associated outlet works and power generating features.

Site C Cost Estimate Validation Report, BC Hydro, British Columbia, Canada.

Project Manager, Mr. Loucks is currently leading a Project Validation Team (PVT) to review and validate the appraisal level facility costs for a major \$6 B CDN Greenfields hydroelectric project on the Peace River in northern British Columbia. The scope consists of a major new earth filled dam, 900-megawatt (MW) power house, penstocks and consequential site infrastructure. BC Hydro needs to have their internal cost opinion certified by an outside expert in order to gain support from the provincial government for approval of the business case financial objectives.

Folsom Dam Joint Federal Project (JFP) Construction Phasing Analysis, U.S. Bureau of Reclamation/U.S. Army Corps of Engineers (USACE)/Department of Water Resources, Sacramento, CA.

Project Manager/Head Technical Lead - The JFP is a \$1 B six gated auxiliary spillway element being designed for dam safety and flood damage reduction purposes at Folsom Dam in California. The phasing study was undertaken to develop a logical and defensible approach for determining the optimum construction packaging and sequencing scheme for the USACE's work package. The overriding objective was to decompose the USACE's work package into a series of discrete construction packages and suggest an optimized phasing sequence that accounts for known and theorized constructability constraints.

Shasta Dam Water Resources Investigation, U.S. Bureau of Reclamation, Redding, CA.

Principal Estimator - Mr. Loucks developed appraisal level Class 4 cost estimates were to support feasibility level designs of dam raise alternatives including main dam and wing dam (embankment) modifications, spillway improvements, river outlet upgrades, temperature control device (TCD) installation, and miscellaneous civil infrastructure improvements.

Los Vaqueros Energy Recovery Project, Contra Costa Water District

Mr. Loucks developed Class 5 and Class 4 cost opinions in support of a small hydropower addition that converts water flows in the Multi-Purpose Pipeline to electrical generation revenue for the district. Total costs: \$10M.

Mr. Trabant has over 20 years of experience in hydrologic, hydraulic, water-resources and civil engineering. He has completed projects throughout the United States and internationally involving a broad range of stream types and physical environments, and varying in scope from collection and analysis of field data through development and application of mathematical models to evaluate hydrologic, hydraulic and sediment-transport conditions for both sand-bed and gravel-bed systems. His primary areas of expertise are in hydraulics, hydrology, fluvial geomorphology, and erosion and sedimentation. Mr. Trabant has significant experience in performing analyses to support the planning and design phases of water-resources and sediment management projects, as well as preparation of design plans and specifications. He also has extensive field experience in topographic and bathymetric (GPS and total station) surveying, sediment sampling, stream gaging and geomorphic mapping and interpretation.

Mr. Trabant has served as the lead design engineer or project manager for numerous stream and river restoration design projects that have focused on habitat improvement, municipal development, flood conveyance, irrigation and agriculture, recreation, flood damage recovery, and water quality, among other things. He was the primary sediment-transport modeler for a number of studies that were carried out to assess alternatives for removal of San Clemente Dam on Carmel River. Mr. Trabant was also the project manager and design engineer for a stream restoration design of an approximately 1-mile long reach of North Fork Clear Creek, near Blackhawk, CO that was undertaken to accommodate highway widening, improve the mining affected water quality, and restore salmonid habitat. He recently instructed a course on engineering geomorphology that was conducted for the Northeast Ohio Regional Sewerage District that was conducted as part of the Districts Master Planning Standards Development Program. He has extensive experience with the full suite of industry-standard hydrologic models, 1-D and 2-D hydraulic models and sediment transport models, (HEC-RAS, HEC-6, HEC-6T, SAM, HEC2-SR, SED2D and CH3D-SED), as well as GIS (ArcGIS), AutoCAD and MicroStation.

RELEVANT EXPERIENCE

San Clemente Dam Removal Project, California Coastal Conservancy, CA, Ongoing – Provided technical review of hydrologic, hydraulic, and sediment analyses prepared during the design phase of the recently constructed Carmel River Reroute and Dam Removal Project.

Sediment-Transport Modeling to Evaluate Potential Impacts of San Clemente Dam Retrofit Options, Carmel, CA, 2007 - Project Engineer for a detailed study of the potential impacts on flooding, river stability and instream habitat in an 18-mile reach of the Carmel River associated with various options for retrofitting San Clemente Dam to meet seismic safety standards. Sediment-transport modeling was also performed in the existing reservoir to evaluate sediment-trapping effects associated with the various options. Project responsibilities included study plan development, collection of sediment and other physical data, hydrologic (HEC-FFA), hydraulic (HEC-RAS) and sediment transport (HEC-6T) modeling, and interpretation of model results. Specifically, the model results were used to evaluate the effects of the various options on sediment storage in the downstream river and the associated potential for increased flood hazards, as well as the effects to salmonid habitat (suspended sediment concentrations, bed material size requirements for spawning and fish passage limitations). His responsibilities also included preparation of a flood damage analysis and flood inundation mapping for selected alternatives. The hydraulic and sediment-transport modeling for the recently constructed Carmel River Reroute and Dam Removal Option required development of a preliminary design of the diversion channel and rerouted channel. The study was initially performed for the California Department of Water Resources and American Waterworks Company, and recently for the California State Coastal Conservancy.

Evaluation of Sediment Sluicing Operations for Pacoima Dam, CA, 2011 - As part of LACDPWs Sediment Management Feasibility Study, Mr. Trabant is currently performing hydraulic and sediment-transport modeling

Education:

M.S., Civil Engineering (Hydraulics),
Colorado State Univ., 1996

B.S., Civil Engineering, Colorado State
Univ., 1994

Registrations/Certifications:

Registered Professional Engineer,
Colorado, #34764, 2000

Professional Affiliations:

American Society of Civil Engineers,
Member

Office:

Fort Collins, Colorado

Years of Experience:

21

Years with Tetra Tech:

20

to evaluate potential sluicing operation options to evacuate accumulated sediments in Pacoima Reservoir. For this study, he carried out a geomorphic field evaluation of the reach upstream from the reservoir to evaluate the sediment supply, the reach downstream of Pacoima Dam to assess sediment-transport characteristics between the dam and the location where the sluiced sediment will ultimately deposit in Lopez Flood Control Basin, the outlet works at the dam and the reservoir itself. A sediment-transport model is currently being developed of the 1983 sluicing operation, and will be validated using pre- and post-sluicing topographic information. Once validated, this model may be used to assess the effectiveness of sluicing the existing reservoir deposits.

Sleepy Hollow Raw Water Intake and Water Supply System Upgrade, Monterey Peninsula Water Management District (MPWMD), CA, Ongoing – Project Engineer for hydraulic, geomorphic and sediment-transport analysis to support design of a new raw water intake on the Carmel River for the Sleepy Hollow Steelhead Rearing Facility, a key objective for which is to minimize sedimentation issues at the fish screen. Work included field reconnaissance to assess conditions in the river adjacent to the site, management of hydraulic and sediment-transport analysis to identify an appropriate location to limit sedimentation issues, and ongoing discussions and assistance to the design team.

Flood Risk Management, Baseline Sediment-Transport and Hydraulic Analysis of the Upper Yuba River, CA, 2008 - Project Engineer for a feasibility study of modifications to Englebright Dam on the Yuba River to provide fish passage to upstream reaches. Project responsibilities included statistical analyses of flood frequency (HEC-FFA) and mean daily flow durations and development of a hydraulic (HEC-RAS) model of the Yuba River from the dam to the confluence with the Feather River, and the Feather River between the confluence with the Yuba River and the Bear River. A sediment-transport (HEC-6T) model of the project reach was also developed and executed to evaluate the stability of the rivers under existing and historical conditions.

Big Thompson River Flood Recovery Services. Loveland, CO, Ongoing – Project Manager and Lead Hydraulic Engineer for two City of Loveland projects on the Big Thompson River, including the Denver Avenue Outfall Bank Stabilization Project and the Development of a Conceptual Design for Viestenz-Smith Mountain Park (VSMP). The Denver Avenue Outfall project included hydraulic modeling, alternatives analysis and design of cost-effective and integrated bank stabilization measures to project the recently reconstructed outfall that was damaged by the September 2013 flood. The VSMP project also initially included development of a hydraulic model and preparation of conceptual design plans and associated cost estimates for channel and overbank stabilization measures to mitigate future damages to park infrastructure. Mr. Trabant is currently serving as co-designer of the final VSMP restoration design, and is responsible for the hydrologic and hydraulic analyses, sediment-transport evaluations, and design of the channel and stream stability and infrastructure protection measures.

Stream Restoration Design for State Highway 119/Main Street South Project, CO, 2012 (Const. 2012) - Project Manager for a the State Highway 119/Main Street South project which is a collaborative effort organized by the Colorado Department of Transportation (CDOT) to develop a multidisciplinary design for the highway corridor along the approximately 1-mile long reach of the North Clear Creek valley bottom downstream (southeast) of the City of Blackhawk, CO. His responsibilities included coordination with numerous state and federal agencies and a variety of local interest groups, hydraulic and sediment-transport modeling, and participation at public meetings. Because the reach is an EPA Superfund Site along a narrow valley corridor, the project goals were varied and involved mine-waste disposal, treatment of toxic runoff, widening of the highway, and a stream restoration design that provides vertical and lateral stability, improved fish habitat, flood protection and wetland mitigation. In addition to developing the stream restoration design and specifications, Mr. Trabant also provided construction management services during the construction phase.

Sediment Augmentation Feasibility Study for the Platte River, NE, 2013 - Project Engineer and Task Order Manager for developing hydraulic and sediment-transport models of an approximately 28-mile reach of the Platte River to assess the feasibility of sediment augmentation program to improve habitat for ESA-listed species. Developed hydraulic and sediment-transport models using HEC-RAS (Version 4.1) that were calibrated and verified using available information. Model development included innovative techniques to address the numerous flow- and sediment splits along the project reach.

Michael is a Civil Engineer experienced in stream restoration, natural channel design, water resources, fluvial geomorphology, and underwater inspection. Michael's responsibilities include project management, technical review, design, project scoping, geomorphic assessments, stream and watershed studies, development of restoration alternatives, and natural channel design. He has been involved in all phases of a stream restoration design project including developing project goals and objectives, scoping, field data collection, design calculations, development of plans and specifications, permitting, construction oversight and monitoring. Michael is a registered Professional Engineer and has attended all four levels of stream restoration courses taught by Dave Rosgen and he currently assists with the Level 3 courses as an instructor. He is especially familiar with sediment transport and early in his career worked on Stantec's dive crew inspecting scour problems at bridge sites. Michael is also well versed at writing and public speaking, and won the 2001 Daniel Terrell Award for outstanding paper presented by the District 9 Council of ASCE. He also helps teach stream restoration related short courses across the country and frequently presents at stream restoration conferences.

EDUCATION

MS, Civil Engineering, University of Kentucky, Lexington, Kentucky, 1998

BS, Civil Engineering, University of Kentucky, Lexington, Kentucky, 1996

BA, History, Vanderbilt University, Nashville, Tennessee, 1993

CERTIFICATIONS & TRAINING

Stream Functions Pyramid Framework, Will Harman, Raleigh, North Carolina, 2012

Ecological and Geomorphic Principles of Stream Restoration, Dr. Margaret Palmer and Dr. Peter Wilcock, Baltimore, Maryland, 2009

Advanced HEC-RAS, Dr. Arthur Miller, Gainesville, Virginia, 2008

HEC-RAS, Dr. Arthur Miller, Gainesville, Virginia, 2008

Comprehensive Project Management Training, PSMJ, Lexington, Kentucky, 2008

Leadership PE Program, Kentucky Society of Professional Engineers, Frankfort, Kentucky, 2006

Natural Channel Design and River Restoration, Wildland Hydrology, Steamboat Springs, Colorado, 2003

River Assessment and Monitoring, Wildland Hydrology, Pagosa Springs, Colorado, 2003

Fluvial Geomorphology for Engineers, Wildland Hydrology, Pagosa Springs, Colorado, 2002

Co-Instructor, NRCS Introduction to Fluvial Geomorphology, Morgantown, West Virginia, 2015

Co-Instructor (RIVERMorph Stream Restoration Software), River Morphology and Applications (Rosgen Level II), Multiple, Various Locations, 2015

Co-Instructor (RIVERMorph Stream Restoration Software), River Assessment and Monitoring (Rosgen Level III), Multiple, Various Locations, 2015

Co-Instructor, NRCS Applications and Planning with Fluvial Morphology, Bozeman, Montana, 2014

Team Leader, River Assessment and Monitoring (Rosgen Level III), Lubrecht, Montana, 2010

Team Leader, River Assessment and Monitoring (Rosgen Level III), Lubrecht, Montana, 2009

Michael F. Adams, Jr. PE

Geomorphology/Sediment Transport

Team Leader, River Morphology and Applications (Rosgen Level II), Meadows of Dan, North Carolina, 2005

REGISTRATIONS

Professional Engineer #90869PE, State of Oregon

Professional Engineer #45587, Commonwealth of Virginia

Professional Engineer #113494, State of Texas

Professional Engineer #50751, State of Minnesota

Professional Engineer #PE 080261, Commonwealth of Pennsylvania

Professional Engineer #36300, State of Maryland

Professional Engineer #034864, State of North Carolina

Professional Engineer #PE905134, Washington, D.C. (District of Columbia)

Professional Engineer #112832, State of Tennessee

Professional Engineer #17980, State of West Virginia

Professional Engineer #22025, Commonwealth of Kentucky

LEED Accredited Professional, U.S. Green Building Council

MEMBERSHIPS

Member, Maryland Stream Restoration Association

Member, Society for Ecological Restoration

Member, American Society of Civil Engineers

Member, River Restoration Northwest

PROJECT EXPERIENCE

Stream and River Restoration

Dewey Creek Stream Restoration Project, Prince William County, Virginia (Lead Designer)

This project was initiated by Prince William County as part of its overall Watershed Restoration Initiatives. The project, which is approximately 6,000LF, consists of four phases. Michael serves as lead designer for each of the four phases, two of which are currently at the Preliminary Design phase. The other two Phases will be taken to a Conceptual Design prior to generating Preliminary Design documents. It is anticipated that Michael will also participate in Construction Observation once the projects go to construction.

Hatchery Creek Design/Build Project (Design and QA/QC), Russell County, Kentucky

Hatchery Creek is Kentucky's first restored trout stream and involves the establishment of 6,000 feet of stream channel across the historic floodplain of the Cumberland River just below Wolf Creek Dam. The design receives flow from the Wolf Creek National Fish Hatchery and includes both single thread and braided sections of channel. Boulder and log structures, connected vernal pools/sloughs, and off channel pools/wetlands throughout the project create a variety of habitat features to serve every phase of the trout life cycle. The stream flow returns to the Cumberland River through 600 feet of designed step pool channel. Michael developed the initial concept plan for the project and served in subsequent QA/QC activities.

Chester Creek Stream Restoration Project, Duluth, Minnesota (Project Manager)

Chester Creek was severely damaged by flooding during the summer of 2012. Two low-head dams were damaged and a pedestrian bridge heavily utilized by snow mobiles and cross country skiers in the winter was washed away. Stantec delivered conceptual and preliminary design packages for the restoration of two reaches of stream including the removal of two low-head dams. Michael served as project manager and QC engineer for the project.

* denotes projects completed with other firms

Michael F. Adams, Jr. PE

Geomorphology/Sediment Transport

Boulder Creek Confluence Stream Restoration Project, Boulder, Colorado (QA/QC)

Recent flooding and a history of flow diversions have significantly altered the landscape of Boulder Creek in its eponymous city. The local perturbations to the system have resulted in excessive sediment deposition in sections of channel that have had the cross section altered. As a consequence, flow has diverted into an adjacent pond thereby starving the downstream reach of water except in high flow events. Stantec is currently developing a design to correct the hydraulic deficiencies of the project to promote single channel flow and sediment transport throughout the project reach. Michael is leading the QA/QC activities for the project.

McCosker Stream Daylighting Project, Canyon, California (Lead Designer)

The East Bay Regional Parks District acquired a tract of land it would like to develop into a multiple-use property. Currently, a perennial stream flows below ground through a series of culverts. Stantec explored the feasibility of removing the culverts, which total approximately 1,200 linear feet, and reconstructing a step-pool stream in its place. Michael conducted a site assessment and developed a conceptual plan and preliminary cost estimate for the project.

TxDOT Grand Parkway Stream Mitigation Project/Phase II Katy Prairie Umbrella Stream Mitigation Bank, Houston, Texas (Project Manager)

Stantec is currently providing stream restoration services to Restoration Systems, LLC for multiple streams within the Katy Prairie Conservancy in Northwest Harris County near Houston, Texas. The majority of this project is for Compensatory Mitigation associated with the Grand Parkway project in Houston. Stantec is providing assessment, design and construction management services. Michael is serving as project manager and lead designer for the project, which consists of over 16 miles of new stream construction, making it the largest known single-site mitigation bank in the United States.

Knowlton Creek Stream Restoration Project Final Design, Duluth, Minnesota (Project Manager)

Elevated sediment loads from bank erosion and bed degradation along Knowlton Creek have caused the filling of a downstream estuary. Following up on a Feasibility Study, Stantec produced Final design documents, assisted with bid preparation and will provide Construction Oversight Services. Michael served as project manager for the project.

Juniata Dam Removal and Stream Restoration Project, Philadelphia, Pennsylvania (Lead Designer, Project Manager)

As part of its Green City initiative, and utilizing a watershed plan developed by Stantec, the City of Philadelphia Water Department identified a number of projects to improve water quality within the city. In its current state, Juniata dam creates a stagnant pool that is believed to be a major contributor to decreased levels of Dissolved Oxygen (DO) within Tacony Creek. Stantec performed a feasibility study for the removal of the dam and the restoration of the channel upstream and downstream of the structure.

Middle Fork Stream Restoration Project, Henderson County, Tennessee (Project Manager; Lead Designer)

This project, located in West Tennessee, restored nearly two miles of perennial, spring-fed streams by raising them nearly fourteen feet in places to re-connect them with the historic flood plain. The design utilized hundreds of pieces of wood to stabilize the bottom as well as to create/enhance habitat value for in-stream and near-stream organisms. Dozens of oxbow and ephemeral pools were incorporated into the design to enhance near-stream habitat value for amphibians. Working closely with the Tennessee Stream Mitigation Program, Stantec provided assessment, design and construction management services. Michael managed the project and was the lead designer.

Phase I Katy Prairie Umbrella Stream Mitigation Bank, Houston, Texas (Project Manager, Lead Designer)

Stantec provided stream restoration assessment, design, construction observation and monitoring services to Restoration Systems, LLC for approximately three miles of stream on the Katy Prairie Conservancy property in Northwest Harris County near Houston, Texas. The project is being utilized in the first stream mitigation bank in Texas. Michael served as project manager and lead designer for the project, which consists of 3 miles of new stream construction.

* denotes projects completed with other firms

Michael F. Adams, Jr. PE

Geomorphology/Sediment Transport

Beasley Creek Stream Restoration Project, Fayette County, Tennessee (Project Manager; Lead Designer)

This project, located in West Tennessee just outside of Memphis, restored over three miles of streams by removing a berm running parallel to the stream system and replacing it with an active floodplain. The design included thousands of trees and shrubs in addition to the engineering work on the stream itself. Working closely with the Tennessee Stream Mitigation Program, Stantec provided assessment, design and construction management services. Michael managed the project and was the lead designer.

Crooked Creek Restoration Project, Hardin County, Tennessee (Project Manager)

The Tennessee Stream Mitigation Program entered a partnership with the Tennessee Wildlife Resource Agency to restore a section of Crooked Creek, a tributary to Mud Creek in the White Oak Wildlife Management Area. Michael served as project manager and lead technical resource for design and construction for approximately 10,000 linear feet of channel and several acres of adjacent wetlands. Construction for the project was accomplished under budget including a number of additional habitat features added during the construction phase.

Kyles Fork Stream Mitigation, Hancock County, Tennessee (Project Manager, Lead Designer)

This project, located on the Clinch River in East Tennessee, was aimed at reducing sediment loads and protecting a shoal that provided habitat for dozens of threatened and endangered mussel species. The Tennessee Stream Mitigation Program entered into a partnership with the Tennessee Wildlife Resource Agency, with Stantec serving as the design consultant, to restore approximately 5,000 linear feet of a tributary to the Clinch, to repair a rapidly eroding section of bank along the Clinch River and to eliminate a breach along a levee that was contributing sediment to the system. Michael was responsible for managing the project and serving as the lead technical resource for the design and implementation.

Little Frozen Creek Stream Restoration, Jackson, Kentucky (Design Engineer)

The construction of KY 15 by the Kentucky Department of Transportation impacted several streams along the proposed highway corridor. As Project Engineer, Michael was responsible for the design of over 2,500 feet of gravel-bed stream in eastern Kentucky as mitigation for the highway improvements. This project included sediment transport analysis, natural channel design, hydraulic modeling, field assessments, constructed riffles, boulder vanes and habitat features in a C4 stream type.

Zack's Fork Stream Restoration, Lenoir, North Carolina (Lead Designer)

Zack's Fork is a highly impacted stream located near Lenoir, North Carolina. The restoration of Zack's Fork was initiated through the North Carolina Ecosystem Enhancement Program (EEP) as a full delivery project. The project included reconstruction of 3900 feet of a highly entrenched F4 stream type as a stable C4 stream. Michael was the Lead Designer for the geomorphic study and stream restoration design.

Four Mile Creek Stream Restoration, Mecklenburg County, North Carolina (Lead Designer)

Four Mile Creek is located in a highly urbanized area near Charlotte. The restoration of Four Mile Creek was initiated through North Carolina's Ecosystem Enhancement Program as a full delivery project. The project included restoration of 2,900 feet of a highly entrenched F4 stream type to a stable C4 stream type. Michael served as the Lead Designer for the geomorphic study and stream restoration design.

Upper Coldwater Fork Stream Restoration, Martin County, Kentucky (Lead Designer)

Michael served as the Lead Designer for the restoration design of approximately 6,000 feet of Coldwater Fork in eastern Kentucky. Coldwater Fork was the most severely impacted stream from the October 11, 2000 slurry spill at the Martin County Coal facility, one of the worst coal mining related environmental disasters in the eastern United States. This project included a geomorphic assessment and design based on a reference reach, preparation of 401 and 404 permits, development of monitoring/maintenance plans, construction oversight and three years of monitoring.

Jim Herbert, PG, CEG

Geologist

Mr. Herbert has 34 years of extensive and varied experience in the engineering geology, geotechnical assessments, and associated construction fields. He has spent considerable time effectively managing quality control programs for significant earthwork construction, structural distress, rock excavation, groundwater assessment, dam instrumentation, and rock/soil slope stability assessments and stabilizations. Mr. Herbert is adept at evaluating existing site conditions with respect to design plans/construction specifications, distress indicators, geotechnical documentation, geological maps and literature, and aerial imagery to develop comprehensive models of subsurface conditions in support of site development, rehabilitation and forensic investigations. Given his wide-ranging experience, Mr. Herbert is capable of working easily with the project managers, design and construction professionals, environmental consultants, and local/state/federal regulators to develop implementable geotechnical, geologic, and hydrogeologic investigations within the confines of budget and schedule. During the course of his career, he has provided detailed plans for investigations into deep foundations, landslides and soil creep, rock slope stability, channel erosion, embankment and structural settlements, bridge and dam foundations, and aggregate resources.

Relevant Project Experience

New Los Padres Dam Feasibility Study and Aggregate Assessment, Monterey County, California, USA, Monterey Peninsula Water Management District

Project Engineering Geologist/Task Leader for the aggregate resources study for the proposed 282-foot high roller-compacted concrete dam on the upper Carmel River. Set up and performed field investigation of rock coring, water pressure and grout testing to evaluate the quantity and quality of rock resources in the area of the reservoir and dam. Supervised geophysical surveys and engineering geologic mapping conducted by others. He was also responsible for compilation of overall geologic/seismic evaluations of the project site, review/evaluation of preliminary design with respect to geologic conditions, and review/revision of construction cost estimate.

L. L. Anderson Dam - Spillway Outfall Modification Mapping & Construction Support, Placer County, California, USA, Placer County Water Agency

Project Engineering Geologist for the geologic mapping and evaluation of damage to the outfall area for the preliminary design, final design for construction of a new spillway outfall after record rainfall in 1996 caused reservoir overflow to leave the original spillway outfall channel. Modifications to the spillway outfall were performed under the jurisdiction of Federal and State agencies.

L. L. Anderson Dam - Spillway Modification Mapping, Investigations & Construction Support, Placer County, California, USA, Placer County Water Agency

Project engineering geologist responsible for developing work plan and project health and safety plan, and for implementation of subsurface exploration into granitic bedrock conditions associated with existing spillway for French Meadows Reservoir. Coreholes were advanced using wireline techniques on both sides of spillway for evaluation of widening, armoring, and new gate construction, and within the spillway for deepening the spillway and foundation conditions. Auger borings were advanced to evaluate foundation conditions for planned parapet wall on the crest of L.L. Anderson Dam, a 231-foot high rockfill structure.

Mokelumne Aqueducts Delta Tunnel Study, Sacramento-San Joaquin Delta, California, East Bay Municipal Utility District

Project Engineering Geologist responsible for data review and evaluation, evaluation of aerial imagery for regional conditions and access, alignment reconnaissance, permitting and contractor acquisition, development of work plan for subsurface exploration program along 16.6 mile long alignment through the Delta.

Big Tujunga Dam Seismic Rehabilitation Mapping, Investigations & Construction Support, Los Angeles County, California, USA, Los Angeles County Department of Public Works

Principal Engineering Geologist responsible for preparation and supervision of geotechnical investigations from a barge in the plunge pool and from cable-suspended platforms on near-vertical downstream abutment walls for evaluation of foundation conditions in planned concrete buttress. Becker Penetration Tests and seismic refraction surveys were conducted to evaluate liquefaction potential in an ancient stream channel

EDUCATION

BS, Geological Sciences,
California State University
at Long Beach

LICENSES/ REGISTRATIONS

Certified Engineering
Geologist: California
No. 1657

Professional Geologist:
California, No 5213,
Washington, No. 2394

underlying the foundation area of the right abutment wing wall. Prepared a detailed geologic report that summarized the field program and geologic/geotechnical findings. Oversaw a subsequent detailed subsurface investigation into left abutment stability and consulted with DSOD regarding findings. Mapped vertical abutment foundation excavations along with DSOD staff using industrial rope access techniques during construction.

Lower Slab Creek Powerhouse, Task 7: Mapping, Feasibility Evaluations & Construction Planning, Camino, California, Sacramento Municipal Utility District

Project Engineering Geologist providing reconnaissance- and design-level geologic mapping, evaluation of aerial imagery for regional bedrock structure, review and summaries of geologic/geotechnical investigations into Slab Creek Arch Dam, White Rock Tunnel and the specific project.

San Luis Reservoir Low Point Improvement Project Alternatives Evaluation, Santa Clara County, California, USA, Santa Clara Valley Water District

Project Engineering Geologist for planning study that addressed over 75 alternatives including new dams and reservoirs, expansion of existing reservoirs, pipelines, tunnels, pump stations, hydroelectric facilities, water treatment facilities, and institutional agreements, and provided geotechnical evaluation of six feasible alternative dam sites.

Upper San Joaquin Storage Investigation Alternatives & Temperance Flat Dam Investigations, Sierra Nevada Foothills, California, USA, U. S. Bureau of Reclamation

Principal Engineering Geologist and Assistant Task Manager for alternative designs, conceptual design and cost estimating for selected alternatives of 15 potential storage measures intended to increase storage within the upper San Joaquin River Basin by 700,000 acre-feet. Dam types considered included concrete-faced rock fill, earth fill, concrete arch, concrete gravity, and RCC. Worked closely with Reclamation staff in site reconnaissance, mapping and geological/geotechnical investigation program development for the preferred Temperance Flat Dam alternative.

El Galeno Mine Tailings Dam & Borrow Resource Investigations, Cajamarca, Peru, Lumina Copper

Lead Engineering Geologist responsible for Bankable Feasibility-level geologic mapping of the 24 km² project site, located in the Andes Mountains at elevations over 3500 m. Provided detailed field mapping and analysis for a planned 10 million m³ tailings dam and 1 million m³ saddle dam, water supply dam, waste rock dump and processing plant facilities. Also provided support to the subsurface field investigation that advanced over 8000 m of diamond core drill hole.

La Pitarrilla Mine Tailings Dam & Borrow Resource Investigations, Casas Blancas, Mexico, Silver Standard

Engineering geologist for geologic mapping of proposed tailings storage facility dam and impoundment in volcanic ignimbrite terrain. Also mapped and assessed sources and quantities of potential fine-grained deposits for impoundment liner material and coarse-grained deposits for aggregate and filter materials.

American River Pump Station Foundation Mapping, Investigations & Construction Support, Auburn, California, USA, Placer County Water Agency

Project Engineering Geologist for the evaluation of potential pump station, intake structure, fish screen configurations and pipeline alignments within the construction area of the abandoned Auburn Dam project. Conducted reconnaissance-level geologic mapping of potential sites and detailed geologic mapping of selected site. Managed and evaluated findings of subsurface field investigation conditions with respect to slope stability, seismicity, and faulting. Provided conceptual design, preliminary design, and final design support and construction observations. During construction, blast-damaged slopes were assessed, slope inclinations were modified, and anchor bolts were installed to provide more stable tunnel portal and slopes.

Tulloch Hydroelectric Project, 3rd Unit Addition, Mapping, Investigations & Construction Support Oakdale, California, USA, Oakdale and South San Joaquin Irrigation Districts

Principal Engineering Geologist responsible for the initial reconnaissance-level mapping of the proposed powerhouse and access road. Provided QA/QC oversight for subsequent detailed mapping and subsurface field investigations consisting of three wireline rock coreholes advanced into the proposed powerhouse footprint. Provided oversight and review for in-construction rock excavation mapping and rock bolt placement.

Jennifer Van Pelt, PG

Geologist

Ms. Van Pelt provides field geological, geotechnical, and supervising services on a wide variety of hydroelectric and water resource projects, and is a licensed professional geologist in California. Ms. Van Pelt's 10 years of project experience includes field mapping (traditional and rope access techniques), geotechnical drill core logging and sampling, soils logging and sampling, well installation and development, slope stability analyses, evaluation, and instrumentation, fracture and kinematic analysis, photogrammetric evaluation, foundation preparation inspection, dam foundation curtain and consolidation grouting design, implementation, and inspection, groundwater and surface water sampling, report preparation, and laboratory experience.

EDUCATION

MS, Geological Sciences,
University of California,
Santa Barbara

REGISTRATIONS

Professional Geologist:
California, 9174

Relevant Project Experience

San Clemente Dam Removal and Carmel River Re-route, California American Water, Carmel Valley, California

The San Clemente Dam has reached the end of its usable life due to heavy sediment buildup. The California State Coastal Conservancy plans to remove the dam and re-establish the natural flow of the Carmel River and San Clemente Creek. Ms. Van Pelt conducted geotechnical field services for a feasibility evaluation of the project which included mapping of geologic structures in the local area including stratigraphic, fracture, and fault identification, and oversaw the advancement of two 120 foot core holes and three sediment borings along the Carmel River, and San Clemente Creek. Produced a Technical Memo for the investigation including the analysis of field work and geotechnical data, kinematic analyses, and the creation of detailed drill core logs and geologic maps.

Preliminary Design: Mill Site Jetty Geotechnical Investigation, Confidential Client, New Mexico

Lead geologist for geotechnical exploration program to evaluate foundation conditions for the design of an arroyo jetty and stormwater channels to control erosion. Services included supervision and coordination of drilling, sample collection, detailed rock core and soils logging, geologic mapping, quality assurance, and training of staff.

White River Hydro Project – Construction and Commissioning Support, Regional Power OPCO Inc., Ontario Canada

Engineering geology inspector and project geologist for two Greenfield run-of-river hydroelectric facilities on the White River, in northwest Ontario, Canada. Provided on-call geotechnical support during excavation and construction, including foundation and abutment rock mapping, and rock slope stability recommendations. Served as technical lead geologist on site during curtain grouting operations, providing coordination, oversight, quality control, and preparation of final grouting report. Commissioning of both sites expected mid-2016. Total installed capacity of both sites is 18.9 MW.

Candelaria Mine New Tailings Storage Facility Dam Project – Phase 3 Geotechnical and Hydrogeological Subsurface Investigation, Freeport McMoran Inc. (FCX), Copiapo, Chile

Lead engineering geologist in the field, and site coordinator for a detailed geologic and geotechnical exploration program to evaluate the subsurface conditions and geohazards for a new tailings storage facility dam in Northern Chile. Services included supervision and coordination of multiple drilling teams and technicians for 24 hours drilling, permeability testing, piezometer installation, discontinuity mapping, detailed logging of samples as well as quality assurance and oversight of 1,500 m (4,900 feet) of soils and rock logging, and training of junior staff.

Wanapum Dam Spillway Repairs, USA, Grant County Public Utility District, Washington State

Engineering Geologist in quick response activities associated with repair of broken concrete monolith within the spillway gate structure for Wanapum Dam located on the Columbia River in central Washington. The designed repair involved installation of post-tensioned anchors (PTA) such that the concrete monoliths would satisfy Federal Energy Regulatory Commission dam stability criteria at an intermediate pool level. The PTAs consist of three 61-strand tendons in each of the 11 spillway piers, supplemented by bar anchors in the spillway ogee sections. Ms. Van Pelt provided drilling supervision and oversight for subsurface investigation crack logging of pilot holes drilled through structure for tendon installation.

Cerro Verde Mine Expansion Tailings Dam Project, Freeport McMoran Inc (FCX), Arequipa, Peru

The Cerro Verde Mine Expansion Tailings Storage Facility includes the construction of a 140 m (459 feet) tall zoned embankment starter dam to handle the start-up water pond and a 300 m (984 feet) tall ultimate cyclone sand embankment dam, to contain a total of 2.025 Gt of processed ore tailings. Ms. Van Pelt provided engineering geology services during the feasibility and design investigation, which included drilling and logging of over 1900 m (6200 feet) of rock core and soils, permeability testing, piezometer installation, field mapping, and training of associated staff.

Susitna-Watana Reservoir Slope Stability Evaluation, Alaska Energy Authority (AEA), Talkeetna Mountains, Alaska

Performed a desktop reservoir rim slope stability evaluation for the proposed 700 foot high Susitna dam which will impound a reservoir approximately 42 miles in length, and an annual drawdown of approximately 200 feet. The evaluation utilized LiDAR (Laser Detection and Ranging) and ISFAR (Interferometric Synthetic Aperture Radar) imagery, the results of previous field investigations and geologic mapping, and from aerial imagery interpretations to examine the landscape for evidence of active/recent and/or historical failures (e.g., slides, flows, solifluction) and to identify the likely dominant failure modes and mechanisms that may occur during reservoir operation, and considered geologic conditions, slope angle and aspect, and potential for permafrost was used to evaluate potential for future instability during reservoir operation.

New Croton Dam Spillway Modification, New York Department of Environmental Protection, New York

Conducted field investigations and kinematic analyses for the New Croton Dam Spillway Modification project, Croton-on-Hudson, New York. Development of 3D models of the spillway slope used ADAM-Tech Photogrammetric tools to create detailed maps, photo-geologic maps, and kinematic figures for slope stability analyses.

Dugway West Interceptor Sewer Expansion Tunnel Geotechnical Investigation, North East Ohio Regional Sewer District (NEORS), Cleveland, Ohio

Provided engineering geology services during the investigation stage for the design of a 3 mile long sewer interceptor to be constructed beneath an urban area. Reaches include cut and cover pipeline, a 108 inch tunnel in hard rock transitioning to a 63 inch EPBM micro-tunnel in soft glacial deposits. Ms. Van Pelt oversaw soils and core drilling for the tunnel geotechnical investigation, including geotechnical core and soils logging, sampling, and piezometer installation.

La Pitarrilla Mine, Tailing Storage Facility Feasibility Investigation, Silver Standard, Casas Blancas, Mexico

Ms. Van Pelt produced detailed geotechnical logs for approximately 1000 m rock core in volcanic, volcanoclastic, altered, and sedimentary rocks as a field geologist in support of the geotechnical investigation and feasibility geotechnical design of a plant site capable of producing 4,000tpd ore body, two alternative locations for a tailing storage facility (TSF) and a 15km long access road including a bridge crossing the Nazas River. Investigation was initiated for the site location and development of a tailings storage facility for daily mine operation of approximately 8000 tons/day for approximately 17 years.

mwhglobal.com



2121 N. California Blvd.
Suite 600
Walnut Creek, CA 94596