Merced Integrated Regional Water Management Implementation Grant Proposal

Appendix 8-18

The Merced River Alliance Project Final Report, Volume I: Education and Outreach

The Merced River Alliance Project

FINAL REPORT, Volume I

Project Overview, Outreach and Education

Prepared by
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Prepared for
State Water Resources Control Board
Sacramento, California

September 2008

Merced River Alliance
River-long and Watershed-Wide

Stillwater Sciences

The Merced River Alliance Project
Final Report: Volume I

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WATERSHED: Upper Merced River (1804008) and Lower Merced River (1804002)
PROJECT TYPE: CalFed Watershed Program

FUNDING SOURCE: Proposition 13 Watershed
COST: $2,300,077

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Contract Summary Form

Completed Grant Summaries are made available to the public on the State Water Resources Control Board's (SWRCB) website at http://www.waterboards.ca.gov/funding/grantinfo.html

Use the tab and arrow keys to move through the form. If field is not applicable, please put N/A in field.

Date filled out: **June 30, 2008**

Grant Information: Please use complete phrases/sentences. Fields will expand as you type.
1. **Grant Agreement Number:** 04-306-555-0
2. **Project Title:** The Merced River Alliance Project
3. **Project Purpose – Problem Being Addressed:** The Project consists of joining two (2) independent watershed management efforts to address issues collaboratively, to conduct biological assessment monitoring and to provide education and outreach to stakeholders in the upper and lower reaches of the Merced River watershed.
4. **Project Goals** a. **Short-term Goals:** To establish the Alliance, the project manager, watershed coordinators and outreach coordinators will coordinate activities via monthly meetings; an Alliance mailing list will be developed and maintained so that an Alliance newsletter can be published and mailed twice each year; biannual general meetings will be held for stakeholders of both reaches; a workgroup will study and prioritize future projects and studies. Biological monitoring will be established following an approved Biological Monitoring and Assessment Plan. The Alliance Project will be promoted to stakeholders, residents, and schools in both reaches.
b. **Long-term Goals**: To date, there has been limited coordination among agencies and watershed groups working the in the lower and upper reaches of the watershed. The Project seeks to connect planning efforts in both reaches and promote joint projects. The Project will provide baseline biological data for both reaches that will furnish a basis for future management decisions. There is also a lack of awareness of watershed issues in local communities, governments, and schools, and there is significant stakeholder resistance to water quality monitoring in the largely agricultural lower reach. The Project will promote sound watershed stewardship to change these conditions over time. The establishment of this innovative "cross-jurisdictional" watershed partnership will leverage stakeholder, stewardship, and management efforts so that they are more effective. It is the first phase of a unified local effort to enhance the watershed, teach residents and others about it, and attract support for future projects in the watershed.
5. **Project Location**: (lat/longs, watershed, etc.) Upper and Lower Merced River Watersheds

a. **Physical Size of Project**: (miles, acres, sq. ft., etc.) NA
b. **Counties Included in the Project:** Merced and Mariposa Counties
c. **Legislative Districts:** (Assembly and Senate) Assembly Districts 17 and 25; Senate Districts 12 and 14
6. **Which SWRCB program is funding this grant?** Please "X" box that applies. X Prop 13 ☐ Prop 40 ☐ Prop 50 ☐ EPA 319(h) ☐ Other
Grant Contact: Refers to Grant Project Director. **Name:** Catherine Weber **Job Title:** Project Director
Organization: East Merced Resource Conservation District **Webpage Address:** www.emrcd.org
Address: 2135 Wardrobe Avenue, Suite C, Merced, CA 95341
Phone: 209 722-4419 EX 3 **Fax:** 209 725-2964
E-mail: info@emrcd.org
Grant Time Frame: Refers to the implementation period of the grant. **From:** March 15, 2005 **To:** September 30, 2008
Project Partner Information: Name all agencies/groups involved with project. East Merced Resource Conservation District, Merced River Stakeholders, Mariposa County Resource Conservation District, Upper Merced River Watershed Council
Nutrient and Sediment Load Reduction Projection: (If applicable) NA

Please provide a hard copy to your Grant Manager and an electronic copy to your Program Analyst for SWRCB website posting. All applicable fields are mandatory. Incomplete forms will be returned.

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EXECUTIVE SUMMARY

The Merced River Alliance Project (Merced Alliance) has aimed to develop community-based, watershed-wide stewardship of the Merced River watershed through three efforts: fostering connections between stakeholders in the lower and upper river segments, providing place-based education for partner schools in the watershed, and conducting a river-long contemporary snapshot of three major communities of organisms throughout the mainstem Merced River. The Merced Alliance Final Report is comprised of two volumes. Volume 1 provides an overview of the project, a detailed discussion of project outreach and education activities, and an analysis of the outcomes of outreach activities. Volume I also provides a brief summary of results from the biological monitoring component of the project.

Volume II of the final report includes methods and results from the two-year, six-season (summer 2006 to spring 2008) biological monitoring and assessment effort. Methods and a summary of existing data, previously described in the Biological Monitoring and Assessment Plan (BMAP [Stillwater Sciences 2006]), are updated and presented in Volume II, as well as further analysis of preliminary data presented in the interim report. The majority of intended analyses described in the BMAP, along with additional analysis approaches developed during the project tenure, are also included in Volume II of the final report.

Merced Alliance community outreach activities included several watershed fairs for the general public and a series of workshops, tours, and forums for specific audiences. Education activities focused on implementing the Adopt-a-Watershed approach to watershed education in two partner schools. One school was located in the lower river corridor and one in the upper; several grade levels were included in the educational program. Students at both partner schools trained for and implemented water quality monitoring in the Merced River near their schools on a regular schedule. Interested community members and stakeholders were informed of community outreach activities and general project news through a biannual newsletter and a web page. However, reaching a wider audience proved challenging as the communities in the watershed have no shared media. Working with partner organizations proved to be most effective in publicizing Merced Alliance events. Considerable effort was spent in developing partnerships with over 20 other partner organizations.

Outreach activities were designed to create an interest in watershed processes and a basic understanding of how past and current human activities have affected these processes. Content at events for the general public began at a basic level, covering the location of the Merced River and its watershed, uses of its water, and how water quality testing is accomplished. At workshops and forums, content was targeted to the

audience with topics ranging from the wastewater treatment system in Merced County to citizen water quality monitoring training. Participants appeared interested in the information and usually requested that they be included on the stakeholder e-mail list.

A total of 95 monitoring sites were located throughout the lower and upper river segments for the Merced Alliance biological monitoring portion of the project. Aquatic habitat mapping was conducted during fall 2005 to support selection of the monitoring sites as representative of the upper and lower segments of the Merced River. Approximately 123 river miles (RM) of the mainstem river were mapped, with results presented at stakeholder meetings in both the upper and lower river segments and made available for downloading from http://www.mercedriverwatershed.org. Subsequent sampling of fish, benthic macroinvertebrate (BMI), and riparian bird species occurred over six seasons during 2006–2008. Three invasive BMI species were also surveyed in the river during the general BMI monitoring activities, including New Zealand mudsnail, Asian clam, and Chinese mitten crab. Overall, the biological surveys were designed to complement information available from current and ongoing studies on the Merced River and regionally, and to ensure compatibility with ongoing data collection efforts to the maximum extent possible.

During 2006–2008, community patterns were documented both spatially and seasonally for fish, BMI, and riparian birds. Results were presented periodically at stakeholder meetings in both the upper and lower river segments, with presentation slides available for downloading from http://www.mercedriverwatershed.org. Data indicated general effects of elevation and other related environmental variables on species composition and biological metrics for all major community groups. The majority of fish species observed in the Merced River during 2006–2008 were introduced, resident species, while the majority of individual fish observed in the Merced River were native residents in the upper river segment and introduced residents in the lower river segment. Throughout the study, multiple fish species were found at variable densities throughout the river. There was general agreement with water temperature assemblages and broad conformity with established community assemblages for the San Joaquin River Drainage. In general, fish habitat associations indicated expected trends based on known species' preferences for a subset of measured physical habitat and water quality variables. Overall, fish habitat associations indicated that a few aquatic habitat types, including primarily margin habitat in the lower river segment and mid-channel pool habitat in the upper river segment, supported a relatively high number of fish. Beyond the primary fish monitoring objectives, several hypotheses regarding fall-run Chinook salmon and contemporary fish community assemblages were investigated.

For BMI, while overall biological signals were highly correlated between targeted riffle composite (TRC) samples and multi-habitat composite (MHC) samples, differences in abundance, biovolume, richness, and diversity metrics for these two sample types were observed. Beyond the primary BMI monitoring objectives, several hypotheses regarding

BMI assemblage quality were investigated, including hypotheses related to large woody debris, site restoration effects, and the potential for serial discontinuity of BMI taxa due to the presence of the foothill dams. Asian clams were found in the lower river segment, as far upstream as RM 44.5 (elevation 77 m [255 ft] above sea level). They were not found in the upper river segment, upstream of the foothill dams. No New Zealand mudsnail or Chinese mitten crabs were found during the surveys.

Results of the avian study component underscore the importance of the upper and lower segments of the Merced River to a large variety of bird species, especially songbirds, throughout the year, and particularly during the breeding season. Additionally, the lower river segment likely provides valuable habitat for raptors. Results suggest that birds in both segments of the Merced River are responsive to local riparian patch and landscape factors, with species diversity strongly related to measures of riparian cover or riparian patch width in both river segments.

LIST OF ACRONYMS AND ABBREVIATIONS

AMFSTP – Adaptive Management Forum Scientific and Technical Panel
BLM – Bureau of Land Management
BMAP – Biological Monitoring and Assessment Plan
BMI – aquatic benthic macroinvertebrate
CAMP – Comprehensive Assessment and Monitoring Plan
CDFG – California Department of Fish and Game
CMARP – Comprehensive Monitoring, Assessment, and Research Program
CNDDB – California Natural Diversity Database
DWR – Department of Water Resources
EMRCD – East Merced Resource Conservation District
GIS – geographic information system
ID – irrigation district
MCRCD – Mariposa County Resource Conservation District
MeID – Merced Irrigation District
MRR – Merced River Ranch
MRS – Merced River stakeholders
NAWQA – USGS National Water-Quality Assessment Program
NOAA – National Oceanic and Atmospheric Administration
NPS – National Parks Service
NRS – Natural Resource Scientists, Inc.
PAEP – Project Assessment and Evaluation Plan
PFMC – Pacific Fisheries Management Council
PRBO – Point Reyes Bird Observatory
QA/QC – quality assurance, quality control
QAPP – Quality Assurance Project Plan
RM – river mile
RCD – Resource Conservation District
SWRCB – State Water Resources Control Board
SWAMP – Surface Water Ambient Monitoring Program
UMRWC – Upper Merced River Watershed Council
USGS – United States Geological Survey
WQ – water quality
YNP – Yosemite National Park
YVS – Yosemite Valley School

1 DISTRIBUTION LIST

The following individuals received copies of the draft versions of the final report.

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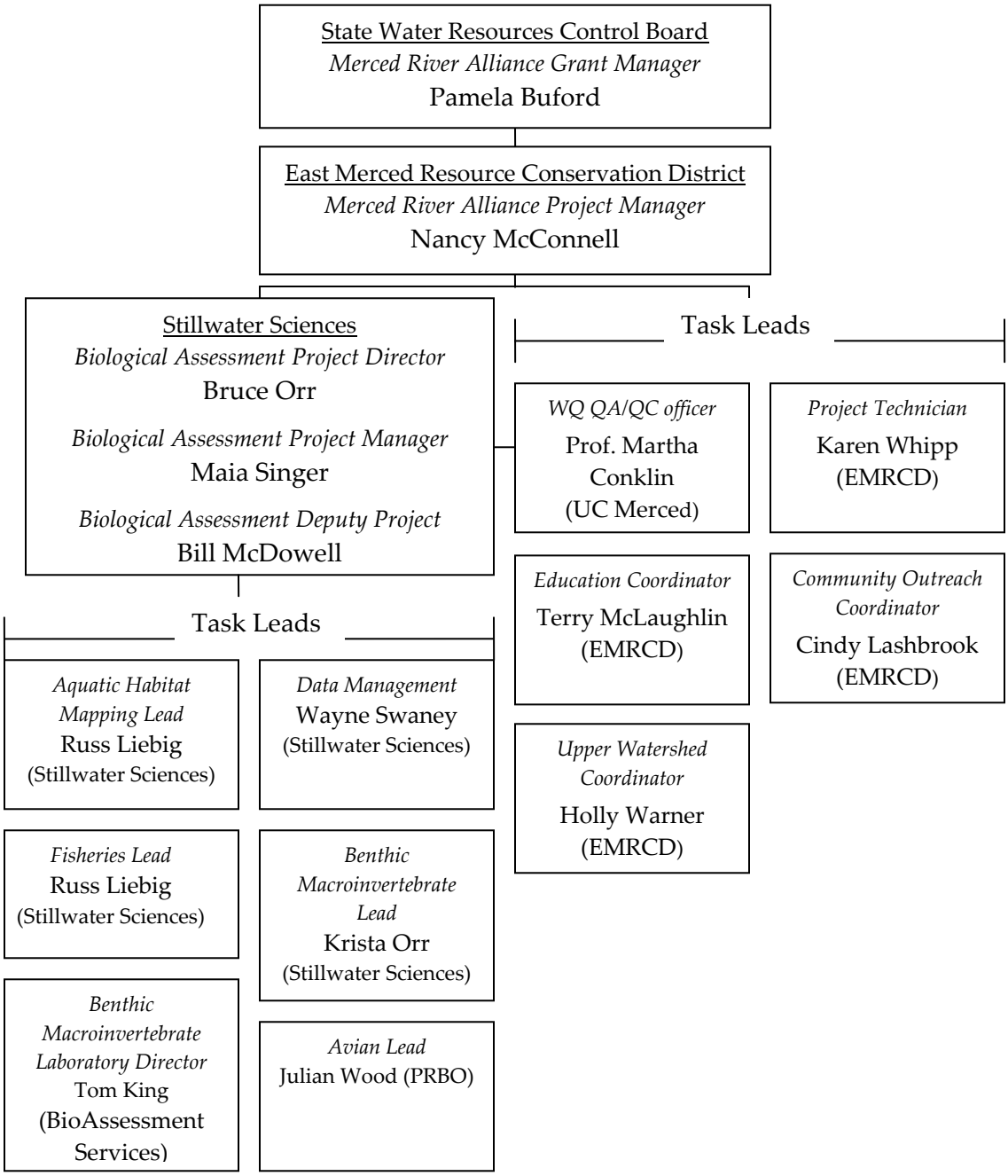
2 PROJECT ORGANIZATION



3 PROBLEM STATEMENT AND BACKGROUND

3.1 Problem Statement

The Merced River, a major tributary to the San Joaquin River, is located in the southern portion of California's Central Valley (Figure 3-1a,b). The upper and lower segments of the Merced River, and the watershed as a whole, have been affected by a range of human interventions including dams and flow regulation, flow diversion, gold and aggregate (sand and gravel) mining, levee construction, land use conversion in the floodplain, clearing of riparian vegetation, introduction of exotic plant and animal species, and point and non-point source pollution from abandoned mines. Beyond these, effluent from wastewater treatment plants, bank protection, and recreational use are also potential factors affecting the range of biological and physical processes occurring in the Merced River watershed. While stakeholders in the small communities of the Merced River watershed have, at times, expressed a common interest in protecting the resources of the watershed, there has been limited stakeholder involvement in watershed-wide protection or enhancement efforts. Additionally, although a number of restoration projects have been undertaken during the past two decades (see Appendix A in Volume II), there has been a lack of contemporary watershed-scale data to evaluate the effects of various reach or sub-reach scale projects in both the upper and lower segments of the Merced River.

The Merced River Alliance Project (Merced Alliance) was designed to join two independent watershed management efforts to collaboratively address issues, conduct biological assessment monitoring, and provide education and outreach to stakeholders in the upper and lower segments of the Merced River, for the benefit of the Grantee.

3.2 Study Rationale

During the project tenure, the Merced Alliance was directed by the East Merced Resource Conservation District (EMRCD) which operates in the lower portion of the Merced River watershed. At the beginning of the project, the lower river segment was also represented by the Merced River Stakeholders (MRS). The upper river segment was represented by the Mariposa County Resource Conservation District (MCRCD) and the Upper Merced River Watershed Council (UMRWC) throughout the project duration. Other project partners were included as the Merced Alliance developed.

Prior to the Merced Alliance, the various stakeholder groups located along the upper and lower river segments had been committed to protecting the resources of the Merced River watershed in their reaches, and each organization had been carrying out studies and projects in their portion of the watershed. However, the upper and lower groups were often unaware of each other's projects and did not always recognize their shared interests and concerns. Because the small communities of the upper and lower river segments lacked the connections of shared community events, media, or organizations, the EMRCD, MRS, MCRCD, and UMRWC focused on their own areas rather than on the entire watershed. Geographic factors also effectively separated the lower river segment from the upper river segment at Lake McClure. Another factor limiting community involvement in watershed management was the apparent disconnect between schools and the watershed. Despite the location of several schools near the Merced River, little if any time had been devoted to learning about the physical, chemical and biological elements of the river or its watershed. Management efforts were also hampered by the lack of watershed-scale data which could be used to update plans or evaluate management activities. Through education and outreach, the Merced Alliance planned to develop a "river-long, watershed-wide" perspective for upper and lower river stakeholders.

The biological monitoring component of the Merced Alliance was envisioned as the first planned comprehensive assessment of fish, bird, and benthic macroinvertebrate (BMI) species composition and distribution in the Merced River. A river-wide biological assessment was included in the Merced Alliance for several reasons. First, it was anticipated that a contemporary baseline data set of this scope would improve understanding of the general patterns of distribution and relative abundance of fish, BMI, and birds throughout the river-riparian corridor. Although the baseline "snapshot" of the Merced River does not represent either pristine or static conditions, analysis and synthesis of the biological assessment results was designed to increase the working understanding of interactions between the aquatic-riparian biota and watershed processes on the Merced River in order to help identify factors potentially limiting ecosystem health (Section 7.3). The contemporary baseline data provided in this study establishes an initial condition against which to compare future restoration and management actions, and supply information necessary for prioritizing those actions. Finally, a contemporary biological assessment of the Merced River increases the scientific evidence available upon which to develop, refine, and strengthen CALFED Ecosystem Restoration Program goals and objectives (CALFED 2004).

Fish, BMI, and birds were chosen as the focal species of the baseline biological monitoring task because: 1) they are generally sensitive and readily measurable indicators of environmental conditions (Temple and Wiens 1989, Klemm et al. 1990, Barbour et al. 1999, Uliczka and Angelstam 2000, Bryce et al. 2002, Brown et al. 2003); 2) prior to Merced Alliance efforts, there had been no river-wide comprehensive attempt to establish an understanding of baseline ecological conditions for these organisms; and 3)

very little is known regarding their composition, distribution, and relative abundance in the Merced River outside of Yosemite National Park (AMFSTP 2002, Stillwater Sciences 2002). Although a number of studies have been conducted within the Park, many of the results are not readily available to the scientific community and the public.

4 OVERALL PROJECT GOALS & OBJECTIVES

The Merced Alliance was guided by a set of four goals and several associated objectives. The first goal was to build the Merced Alliance by developing a "river-long, watershed-wide" perspective among stakeholders of the lower and upper Merced River segments. This goal was based on the expectation that a shared perspective would lead to collaborative planning for the watershed. Thus, the Merced Alliance focused on outreach to watershed communities (and adjacent municipal communities) and on implementing watershed education in key schools. Outreach was designed to promote increased watershed stewardship by providing relevant and useful information to stakeholders, communities, students, and governments.

The second goal of the project was to develop a Biological Monitoring and Assessment Plan (BMAP) to clearly state the monitoring-specific goals, lay out a set of secondary hypotheses focused on guiding current and future restoration efforts, and provide contemporary baseline data regarding native and non-native fish, riparian bird, and BMI communities on the upper and lower segments of the Merced River. As part of BMAP development, existing fish, BMI, and riparian bird data sources were reviewed in order to provide an historical context to the contemporary understanding of the Merced River ecosystem.

The third goal of the Merced Alliance, and the primary goal of the biological monitoring portion of the project, was to implement the BMAP though two years of surveys on the upper and lower segments of the Merced River. This goal included summarizing findings of the biological monitoring efforts for the SWRCB, local landowners, and other interested stakeholders in the Merced River watershed.

Goal four, the primary goal for the outreach and education component of the Merced Alliance, involved developing a better understanding of the Merced River watershed within the stakeholder community and building capacity within that community to sustain the river's health and beauty. For example, through improved understanding of the connections between the lower and upper segments of the Merced River, local government and agency officials might better plan for their respective management areas in the watershed. Additionally, data made available to decision-makers through the biological monitoring and assessment component could provide a basis for better informed management actions. Stakeholders in both the lower and upper river segments might be more likely to support collaborative management activities.

Ultimately, by learning about the connections between the upper and lower river segments, students and stakeholders might become better stewards of the Merced River watershed's resources.

The following list summarizes the Merced Alliance goals and associated objectives.

Goal 1: Build the Merced Alliance

1. Recruit partners for watershed outreach and education.
2. Schedule and hold two annual meetings of Merced Alliance stakeholders and RCD directors from East Merced County and Mariposa County.
3. Schedule and hold monthly meetings of Merced Alliance staff.
4. Form a work group to study and prioritize future projects.

Goal 2: Prepare and Implement a Biological Monitoring and Assessment Plan

1. Compile and synthesize existing biological data for the Merced River corridor.
2. Develop a river-long, two year monitoring plan for fish, riparian bird, and BMI species.
    a. Use standardized monitoring protocols to ensure compatibility with regional datasets (including SWAMP Quality Assurance Project Plan [QAPP] elements).
    b. Develop testable hypotheses to guide current and future river restoration efforts.

Goal 3: Implement the Biological Monitoring and Assessment Plan

1. Compile and map aquatic habitat data for the Merced River corridor in GIS.
2. Undertake two years of biological monitoring for fish, BMI, and riparian bird communities in the Merced River watershed.
    a. Expand and enhance past and existing monitoring efforts.
    b. Standardize monitoring protocols to ensure compatibility with regional datasets (including SWAMP Quality Assurance Project Plan [QAPP] elements) and allow for comparisons with other Central Valley river corridors.
    c. Apply river-long monitoring and assessment protocols that support CALFED Science Board recommendations (AMFSTP 2002).
    d. Address specific biological assessment hypotheses developed to guide current and future river restoration efforts.
3. Organize baseline biological and relevant physical habitat data and make available to local watershed-related entities and agencies.
    a. Present at community meetings.
    b. Transfer data to the Merced Alliance web-site (www.emrcd.org).
    c. Submit annual reports to the SWRCB.

Goal 4: Promote the Merced Alliance

1. Publish a newsletter twice a year and mail to five hundred stakeholders.
2. Develop and maintain a web page (www.emrcd.org).
3. Conduct a tour of the watershed for stakeholders.
4. Hold two watershed fairs, one in lower river corridor and one in upper river corridor.
5. Conduct six community outreach forums.
6. Form an education team.
7. Identify two partner schools, one in lower river corridor and one in upper river corridor and implement Adopt-a-Watershed place-based watershed education in at least two grade levels at each school.
8. Hold an introductory citizen monitoring event in the lower river corridor.
9. Train lower river corridor stakeholders as citizen water quality monitors using upper river corridor monitors as mentors.
10. Hold four water quality monitoring events in conjunction with the "science van" of Mariposa County schools.
11. Publish six articles on water quality monitoring, one in each issue of the Merced Alliance newsletter.

Goal 5: Prepare required documents and reports including the Quality Assurance Project Plan, the Project Assessment and Evaluation Plan, monthly invoices and progress reports, and the final report.

5 PROJECT DESCRIPTION

5.1 Project Costs

Project costs for outreach and education to build and promote the Merced Alliance as well as biological monitoring costs for the three-year project duration are presented in Table 5-1. Each of the major tasks included overall task management and management of subtasks. For example, the biological monitoring costs included field efforts, travel, expenses, data management, and existing data collection and synthesis of the aquatic habitat mapping, fish monitoring, avian monitoring, and benthic macroinvertebrate monitoring subtasks. Additionally, development of draft and final project reports, grant accounting, permitting, and development of the Project Assessment and Evaluation Plan (PAEP), a requirement of the SWRCB grant process, were included in both the outreach and biological monitoring components of the overall project. A detailed project schedule for the biological monitoring component is presented in Volume II of this final report (Stillwater Sciences 2008).

Table 5-1. Merced Alliance budget.

Description	Total by Item
Build the Merced Alliance • Develop mailing list • Schedule and hold annual Alliance meetings • Form workgroup to prioritize future activities	$ 89,362
Develop the Biological Monitoring and Assessment Plan (BMAP) • Develop fish monitoring plan • Develop BMI monitoring plan • Develop avian monitoring plan • Communication with SWRCB and other resource agencies • External peer review	$ 135,558
Conduct Biological Assessment Monitoring • Landowner outreach • Compile and synthesize existing data • Aquatic habitat mapping • Fish reconnaissance, monitoring, and data analysis • BMI reconnaissance, monitoring, and data analysis • Avian reconnaissance, monitoring, and data analysis • Reports - Draft and final reports - Permits and permit reporting - Project Assessment & Evaluation Plan - Invoicing / progress reports	$ 1,629,845

Table 5-1. Merced Alliance budget.

Description	Total by Item
Promote the Merced Alliance Through Outreach & Education • Develop outreach tools: newsletter • Develop outreach tools: simple webpage • Develop outreach tools: watershed / river fairs • Develop outreach tools: tours & community forums • Education: form team, implement Adopt-a-Watershed curriculum • Water quality monitoring: introduce & mentor stakeholders in lower river segment • Reports - Expenditure/invoice projections - Forms / permit cover sheets / project summary / project inventory - QAPP & Monitoring Plan - Project Assessment & Evaluation Plan - Track success toward completing project goals - Invoicing / progress reports - Draft and final reports	$ 445,312
TOTAL	**$ 2,300,077**

5.2 Project Methodology

5.2.1 Outreach Methodology

The outreach and education methodology followed the process developed by Adopt-a-Watershed. In August 2005, an initial team of volunteers and staff attended a leadership institute and developed a draft education strategic plan. The education component of the plan was modified as more educators joined the team and as partner schools were identified and curriculum materials were prepared. In December 2005, Merced Alliance staff participated in a two-day workshop sponsored by Adopt-a Watershed to prepare a strategic plan for the outreach component. An evaluation workshop through Adopt-a-Watershed in February 2006 provided information for assessing the success of outreach efforts and for adaptive management of education and outreach.

Outreach efforts followed two strategies. One was to plan activities and events for the general public that would raise awareness about the Merced watershed. Events such as river days and watershed fairs provided opportunities for the general public to learn about the Merced River and its watershed while an Alliance newsletter informed subscribers about the watershed and Alliance activities. The second strategy was to target groups with special interests in the watershed such as landowners and local government officials. Community forums allowed for dialogue among landowners along the Merced River, local farmers, local leaders,

and agency administrators, who might otherwise not interact. In order to promote these Merced Alliance activities and to ensure that interested parties were aware of them, multiple media forms were used, including promotion of Merced Alliance activities and events in local newspapers, publication and distribution of the Merced Alliance newsletter, and the creation of a Merced Alliance web page. Annual Merced Alliance meetings brought lower and upper stakeholders together for shared meals and informative programs. Whenever possible, the organizations and agencies that cooperated with the Merced Alliance were invited to participate and assist in planning outreach events. Outreach activities were directed by a part-time Community Outreach Coordinator assisted by upper and lower watershed coordinators and volunteers.

Snelling Elementary School, located across the street from the Merced River in Snelling, California and Yosemite Elementary School, located in Yosemite Valley within walking distance of the Merced River, were selected as partner schools for Merced Alliance work in education. The Adopt-a-Watershed approach, which emphasizes place-based learning and the belief that students learn best when learning about and participating in their local environment, was determined to be the most effective way to educate local students about the Merced River. A part-time Merced Alliance Education Coordinator developed curriculum based on the Merced River watershed that was aligned with California Content Standards for Science in grades 4 through 8, taught demonstration lessons in the schools, and mentored teachers in the partner schools who implemented the curriculum in their classrooms.

5.2.2 Biological Monitoring Methodology

As discussed in Section 1, the Merced Alliance biological monitoring and assessment component of the project was designed to provide a river-long contemporary snapshot for three major communities of organisms; fish, BMI, and riparian birds. As a reflection of the river-long monitoring and assessment approach, and in an effort to significantly expand and enhance past and existing monitoring efforts on the Merced River, a total of 95 monitoring sites were located throughout the lower and upper river segments (see Volume II for monitoring site locations). Site selection for the fish, BMI, and riparian bird surveys was carried out during fall 2005, following intensive coarse-scale aquatic habitat mapping. To ensure that the selected sites were representative of existing aquatic habitat on the Merced River, information on the longitudinal distribution and relative proportion of various aquatic habitat types (e.g., run, riffle, pool, etc.) in the lower and upper river was used to select monitoring sites corresponding to mapped habitat type occurrence. Sites were also selected to be accessible and to take advantage of existing data, where possible. Low-elevation helicopter videography was used to map the coarse-scale aquatic habitat types in the lower river, from the confluence with the San Joaquin River (RM 0) to Merced Falls Dam (RM 54.3), and in the upper river from the upstream extent of Lake McClure (RM 79.9) to Yosemite National Park (RM

105.6). Within the boundaries of Yosemite National Park (RM 105.6 to approximately RM 130), helicopter flights were not allowed, and on-the-ground mapping of discrete monitoring sites was carried out instead.

Over the two-year tenure of the monitoring effort, fish sites in the lower river segment were sampled across three seasons (spring, summer, and fall), and each season was sampled during two separate years (2006, 2007, or 2008). Fish sites in the upper river were sampled in one season (fall) and during two separate years (2006 and 2007). A variety of fish sampling methods were used, appropriate to habitat type, flow conditions, and resource agency permit requirements, including snorkel surveys, boat and backpack electrofishing, and beach seining. BMI monitoring sites in both the upper and lower river segments were sampled primarily in the fall, and during two separate years (2006 and 2007). A subset of BMI sites were also sampled during the spring during the second year of the study (2007), and several sites in the lower river segment, near the confluence with the San Joaquin River, were sampled for Chinese mitten crab occurrence during summer 2006. BMI samples were collected using targeted riffle composites (where appropriate) and multi-habitat composites. Finally, bird monitoring sites along the lower river corridor were sampled across three seasons (spring, fall, winter), and each season was sampled during two separate years (2006 and 2007). Bird monitoring sites along the upper river corridor were sampled during two seasons (spring and fall) during two separate years (2006 and 2007). Further information about monitoring schedules and all details regarding methods, new data, and data evaluation are included in Volume II of the final report, *Biological Monitoring and Assessment* (Stillwater Sciences 2008).

5.3 Existing Data

5.3.1 Education and Outreach Existing Data

No formal survey data of residents' knowledge about the Merced River watershed existed at the beginning of the Merced Alliance project. Informal assessments of understanding about the Merced River watershed indicated that baseline knowledge of the watershed was quite limited. For example, some community members attending the river fairs along the lower river corridor were surprised to learn that the Merced River did not begin at Lake McClure. Similarly upper river corridor residents were unsure about what happened to the Merced River once it left the Merced Canyon near Briceburg. Few students could identify the watershed in which they lived. Only six of 137 students, grades 2 through 6, correctly identified the watershed as the Merced in pre-surveys of their knowledge about the watershed.

Although individual teachers provided some information about the local environment, schools in the watershed had no formal programs of watershed education. One of the partners, Snelling School, had no place-based curriculum. The other partner school, Yosemite Valley Elementary, did carry out place-based projects such as *River of Words*,

but the projects were not based on watershed science. One of the teachers at this school had also participated in the *GLOBE* project, a primary and secondary school-based science and education program, by monitoring water quality in the Merced River. However, she said that her class did not fully understand the measurements being made and requested help in explaining the importance of the tests, what the various parameters indicated, and in interpreting the results.

5.3.2 Existing Biological Data

Existing biological and water quality data for the upper and lower segments of the Merced River was reviewed to provide an historical context for our contemporary understanding the current baseline biological conditions within the river. Data that was compiled for this effort include that from work undertaken by agencies, individual researchers, and watershed-related groups. The information presented in the following section represents a compilation of sources to date, but does not exhaust possible sources of data on the Merced River. A summary of the existing data itself was provided in the BMAP (Stillwater Sciences 2006). Limited re-analysis of existing data was, in some cases, necessary to allow direct comparison with Merced Alliance data. Results of any re-analyses are presented in Volume II of this final report.

Data from the sources listed in the following sections have been provided by the agencies or individuals identified. Stillwater Sciences has assumed that data contained within reviewed reports was of sufficient scientific quality (sampling protocols, accuracy, and precision) and has undergone quality assurance / quality control (QA/QC) procedures to render it adequate for the desired application. Information was compiled, to the extent practicable, for display on base maps and GIS data layers for further analyses.

5.3.3 Existing Fish Data Sources

To date, the majority of data on fish in the river has been gathered during studies assessing Chinook salmon outmigration timing, abundance, and survival in the lower Merced River and through more general fish surveys conducted in Yosemite National Park. Table 5-2 and Figure 5-1 include sources and ongoing studies that were reviewed for the BMAP (Stillwater Sciences 2006) and updated for this final report (Note: these references are not necessarily repeated in the reference list). Additional studies co-led by CDFG and Merced Irrigation District (MeID) are either planned or currently underway on the Merced River, with descriptions and timing detailed in the Merced River Memorandum of Understanding (see Volume II). In most cases, data from these studies was not available for inclusion in the Merced Alliance data compilation.

Table 5-2. Existing fish data sources reviewed for the Merced Alliance biological assessment.

Author	Year	Title	Publication Information
Bertetta, F.	1992	Summer fish population survey Upper Merced River watershed	Report to Wilderness Manager Ron Mackie, Yosemite National Park, California
Botti, S.	1977	Status of fish populations in 102 planted lakes.	Unpublished file report, U.S. Department of the Interior, National Park Service, Yosemite National Park, California
Brown, L., T. Ford, M. Saiki, J. May, and J. Merz	2005	Monitoring, Research, and Assessment Components (CMARP) for River Resident Fish Species.	http://calwater.ca.gov/Programs/Science/cmarp/a7a10.html
Brown, L.R.	1996	Aquatic Biology of the San Joaquin-Tulare Basins, California: Analysis of Available Data Through 1992.	U.S. Geological Survey Water-Supply Paper 2471, 89 p.: USGS National Water-Quality Assessment Program San Joaquin - Tulare Basins NAWQA.
Brown, L.R.	2000	Fish communities and their associations with environmental variables, lower San Joaquin River drainage, California.	Environmental Biology of Fishes 57: 251-269.
Brown, L.R. and T.M. Short	1999	Biological, habitat, and water quality conditions in the Upper Merced River Drainage, Yosemite National Park, California, 1993-1996.	USGS Water-Resources Investigations Report 99-4088.
Brown, L.R., C.R. Kratzer, and N.M. Dubrovsky	1999	Integrating Chemical, Water Quality, Habitat, and Fish Assemblage Data from the San Joaquin River Drainage, California.	Chapter 3 in Scow, K. M., Fog G. E., Hinton D.E., and Johnson M.L. Integrated Assessment of Ecosystem Health Lewis Publishers, Boca Raton, Florida.
CDFG	2003	Merced River Current Fish Counts. Weekly Anadromous Fish Count.	http://www.dfg.ca.gov/lands/fh/weekly_counts/merced.htm
CDFG	2003	Adult Return-Estimates of Spawning Population Merced River. 1940-2002.	Query StreamNet Database – searched database on July 25, 2005 for fish. http://query.streamnet.org
CDFG	2003	Hatchery-Returns Estimates of Spawning Population Merced River. 1970-1995.	Query StreamNet Database – searched database on July 25, 2005 for fish. http://query.streamnet.org
CDFG	2003	Hatchery-Weir Counts Estimates of Spawning Population Merced River. 1979-1989.	Query StreamNet Database – searched database on July 25, 2005 for fish. http://query.streamnet.org
CDFG	2001	AFRP. Riffle Atlas - San Joaquin Tributaries (Merced, Stanislaus, and Tuolumne Rivers).	http://www.delta.dfg.ca.gov/afrp/project.asp?code=1999-20
CNDDB	2005	Upper Merced_CNDDB_042605 - All Species List (Amphibians, Plants, etc.)	Searched Rarefinds 3.0.5 on 26 April, 2005 for plants and animals by selected USGS quads.

Table 5-2. Existing fish data sources reviewed for the Merced Alliance biological assessment.

Author	Year	Title	Publication Information
Dubrovsky, N.M., C.R. Kratzer, L.R. Brown, J.M. Gronberg, and K.R. Burow	1998	Water Quality in the San Joaquin-Tulare Basins, California, 1992-95.	USGS National Water Quality Assessment (NAWQA) Program data. http://water.usgs.gov/pubs/circ/circ1159/
Holdeman, S.	2005	Personal communication with Steve Holdeman, Fisheries Biologist, Stanislaus National Forest, California, by Maia Singer, Stillwater Sciences, Berkeley, California.	Fish surveys of North Fork Merced River and tributaries, and mainstem Merced River, limited data available on resident management indicator species. August 30.
Kisanuki, T.T. and T.A. Shaw	1992	Merced River habitat typing, underwater fish observations, and habitat restoration. Report AFF1-FRO-92-03.	USFWS (U.S. Fish and Wildlife Service), Coastal California Fishery Resource Office, Arcata, CA.
Knapp, R.A.	2003	Yosemite Lake Survey, 2000-2002, Final Report to the National Park Service	Sierra Nevada Aquatic Research Laboratory, U.C. Santa Barbara. June 1.
Lindley, S.T.	2003	California Central Valley steelhead. Preliminary conclusions regarding the updated status of listed ESUs of West Coast salmon and steelhead: draft report	Pages B90-B99. National Marine Fisheries Service, West Coast Salmon Biological Review Team (Individual authors not specified in publication).
Lindley, S.T., R. Schick, B.P. May, J.J. Anderson, S. Greene, C. Hanson, A. Low, D. McEwan, R.B. MacFarlane, C. Swanson, and J.G. Williams	2004	Population structure of threatened and endangered Chinook salmon ESUs in California's Central Valley Basin.	NOAA (National Oceanic and Atmospheric Administration) Technical Memorandum NMFS (National Marine Fisheries Service).
MeID	2005	Merced River juvenile salmon capture counts. Merced, California.	http://www.mercedid.org/salmon/totals.html
MeID and NRS (Natural Resource Scientists, Inc.)	2003	Merced River Wing Dam Gravel Monitoring 2000-2002.	Final Report, March 2003. Conducted by Merced Irrigation District and Natural Resource Scientists. Merced, California. Anadromous Fish Restoration Program. 40 p.
NPS (National Park Service)	2002	Fish species of Yosemite National Park.	Species list only (no counts). http://www.nps.gov/yose
Stillwater Sciences	2006	Baseline Monitoring of the Merced River Dredger Tailings Reach.	Stillwater Sciences, Berkeley, CA.
Stillwater Sciences	2002	Merced River Corridor Restoration Plan.	Prepared by Stillwater Sciences, Berkeley, California, for CALFED, Sacramento, California.

Table 5-2. Existing fish data sources reviewed for the Merced Alliance biological assessment.

Author	Year	Title	Publication Information
USFWS (U.S. Fish & Wildlife Service)	2002	Comprehensive Assessment and Monitoring Program (CAMP) Annual Report 2000.	Prepared by CH2M-Hill, Sacramento, CA. http://www.fws.gov/pacific/sacramento/fwr/2000_CAMP_Report.pdf
USFWS	1997	Identification of the instream flow requirements for Fall-run Chinook salmon in the Merced River.	Final report prepared by USFWS Ecological Services, Sacramento Field Office. 69 p. http://www.delta.dfg.ca.gov/afrp/documents/MR_Spawning_Report_March_1997.pdf
USFWS	2000	Instream Flow, Merced River Robinson Reach Investigation, 2000 Annual Report.	Annual Report prepared by USFWS, SFWO, Energy, Power, and Instream Flow Branch. September 2000. 4 p. http://www.delta.dfg.ca.gov/afrp/documents/MR_annual_rep_2000.pdf
USFWS	2002	Instream Flow, Merced River Robinson Reach Investigation, 2002 Annual Report.	Prepared by USFWS, SFWO, Energy, Power, and Instream Flow Branch. February 2002. 4 p. http://www.delta.dfg.ca.gov/afrp/documents/MR_annual_rep_2001.pdf
Vogel, D.A.	2003	Merced River water temperature feasibility investigation reconnaissance report.	Report to US Fish & Wildlife Service, Anadromous Fish Restoration Program.
Williams, K.	2005	Personal communication with Kevin Williams, Fisheries Biologist, Sierra National Forest, Bass Lake Ranger District, California, by Maia Singer, Stillwater Sciences, Berkeley, California.	2005 Fish surveys of South Fork Merced River, limited data available. 22 August.

Table 5-3. Ongoing anadromous fish monitoring programs relevant to the Merced River.

Species/Race	Life-History Stage	Fish Monitoring Programs	Agency/ Organiza-tion	Years Sampled	Primary Source Location (secondary or summary source location)
Fall-run Chinook Salmon (*Oncorhynchus tshawytscha*)	Adult	Carcass counts	CDFG	1940 to present	CDFG Grandtab[1] (http://www.streamnet.org as well as CAMP reports)
		Hatchery marking[2]	CDFG	1970 to present	http://www.streamnet.org
		Hatchery returns[2]	CDFG	1970 to present	http://www.streamnet.org (CAMP reports)
		Ocean harvest	PFMC		http://www.rmis.org (CAMP reports)
		Redd surveys[3]	CDFG	1988 to present	theyne@dfg.ca.gov
	Juvenile	Rotary screw trapping	MeID	1998 to present	http://www.mercedid.org/ salmon/count.html (1998-2000 data avail)
Steelhead (*Oncorynchus mykiss*)[4]	—	—	—	—	—
American Shad (*Alosa sapidissima*)[4]	—	—	—	—	—

1 Summary of the Annual Reports of Chinook Salmon Stocks in California's Central Valley, as taken from the CDFG annual Administrative Reports of the Inland Fisheries Division.

2 Merced River Hatchery is located immediately downstream of Crocker-Huffman Dam (RM 52).

3 From 1988-2004, counts are intermittent and by section. From 1992-2004 counts are regular (weekly) and by riffle.

4 Although these species have been observed in the lower reaches of the Merced River (see Appendix B Volume II of this report), there are currently no established monitoring programs to estimate their populations. The Merced River and adjacent riparian habitat downstream of Crocker-Huffman Dam were included in the final critical habitat designation for steelhead in 2005 (NOAA 2005).

5.3.4 Existing BMI Data Sources

Previous studies of BMI assemblages have been conducted in both the upper and lower segments of the Merced River, including sites in Yosemite National Park and near the confluence with the San Joaquin River. Table 5-4 includes sources and ongoing BMI studies that have been reviewed for this report (Note: these references are not necessarily repeated in the reference list). A map of monitoring site locations for existing BMI data on the Merced River is included in Figure 5-2.

Table 5-4. Existing BMI data sources reviewed for the Merced River Alliance biological assessment.

Author	Year	Title	Publication Information
L.R. Brown and T.M. Short	1999	Biological, Habitat, and Water Quality Conditions in the Upper Merced River Drainage, Yosemite National Park, California, 1993–1996	USGS Water-Resources Investigations Report 99-4088 Sacramento, California
Brown, L.R. and J.T. May	2000a	BMI assemblages and their relations with environmental variables in the Sacramento and San Joaquin River drainages, California, 1993–1997	U.S. Geological Survey Water-Resources Investigations Report 00-4125, National Water-Quality Assessment Program.
Brown, L.R., and J.T. May	2000b	BMI assemblages on woody debris and their relations with environmental variables in the Lower Sacramento and San Joaquin drainages, California	Environmental Monitoring and Assessment 64: 311-329
Brown, L.R., and J.T. May	2004	Periphyton andBMI communities at five sites in the San Joaquin River Basin, California, during June and September, 2001	U.S. Geological Survey Scientific Investigations Report 2004-5098.
Carter, J.L. and S.V. Fend	1997	Interannual Distribution and Abundance of Lotic Invertebrates from Five Habitats of the Merced River in Yosemite Valley, Yosemite National Park, 1992-1995	Open File Report 97-584. Prepared in cooperation with Yosemite National Park, National Park Service. Menlo Park, CA: USGS.
Carter, J.L. and S.V. Fend	2001	Inter-annual changes in the benthic community structure of riffles and pools in reaches of contrasting gradient	Hydrobiologia 459: 187-200.
Herbst, D.B., E.L. Silldorff, and S.D. Cooper	2003	The influence of introduced trout on native aquatic invertebrate communities in a paired watershed study of High Sierran streams	Final Report to The Nature Conservancy, Ecosystem Research Program (#HO-CSD-050600-CA) and the University of California Water Resources Center (#W-930).
Markiewicz, D., K. Goding, V. de Vlaming, and J. Rowan	2003	BMI bioassessment of San Joaquin River tributaries: Spring and Fall 2002	California SWRCB. Available at: http://www.swrcb.ca.gov/rwqcb5/available_documents/waterqualitystudies/SJR02_Bioassess_final_083005.pdf
Silldorff, E.L.	2003	Stream invertebrate responses to trout introductions: results from large-scale studies in the central Sierra Nevada and Yosemite National Park	Dissertation, University of California, Santa Barbara.
Stillwater Sciences	2006	Baseline Monitoring of the Merced River Dredger Tailings Reach	Stillwater Sciences, Berkeley, CA.

5.3.5 Existing Avian Data Sources

The majority of data on birds in the Merced River riparian corridor has been gathered through site specific monitoring of baseline conditions, as incidental observations, and through surveys conducted in Yosemite National Park. Table 5-5 includes sources and ongoing studies that have been used to review existing avian data, and mapped in Figure 5-3 (Note: these references are not necessarily repeated in the reference list).

Table 5-5. Existing avian data sources reviewed for the Merced Alliance biological assessment.

Author	Year	Title	Publication Information
Archives of the Museum of Vertebrate Zoology, University of California	2005	Query Merced – Avian Species List searched database on 21 July, 2005 for plants and animals.	http://elib.cs.berkeley.edu/mvz/index.html
BLM (Bureau of Land Management)	1979	Unpublished, untitled BLM data from Peggy Cranston, Wildlife Biologist	Totals of birds, mammals, and herpetofauna from Peggy Cranston
California Partners in Flight, Study Area Database	2005	Query Merced River sites – searched database on September 6, 2005 for birds.	http://www.prbo.org/calpif/data.html
CNDDB	2005	Query Merced River _CNDDB_042605 – All Species List (Amphibians, Plants, etc.)	Searched Rarefinds 3.0.5 on 26 April, 2005 for plants and animals by selected USGS quads
Gaines, D.	1988	Birds of Yosemite and the East Slope	Artemesia Press, Lee Vining, CA
Holdeman, S.	2005	Personal communication. Fisheries Biologist, Stanislaus National Forest, California.	No known Stanislaus NF avian data conducted in Merced River drainage. 30 August
Siegel, R.B. and D.F. DeSante	2002	Avian inventory of Yosemite National Park (1998-2000): Final Report.	The Institute for Bird Populations, Point Reyes Station, California, 100 p.
Siegel, R.B. and D.F. DeSante	2003	Bird communities in thinned versus unthinned Sierran mixed conifer stands.	Wilson Bulletin 115(2): 155-165
Stillwater Sciences	2006	Baseline Monitoring of the Merced River Dredger Tailings Reach.	Stillwater Sciences, Berkeley, CA.
USDA Forest Service, Sierra National Forest	unknown	Spotted owl point locations and spotted owl protected activity centers, GIS shapefiles.	N/A
Verner, J., and L.V. Ritter	1983	Current status of the brown-headed cowbird in the Sierra National Forest.	Auk 100: 355-368. http://elibrary.unm.edu/sora/Auk/v100n02/p0355-p0368.pdf
Williams, K.	2005	Personal communication with Kevin Williams, Fisheries Biologist, Sierra National Forest, Bass Lake Ranger District, California, by Maia Singer, Stillwater Sciences, Berkeley, California.	Other than for spotted owl, no known Sierra NF avian data conducted in Merced River drainage. 22 August.

5.3.6 Existing Flow, Water Temperature, and Water Quality Data Sources

Although not included in the original scope of the project, compilation of existing flow, water temperature, and water quality data sources was included in the BMAP (Stillwater Sciences 2006) because these parameters affect aquatic habitat quality. As presented in Volume II of the final report, existing water quality data was one of the site selection criteria for fish and BMI monitoring sites; flow was a measurement parameter for fish habitat characterization; flow (discharge) was the prime parameter used for the analysis of hydrologic alteration during BMI habitat quality assessment; and, the effect of water temperature on fish distribution (e.g., steelhead) in the lower river was included among the secondary fish study hypotheses.

Figure 5-4 illustrates the locations of California Data Exchange Center (CDEC) and/or USGS gaging stations, as well as the locations of MeID, CDFG, and DWR thermographs along the upper and lower segments of Merced River. Gaging stations located in both segments are summarized in Volume II Appendix D. Table 5-6 summarizes existing sources for water temperature and water quality data on the Merced River.

Table 5-6. Existing water temperature and water quality data sources on the Merced River.

Author	Year	Title	Publication Information
Brown, L.R., C.R. Kratzer, and N.M. Dubrovsky	1999	Integrating chemical, water quality, habitat, and fish assemblage data from the San Joaquin river drainage, California.	Chapter 3 in Scow, K. M., Fog G. E., Hinton D.E., and Johnson M.L. Integrated Assessment of Ecosystem Health Lewis Publishers, Boca Raton, Florida.
Brown, L.R., and T.M. Short	1999	Biological, habitat, and water quality conditions in the Upper Merced River Drainage, Yosemite National Park, California, 1993–1996.	USGS Water-Resources Investigations Report 99-4088.
CDFG	2008	Monitoring gages in the upper and lower segment of the Merced River	Available by request from Shelly Schubert, [sschubert@dfg.ca.gov]
Dubrovsky, N.M., C.R. Kratzer, L.R. Brown, J.M. Gronberg, and K.R. Burow	1998	Water quality in the San Joaquin-Tulare basins, California, 1992–95.	USGS National Water Quality Assessment (NAWQA) Program data. http://water.usgs.gov/pubs/circ/circ1159/
NPS (National Park Service)	1994	Baseline water quality data inventory and analysis, Yosemite National Park. Water Resources Division and Service-wide Inventory and Monitoring Program.	Technical Report, NPS/NRWRD/NRTR-94-03, September. http://nrdata.nps.gov/YOSE/nrdata/water/baseline_wq/docs/YOSEWQAA.pdf
Pereira, W.E., J.L. Domagalski, , F.D. Hostettler, L.R. Brown, and	1996	Occurrence and accumulation of pesticides and organic contaminants in river sediment, water and clam tissues from the San Joaquin River	Environmental Toxicology and Chemistry 15(2): 172–180.

Table 5-6. Existing water temperature and water quality data sources on the Merced River.

Author	Year	Title	Publication Information
J.B. Rapp		and tributaries, California.	
Stillwater Sciences	2004	Mercury assessment of the Merced River Ranch.	Stillwater Sciences, Berkeley, California.
Upper Merced River Watershed Council	2006	Appendix data from citizens water quality monitoring project	Upper Merced River Watershed Council
Vogel, D.A.	2003	Merced River water temperature feasibility investigation reconnaissance report.	Report to U.S. Fish and Wildlife Service, Anadromous Fish Restoration Program. December 29, 2003.

5.3.7 Existing Geomorphic Cross-Section Data Sources

Table 5-8 summarizes existing sources for geomorphic cross-section data in the Merced River. The majority of surveys have been conducted in the lower river. Although the existence of cross-section data was not a requirement for the biological monitoring site selection, it was originally considered during Merced Alliance site selection because it could be used to complement aquatic habitat mapping information.

Table 5-7. Existing geomorphic cross-section data sources on the Merced River.

Author	Year	Title	Publication Information	Number of Cross-Sections (RM)
Blodgett, J.C. and G.L. Bertoldi	1968	Determination of channel capacity of the Merced River downstream from Merced Falls Dam; Merced County California	USGS Open File Report	149 (RM 0 to 52)
Vick, J.C.	1995	Habitat rehabilitation in the Lower Merced River: A geomorphic perspective	M.S. Thesis: University of California at Berkeley, Department of Landscape Architecture	22 (RM 27 to 52), with 16 re-occupied from Blodgett and Bertoldi (1968)
Stillwater Sciences	2004	Channel and floodplain surveys of the Merced River Dredger Tailings Reach	Prepared for CALFED ERP, Sacramento, California	40 (RM 43.5 to 52)
Madej, M.A, V. Ozaki, C. Jones, and G. Gibbs	1997	Channel changes in the Merced River following the January, 1997 flood	USDOI, U.S. Geological Survey Biological Resources Division and Redwood National and State Parks	44 (RM 119-124)

5.4 New Data

5.4.1 New Data for Education and Outreach Activities

The Merced Alliance staff attempted to gather data about outreach activities through evaluation forms completed by participants and response posters where participants could post their thoughts on the events. Neither of these strategies was particularly successful as participants were not willing to take the time to respond. In two instances, small prizes were offered for completion, but that did not improve the percentage of responses. Despite the small number of responses, some general conclusions could still be drawn.

Respondents enjoyed activities in which they could participate actively. Tours, water quality monitoring, river fairs and watershed days, demonstrations of biological monitoring protocols, and local or natural history walks were all rated highly. Lecture-type talks and PowerPoint presentations were rated less highly. However, participants still reported that their knowledge of the Merced River increased as a result of these less active presentations. Programs at the annual Merced Alliance meetings, which reprised Merced Alliance education, outreach, and biological monitoring for the year, were well attended by stakeholders, an indication of their interest.

In classroom settings, students could be required to complete a pre-and post- survey of their knowledge, allowing for better collection of data. Multi-grade classrooms are the norm in the small schools of Mariposa and Merced counties that are in the Merced River watershed. Students from second to sixth grade took the pre- and post- surveys. Regardless of age, the students' ability to define a watershed and to identify the watershed in which they lived improved following a lesson using a watershed model. Before the lesson, 137 students took the pre-survey, and only one student (less than 1%) correctly defined watershed, and six students (4%) identified the Merced River as the watershed in which they lived.

The post-survey was administered two weeks after the lesson to check for mastery rather than short-term memorization. Ninety-two post-lesson questionnaires were completed. Fewer surveys were completed because of student absences and one teacher who did not return any post-surveys. Of the 92 post-lesson surveys, 23 students (25%) had clearly mastered the concept of a watershed in their definition. Another 23 students (25%) were beginning to grasp the concept, responding with ideas like "a place where you get your water", "a place where they put water in a river", or "a water purification place." Fifty-eight students (63%) correctly identified the watershed in which they live.

These results indicate that the concept of a watershed is a difficult one and challenges students. The watershed lesson was designed for fifth grade students in order to align with the California Content Standards for Science. However, because of the multiple grade classrooms of Snelling and Yosemite Valley Schools, students from second

through sixth grade experienced the watershed lesson. Younger students may require a slower pace and perhaps more repetitions. Multiple exposures to the definition and concept of a watershed through more follow-up should improve student understanding and retention. Also, a simpler and "catchier" definition of a watershed, one that could be repeated and remembered easily, would be helpful to students.

Comments from teachers in whose classrooms the watershed lesson was taught were positive and encouraging. They remarked on how engaging the curriculum was for their students and asked to be included in the watershed lesson in future years.

5.4.2 New Biological Monitoring Data and Data Analysis

All new biological monitoring and assessment data and supporting data analyses are presented in Section 7 of Volume II of the final report.

6 PUBLIC OUTREACH

Outreach to residents, students, landowners, local government officials, and agency staff followed four major paths. The first path was outreach through media. To reach landowners and residents, the Merced Alliance published two newsletters during each year of the project. From an initial Merced Alliance mailing list of over one thousand names, approximately 700 stakeholders in the lower and upper river corridors were selected to receive the newsletter by mail. This list was gradually reduced to approximately 500 when duplicate entries and incorrect addressees were eliminated. Each issue publicized Merced Alliance events and activities, provided a summary of the biological monitoring project, provided information about water quality monitoring, and introduced readers to species and places of interest in the watershed. In 2006, a logo integrating the fields of the lower river corridor with the mountains of the upper river corridor was designed and used to "brand" the Alliance in the masthead of the newsletter. A website was designed for the EMRCD that included a page for the Merced Alliance, where Merced Alliance news and events were publicized. Aquatic habitat maps and key Merced Alliance documents were also posted on the digital library of the UMRWC (www.mercedriverwatershed.org). Press releases to local newspapers were prepared for major events, which led to several in-depth stories about Merced Alliance activities being published in the Merced Sun-Star.

The second public outreach path was to provide activities and events for residents of the Merced River watershed who had little or no prior experience with the Merced River or its watershed. During the course of the Merced River Alliance Project, two river fairs were held in the lower river corridor and one Watershed Day in the upper river corridor (Table 6-1).

Table 6-1. Merced Alliance river fairs.

Date	Theme	Location	Intended Audience	No. of Participants	Partners
5/22/2005	River Fair	Livingston	General Public	100 (approximate)	• Adopt-a-Watershed • Ecological Farming Assn • Great Valley Museum • Merced Fly Fishers • Revive the San Joaquin • NRCS
9/30/2006	Watershed Day	Briceburg	Residents of upper river corridor	100 (approximate)	• UMRWC • BLM • USFS • NPS • Audubon • The Yosemite Bug Hostel • UC Merced
6/2/2007	River Fair	Livingston	Residents of lower river corridor	300 (approximate)	• Ecological Farming Assn. • CA State Parks • Great Valley Center • NRCS

The river fairs were planned to attract the general public, especially families, to sites near the lower Merced River. There participants watched demonstrations, participated in craft activities, learned how to assess and protect water quality, took nature walks, received updates on Merced Alliance activities, and relaxed in pleasant natural surroundings. Watershed Day in the upper watershed had a schedule of planned activities which included bird walks, wildflower hikes, fly-fishing demonstrations, water safety demonstrations, a geologic presentation on the Ferguson slide which had closed Highway 140, nature activities for children, and Native American cultural presentations. The success of these events can be attributed in part to the support of partners who provided activity leaders, demonstrations, and logistical support.

The third public outreach path was to provide forums, workshops, and meetings which targeted particular audiences. These events are summarized in Table 6-2.

Table 6-2. Major Merced Alliance outreach events.

Date	Topic	Location	Intended Audience	No. of Participants	Partners
11/3/2005	Sustainable Agriculture & Water Quality	Livingston	Local farmers and landowners	27	• Merced Co. Farm Bureau • CA Coalition of Organic Farmers
11/21/2005	First Annual Alliance Meeting and Dinner	Catheys Valley	RCD directors & stakeholders	98	• Merced & Mariposa Co. Supervisors • UC Merced • NRCS
3/7/2006	Water Stakeholders' Round Table	Merced	Local officials & agency representatives	15	• MeID • East San Joaquin Water Quality Coalition • Merced Co. Farm Bureau • Merced Co. Ag. Commissioner • NRCS • Merced Co. Planning & Public Works • Merced Co. Supervisors
6/3/2006	The dam that divides us	Henderson Park, Exchequer Dam (lower watershed)	Board members of Mariposa & East Merced RCDs	7 board members, 9 stakeholders & staff	• MeID
10/19/2006	Watershed, Wetlands, & Wastewater	Merced	Planners, stake-holders, community members	45 on tour; 63 at dinner & talks	• Merced Co. Supervisors • MeID • Merced Farm Bureau • Merced Sierra Club
11/14/2006	Second Annual Alliance Meeting & Dinner	Briceburg (upper watershed)	RCD directors & stakeholders	54	• UC Merced • NRCS • Merced & Mariposa Co. Supervisors
6/18/2006	Lower Merced River Float	Lower Merced River	Stakeholders & residents	50	• UMRWC
11/14/2006	Local history tour of Briceburg	Briceburg (upper watershed)	Stakeholders	17	• UMRWC
6/6/2007	Urban Development & Water Resources	Merced	Stakeholders & residents	21	• MeID • UC Merced
9/6/2007	Bird Protocol Monitoring Demonstration	El Portal	Lower & upper stakeholders & residents	15	• Audubon • UMRWC
10/13/2007	Introduction to Water Quality Monitoring	Henderson Park, Snelling (lower watershed)	Lower watershed stakeholders & residents	32	• UMRWC • Snelling School

Table 6-2. Major Merced Alliance outreach events.

Date	Topic	Location	Intended Audience	No. of Participants	Partners
10/22/2007	Upper Watershed Tour	Briceburg (lower watershed)	RCD directors & stakeholders	14	• BLM/UMRWC
1/11/2008	Water Resources of Merced County	Lower Merced River	Local gov't officials, stakeholders, local farmers	76	• CA Women in Agriculture • UC Merced • UC Cooperative Extension • MeID • UMRWC
2/9/2008	Water Quality Monitoring Training	Midpines (upper watershed)	Volunteers from lower watershed	7 from lower, 29 from upper	• UMRWC
3/11/2008	Third Annual Alliance Meeting & Dinner	Catheys Valley	RCD directors & stakeholders	67	• Merced HS • Snelling School • UC Merced • Mariposa Co. Schools • Mariposa Co. Supervisors • NRCS • YNP

The forums and workshops, although open to all, were designed for stakeholders with particular interests in agriculture, the environment, and water resources. In particular the forums which included the tour of the City of Merced waste water treatment system and the tour of Merced watershed sites (Lake McClure & vernal pools) generated interest in more coordinated planning for water resources in the lower river corridor. Partner organizations and agencies assisted in planning and promoting almost all of these events. Collaborating with partner groups proved to be the most effective means of "getting the word out" about Merced Alliance events.

Annual Merced Alliance meetings were also held in 2005, 2006, and 2008. All stakeholders were invited to attend these meetings, and attendance ranged from 54 to 98. The program at these meetings included time for networking, progress reports on Merced Alliance outreach and education, and updates on the biological monitoring studies. At the last Merced Alliance meeting, held in March 2008, the connections created by Merced Alliance work were celebrated through student talks, photo displays, a discussion of the major features in the Merced River watershed and a review of grant tasks, and an update on the biological monitoring and assessment results.

The fourth public outreach path was education in partner schools. The Merced Alliance Education Coordinator spent considerable time developing place-based lessons on watershed science that were aligned with the California Content Standards for Science.

She also created a watershed kit that included watershed and groundwater models, lesson materials, and pre- and post- surveys. The coordinator made multiple visits to the partner schools, Snelling Elementary School and Yosemite Valley Elementary School. These visits averaged two to three hours, not including transportation time, and involved teaching demonstration lessons, working with students in the field, and planning lessons with teachers. Students at both sites were also trained as water quality monitors using the protocols of the UMRCW's Monitoring Plan and Quality Assurance Project Plan. Students at Snelling School monitor water quality in the Merced River three times during the school year while, students at Yosemite Valley Elementary School monitor water quality on an almost weekly basis.

In addition to the regular classroom instruction and field work, the Merced Alliance Education Coordinator also planned and led special activities for the students of the partner schools (Table 6-3).

Table 6-3. Merced Alliance education tours, projects, and presentations.

Date	Activity	Location	School/grade level	Partners
9/2006-10/2006	Envirothon Teacher Training (WQM equip)	Merced	Teachers	• NRCS
11/2006	Snelling 7th-8th grade to Yosemite; Watershed tour, train WQM	Yosemite Valley	Snelling 7th-8th grade students	• UMRWC
2/2007	New Exchequer Dam Tour	Lower Merced	Snelling 7th-8th grade students	• MeID
2/2007	Snow Survey / presentation by Dr. Robert Rice, UC Merced	Yosemite high country	Snelling students	• UC Merced
3/2007	Merced River float	Lower Merced	Snelling 7th-8th grade students	
4/2007	Student presentation to MCUSD Administration	Mariposa Administrative Offices	Yosemite Valley School (YVS) students	
5/2007	Signs of Spring	South Fork of the Merced	Yosemite & Wawona students	
6/2007	Kids' Guide to Yosemite published	Yosemite Valley	YVS students	
6/2007	Hedgerow Planting Service Project	Livingston	Snelling 7-8th grade students	• NRCS • USFWS • Intermountain Nursery
6/2007	BMI demonstration	El Portal	El Portal Elementary	
6/2007	Stewardship project	Yosemite Valley	Wawona School, YVS	
6/2007-7/2007	Merced River Fair/Heartland Festival Student WQM presentation	Livingston	public	• YVS
10/2007	Watershed tour: Snelling Elementary to Yosemite Valley, WQM training	Yosemite National Park	Snelling 4-5-6th grade students	• YVS

Table 6-3. Merced Alliance education tours, projects, and presentations.

Date	Activity	Location	School/grade level	Partners
10/2007-11/2007	WQM refresher	Yosemite Valley	YVS students	•
10/2007-11/2007	Watershed tour to Sierra high country	Sentinel Dome	YVS and Wawona 2-3rd grade students	• Yosemite Institute
2/2008	Merced River lower reach WQM volunteer training	Midpines	Lower reach volunteers	•
2/2008-3/2008	Watershed tour	Wawona	Wawona 2-3rd grade students	•
3/2008-4/2008	WQM refresher for YVS	Yosemite Valley	YVS	•
3/2008-4/2008	WQM training supported by Merced River upper river segment volunteers	Henderson Park	Snelling 4-5-6th grade students	• UMRWC
4/2008	Redwing blackbird study	Yosemite Valley	Wawona 2-3rd grade students	• Yosemite Institute
5/2008	Hedgerow community service project	Livingston	Snelling 4-5-6th grade students	

In addition to her work with the partner schools, the Merced Alliance Education Coordinator taught lessons in nine other schools and worked with students grades K – 12. Most of these lessons centered on the Watershed Education Kit she had developed. The Education Coordinator also used the watershed and groundwater models in presentations to adult groups including the Master Gardeners of Mariposa County, visiting science educators from Mongolia, the Snelling school board, the Sierra Nevada Alliance Annual conference, the Central Sierra Watershed Council, and the general public at community events such as Step It Up (Climate Change workshop), Earth Day, and farmers' markets.

The Merced Alliance Outreach Coordinator also pursued some education activities. She worked with an existing program for English as a Second Language Learners at Merced High School who were involved in a highly successful writing program. The Outreach Coordinator provided support for the teacher in planning fieldtrips to the Merced River and to Yosemite National Park. She also assisted these students in planning and carrying out a restoration project of native plants at the Merced Wildlife Refuge.

7 CONCLUSIONS

7.1 Project Evaluation and Effectiveness

The Performance Assessment and Evaluation Plan (PAEP) was developed by Merced Alliance and Stillwater Sciences staff. As Table 7-1 indicates, targets were developed for each of the Merced Alliance goals.

Table 7-1. Merced Alliance project performance measures.

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
GOAL 1: Build the Merced Alliance					
	1. Develop "river-long, watershed-wide" perspective among stakeholders of upper and lower segments of the Merced River.	1. Increased attendance at joint stakeholder meetings.	1. Increased knowledge about the Merced River watershed.	1. Pre- & post-survey of stakeholders' knowledge about the Merced River watershed.	1. 50% of respondents show a gain of 25% or more in general knowledge about watershed.
	2. Establish collaborative planning between the EMRCD and the MCRCD.	1. Agendas & minutes of joint meetings of RCDs and Alliance staff.	1. List of possible collaborative projects.	1. Agendas & minutes prepared by Alliance staff and submitted to meeting participants for approval.	1. One joint RCD meeting each year and two joint stakeholder events each year. 2. List of 5 possible collaborative projects.
GOAL 2: Prepare and Implement a Biological Monitoring and Assessment Plan					
	1. Compile and synthesize existing biological data for fish, bird, and BMI communities in the Merced River watershed.	1. List of existing data sources 2. Summary tables and figures of existing data sites.	1. External review of BMAP by SWRCB, EMRCD, and external scientific expert panel. 2. Response to reviewers and incorporation of comments.	1. Tone of nature reviewer comments specifically addressing existing data compilation.	1. Broad acceptance of a peer-reviewed monitoring plan.
	2. Develop a 2-year monitoring plan for fish, avian, and BMI communities.	1. Draft and final BMAP documents.	1. External review of BMAP by SWRCB, EMRCD, and external scientific expert panel. 2. Response to reviewers and incorporation of comments.	1. Tone of nature reviewer comments specifically addressing existing data compilation.	1. Broad acceptance of a peer-reviewed monitoring plan.
GOAL 3: Implement the Biological Monitoring and Assessment Plan					
	1. Create aquatic habitat maps.	1. DVD's showing low-elevation videography of the entire lower Merced River and portions of the upper river segment. 2. Data collected from discrete reaches of the upper Merced River in Yosemite National Park.	1. USGS DOQ's with overlay showing the distribution of coarse-scale aquatic habitat in the upper and lower Merced River, used to support monitoring site selection for fish and macroinvertebrate studies.	1. Coarse scale aquatic habitat mapping based on techniques of McCain et al. (1990), Thomas and Bovee (1993), and Cannon and Kennedy (2003). Data collection using low-elevation helicopter videography for RM 0 to 105.5 and on-the-ground mapping for discrete reaches.	1. Completed aquatic habitat maps available on Merced Alliance website (http://mercedriveralliance.org).

Table 7-1. Merced Alliance project performance measures.

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
	1. Undertake 2 years of biological monitoring for fish, bird, and BMI communities in the Merced River watershed.	1. Completion of scheduled field surveys.	1. Fish, BMI, and bird data describing contemporary species composition and distribution in the upper and lower segments of the Merced River. 2. WQ data that meets QAPP guidelines.	1. Fish surveys based on standard methods of Murphy and Wills (1996) and McCain et al. (1990). 2. Avian point counts based on the methods in Ralph et. al (1993), and riparian habitat mapping using releve plots. 3. BMI surveys by combination of TRC and MHC sampling methods. 4. QAPP guidelines adapted from SWAMP protocols.	1. Interim (2007) and final (2008) reports which describe biological monitoring activities and present data analysis and interpretation. Post reports on the Merced Alliance website (http://mercedriveralliance.org).
	1. Organize contemporary baseline biological and relevant physical habitat data and make available to local watershed-related entities and agencies.	1. Summary tables of measured biological data for the Merced River for fish, birds, and macroinvertebrate species.	1. Results presented to EMRCD and UMRWC at watershed group meetings.	1. Response from EMRCD and UMRWC to presentation of biological data.	1. Presentation of project progress, including data and aquatic habitat maps at 6 watershed (EMRCD, UMRWC) meetings throughout the Merced Alliance project term.
GOAL 4: Promote the Merced Alliance					
	1. Educate stakeholders, students and agency staff of the connections between the upper and lower segments of the Merced River.	1. Participation in annual watershed fairs of stakeholders, students, and agency staff.	1. Stakeholders understand connection between water production in upper segment and uses in lower segment of Merced River.	1. Survey tool.	1. Survey participants explain connection between upper and lower segments of the Merced River.

The first project goal, *build the Merced Alliance*, was aimed at developing a 'river-long, water-shed wide' perspective among stakeholders in the lower and upper segments of the Merced River. Attendance at river fairs, Merced Alliance meetings, and community forums remained steady or increased during the three and a half years of the project. Informal discussions with participants indicated that understanding of the physical character of the Merced River watershed and its issues increased because of participation in Merced Alliance events. However, efforts to conduct a pre- and post-survey of stakeholder knowledge were not successful. Pre- and post- surveys were taken of some events and were used to assess the success of the watershed curriculum kits. The target for a 25% increase in knowledge about the watershed by 50% of respondents was not met for the general public. However, the target was met by students who participated in the watershed education lessons as a "captive" audience. Among the students, 25% demonstrated mastery in understanding what a watershed is, and an additional 25% had made progress in understanding the concept. Before the lesson only one student out of 137 had been able to define watershed correctly. Before the lesson 4% of these students could name the Merced River watershed as the watershed in which they lived. Two weeks after the lesson, 63% responded correctly.

The target established for number of event under the first project goal of three events each year was met. Three stakeholder events were held in 2005, seven events in 2006, five in 2007, and three in 2008. Directors from the EMRCD and MCRCD attended at least one joint event each year.

The target for the list of five future projects was also met. A volunteer team prepared a draft strategic plan for watershed education in August of 2005. After review in April 2006 and the hiring of a part-time Merced Alliance Education Coordinator, the team was expanded by including more educators, parents, and students. This work group, MRelate, first met in June 2006 and identified common concerns of educators from the small schools in the watershed. These concerns included lack of resources, isolation, and uncertainty as to how to incorporate information about the Merced River watershed into the curriculum. The place-based curriculum developed by the Education Coordinator addressed these concerns. The work group met twice more in 2006 and twice in 2007 to review education and outreach. In 2007, participants decided to expand the work group to better represent local communities and insure that the projects identified for future work were supported by the wider communities. An expanded work group met in February 2008 and, after considerable discussion, identified needed future work. The work group agreed on this summary statement:

"We are a group of committed, engaged community leaders dedicated to:

- Thoughtful awareness of the commitment of all of our resources.
- Developing community values to work together to create decision-making processes and solve problems.
- Understanding and addressing the impacts of development.
- Supporting and maintaining working landscapes, farms, and a rural community.
- Protecting and nurturing our natural capital: the environment.
- Developing awareness of the critical importance of water to local economies and life styles.
- Valuing environmental and cultural diversity."

The second project goal, *develop a BMAP with QAPP elements,* was completed in December 2006. All desired outcomes, output indicators, outcome indicators, and targets were met. For example, the desired outcomes for this goal, a list of existing data sources, summary tables, and maps of existing data sites, were provided in the BMAP (Stillwater Sciences 2006) and were updated as information became available throughout the project. An updated version of the existing data source compilation is included in Section 5.3.2 of Volume I of this final report.

The outcome indicator for the second project goal—i.e., external review of the BMAP, was also met. The review panel for the BMAP included the following individuals:

State Water Regional Control Board
Mandy Lewis, Previous SWRCB Grant Manager (2006–2007)
Annee Ferranti, Previous SWRCB Grant Manager (2005–2006)
Diane Beaulaurier, San Joaquin River TMDL and NPS Unit
Jay Rowan, Previously with the San Joaquin River Watershed Unit (2005–2006)

CALFED
Dan Wermeil, Previously with the Watershed Program (2005–2008)

East Merced Resource Conservation District
Tim Johnson, Previous Project Director and President (2005–2006)
Teri Murrison, Previous Grant Manager (2005)
Nancy McConnell, Grant Manager (2006–2008)

Merced River Stakeholders
Gwen Huff, Previous Watershed Coordinator (2005–2007)

Upper Merced River Watershed Council
Holly Warner, Watershed Coordinator (2005–2008)

Scientific Expert Panel
Dr. Bill Trush, McBain & Trush
Dr. Larry Brown, Biologist, United States Geological Survey
Dr. Jim Carter, United States Geological Survey
Julian Wood, Biologist, Point Reyes Bird Observatory
Morgan Tingley, M.S., Biologist, University of California, Berkeley

All reviewer comments were compiled in a spreadsheet, organized by reviewer name, BMAP section, and subject matter, systematically addressed, and submitted to the SWRCB in late fall 2006. Thus, the final BMAP with incorporated reviewer comments represents a broadly accepted peer-reviewed monitoring plan, meeting the stated target for Goal 3 of the Merced Alliance.

The third project goal, *conduct biological monitoring and assessment*, was also achieved through adherence to all desired outcomes, output indicators, outcome indicators, and targets (Table 7-1). Aquatic habitat maps were developed in fall 2005 using USGS DOQ's, and they included an overlay showing the distribution of coarse-scale aquatic habitat in the upper and lower segments of the Merced River. The maps were made available as 34 tiles for download from http://mercedriveralliance.com, with each tile as an individual pdf file. Their availability was announced at multiple stakeholder meetings during 2006–2007 and indicated on the EMRCD website as well. As described in Section 5.2.1, Volume II of this final report, the aquatic habitat maps were used to support monitoring site selection for fish and macroinvertebrate studies, and ultimately, to support analysis of fish habitat use in both the upper and lower Merced River (Section 5.2.3.3, Volume II).

Two years of biological monitoring for fish, BMI, and bird communities in the Merced River watershed was completed in spring 2008. Species composition and distribution in the upper and lower segments of the Merced River is described in Sections 7 and 8 of Volume II of this final report. All methods listed as measurement tools and methods in Table 7-1 were followed, as described in Sections 5.2.3, 5.2.4, and 5.2.5 of Volume II of this final report. Targets for the third project goal were met, including the interim monitoring report which was made available for download from the Merced Alliance website (http://mercedriveralliance.com) from April 2007 to June 2008. This final report is currently available for download from the Merced Alliance website.

Contemporary baseline biological and relevant physical habitat data was organized and presented to local watershed-related entities and agencies at Merced Alliance meetings (11/15/05, 11/14/06, and 3/11/08), UMRWC meetings (2/16/06), and MRS meetings (3/20/06, 7/24/06, 9/18/06, 11/20/06, and 3/19/07). Summary tables, graphics, and photographs were presented at the stakeholder meetings, as well as in the interim report.

The fourth project goal, *promote project awareness*, was advanced by activities aimed at emphasizing the connections between the upper and lower watersheds. For example, the tour of New Exchequer Dam in 2006, the Introduction to Water Quality Monitoring for lower river segment stakeholders in 2007, and the Merced Water Resources Community Forum and Tour in 2008 provided information about the source of water in the Merced watershed and its uses downstream of New Exchequer Dam. The program at the Third Annual Alliance Meeting in March, 2008 focused on connections between the upper and lower watersheds through the biological monitoring studies, the shared activities between partner schools, and the partnerships developed with community organizations and agencies. Attendance at the river fairs in the lower watershed and the watershed day in the upper watershed remained steady or increased during the Merced Alliance project.

Although the Merced Alliance was unable to use the 'science van' of the Mariposa County Schools because of the school district's funding difficulties, equipment from the van was used at partner schools. Students also met the task of participating in water quality monitoring at least four times. Snelling students monitored water quality three times each school year for a total of six times while Yosemite students monitored on an almost weekly basis for a total of approximately 40 times.

A Merced Alliance newsletter was sent to over 500 stakeholders in the fall and late winter of every year. The newsletter promoted Merced Alliance activities and events. Updates on the biological monitoring studies and education activities were included in each issue. Features on the natural history of the watershed and places of special interest were included. An article on an aspect of water quality monitoring was also featured in each issue. Although it is difficult to judge the success of the newsletter in promoting the Merced Alliance, fewer than ten people asked to be removed from the mailing list while over twenty-five other people asked to be included.

In summary, the majority of the indicators and targets of the Performance Assessment and Evaluation Plan were achieved. The indicators and targets that were not met depended on stakeholder participation in pre- and post- surveys of their knowledge about the Merced River watershed. In every instance where surveys were available for stakeholder participation, only a few stakeholders elected to participate. In an effort to address this problem through adaptive management, pre- and post- surveys were administered to students who participated in the watershed education curriculum. However, the results of these surveys measure only the success of the education component of the Merced Alliance project and do not indicate anything about the success of the various outreach activities in improving stakeholder understanding of the watershed.

7.2 Lessons Learned

The Merced Alliance combined two different efforts: building connections between stakeholders in the upper and lower segments of the Merced River watershed and biological monitoring of fish, BMI, and birds in the Merced River corridor. Although this difference made project management more challenging, it also contributed to the ultimate success of the project. The biological monitoring studies elicited interest from agency staff that otherwise might not have been willing to participate in the Merced Alliance. The studies also attracted some key partners, especially the local chapters of the Audubon Society and the Sierra Club. Through the Merced Alliance stakeholder activities, basic awareness of the biological surveys was transformed into an understanding of and appreciation for the relevance of the surveys. Stakeholders attended demonstrations of monitoring techniques and listened attentively to detailed reporting on survey progress at annual stakeholder meetings. This interaction will hopefully contribute to more informed watershed management decisions by stakeholders for the Merced River watershed.

A major challenge for the Merced Alliance project managers and SWRCB grant managers was maintaining the project schedule. Several tasks, including negotiating the final grant agreement, permitting the biological studies, and obtaining scientific expert panel reviews of the BMAP required more time to complete than anticipated. Unforeseen natural events also contributed to scheduling delays. The Ferguson rock slide in spring of 2006 closed Highway 140 and delayed several stakeholder activities and events. Greater than normal river flows in the spring of 2006 also forced the delay of fish studies and required filing a time extension request with the SWRCB contract manager. The collapse of a building next to the office of the UMRWC disrupted Merced Alliance work at that location. Despite these delays, establishing a grant timeline that was reviewed monthly at staff meetings helped focus attention on tasks that were behind schedule; the Merced Alliance staff then developed work plans to return the project to its planned schedule.

Building connections between stakeholders in the lower and upper river segments was more difficult than originally anticipated. Events held just after the inception of the Merced Alliance were sparsely attended, and, well into the project tenure, some stakeholders would ask, *"Now, what is the Alliance? Is it the same as our watershed group?"* Merced Alliance staff replied to this question by stating that the Merced Alliance does not replace the watershed groups along the upper and lower segments of the Merced River; rather the Merced Alliance brings stakeholders from the various watershed groups together to learn more about the entire Merced River watershed and to identify common interests and concerns. Thus, staff stayed 'on message' in one-on-one explanations and at Merced Alliance activities and events.

As communities along the Merced River are small and widely separated, existing connections are few and weak. There are no common newspapers, schools,

organizations, or activities, so getting the word out about Merced Alliance activities and events proved to be quite challenging. Newspaper releases and similar efforts did not appear to be effective. Publicizing the river fairs and the Watershed Day drew some attendees from both river segments. However, the most effective strategy was to work with partners that had ties to both watersheds: The Farm Bureau, The Audubon Society, The Sierra Club, Merced Fly Fishers, Natural Resources Conservation Service, The Merced High School Writers' Club, and others. When possible, events were co-sponsored which drew attendance from more than one organization. Events and activities were also advertised in the newsletters of partners whenever possible.

Merced Alliance staff had initially expected that local elementary schools would be eager to take advantage of watershed science lessons because science had recently been added to California STAR testing. However, this expectation did not turn out to be correct. Only repeated efforts by the Merced Alliance Education Coordinator resulted in preliminary meetings with teachers at the local elementary schools. However, once the Merced Alliance Education Coordinator taught a model lesson, teachers and principals were eager to participate in Merced Alliance watershed education and participating teachers soon became advertisers of the lessons to other teachers.

Establishing connections between the lower and upper segments of the Merced River was a slow process. Establishing partnerships through co-sponsoring events, helping out with community activities, and developing personal relationships with key people in other local organizations was the most effective approach to bringing people together. As the Merced Alliance staff continued to work with other local organizations, a sense of trust and common purpose emerged for participants. This shared purpose then translated into greater attendance at Merced Alliance events and better connections between the lower and upper segments of the Merced River watershed. When the sense of shared purpose was lost, as it was between some stakeholders and the EMRCD, efforts to build the Merced Alliance were stalled. Attempts to rebuild a sense of shared purpose included discussion of the divisive issues between the dissatisfied stakeholders and EMRCD directors and staff. Increased emphasis was also placed on regular communication about grant progress with all stakeholders, to the extent possible.

Successful management of the Merced Alliance also depended on frequent and open communication among the various managers for the SWRCB, EMRCD directors, and Merced Alliance staff. The staff changes that occurred within the SWRCB and the EMRCD necessitated extra time to bring new staff up to speed on the grant scope of work and task list. Additionally, the lack of job descriptions for EMRCD staff sometimes made it difficult for the Merced Alliance Project Manager to effectively direct the work of EMRCD staff.

In summary, management of the Merced Alliance Project required continual flexibility and open communication between Merced Alliance staff and partners, with occasional

modification of management techniques based on shared project experiences. Although not explicitly required by the grant agreement, throughout its tenure the Merced Alliance Project embodied the essence of the adaptive management approach, which is the practice of revisiting management decisions and revising them in the light of new information.

7.3 Evaluation of Overall Merced River Health

The overall health of a river system or watershed is a somewhat subjective concept and as such, is difficult to precisely define. Shilling et al. (2005) offer one definition of watershed health as an estimate of the natural functioning of the watershed relative to a reference or historical condition. As the Merced Alliance biological monitoring data will be used as a reference condition for future studies, the evaluation of river health does not attempt to compare current conditions with a reference condition. The latter is also due to the fact that an adequate reference condition for the Merced River is lacking due to widespread anthropogenic alteration by dams, agriculture, and urban development throughout California's Central Valley. Rather, the evaluation of overall Merced River health focuses primarily on the concept of natural functioning for observed species and biological communities and, as stated in Section 3.2, identification of factors potentially limiting river health.

The balance between native and introduced species is one potential indicator of river health because it can be used to characterize the degree of departure from natural conditions, where introduced species are absent. All of the native fish species historically present in the Merced River were found during 2006–2008 Merced Alliance Surveys, indicating that native fish species are currently well-represented in the Merced River. In particular, the native Sacramento sucker (*Catostomus occidentalis*) appears to be thriving, based on its broad distribution in the river and relatively high numbers (see Volume II of this final report). With the exception of California roach (*Lavinia symmetricus*) and riffle sculpin (*Cottus asper*), other native fish species were observed at relatively high frequencies. Additionally, the presence and distribution of native fish community assemblages was roughly consistent throughout the study, despite the contrast between high flow (2006) and low flow (2007–2008) water years that occurred during the Merced Alliance study.

Numerous introduced fish species were present in the Merced River and dominated species richness in most reaches of the upper and lower river. In some reaches of the lower river introduced fish species dominated abundance as well. The particularly invasive redeye bass (Moyle 2003) was observed in the upper river, indicating the potential for decline of native species such as Sacramento sucker and Sacramento pikeminnow in the upper river. Further fish species data collection would help to determine whether native fish species observed at high numbers during the 2006–2008

Merced Alliance surveys are able to thrive under continuing dry weather, low-flow conditions.

Overall, native riparian bird species also appear to be well-represented in the Merced River corridor. A large number of native riparian bird species (138 species), particularly songbirds, were observed throughout the Merced Alliance surveys, and included several state species of special concern. Breeding behavior was evident for most songbirds as well as several raptor species. While few introduced bird species were observed along the Merced River corridor, Rock Pigeon (*Columba livia*) and House Sparrow (*Passer domesticus*) were present. However, these two species are considered to be common to the region and not particularly invasive. Conversely, European Starling (*Sturnus vulgaris*), which is widely distributed in the United States and was observed during the Merced Alliance surveys, is considered to be an invasive riparian bird species that negatively impacts native bird species. There were some notable differences between historical species and those found during the Merced Alliance surveys, including the contemporary lack of Bell's Vireo, Willow Flycatcher and Swainson's Thrush. These species have experienced dramatic range reductions in the Central Valley and Northern Sierras where they formerly bred (Sedgwick and Knopf 1988, RHJV 2004, Gardali et al. 2006, Siegel et al. 2008).

Overall, observed BMI assemblages responded in an expected manner to habitat factors associated with changes in elevation. However since the BMI component metrics were developed for sites upstream of the California Central Valley floor in riffle habitats, site scores in the most downstream reaches of the lower Merced River, where riffles are largely absent, are not truly representative of site quality. It is likely that a different suite of BMI metrics would be more appropriate for characterizing sites of river and stream systems on or near the valley floor, and for determining the effects of habitat and water quality on BMI assemblages in corresponding reaches. No introduced New Zealand mudsnail (*Potamopyrgus antipodarum*) or Chinese mitten crabs (*Eriocheir sinensis*) were found during the Merced Alliance surveys. However, the introduced Asian clam (*Corbicula fluminea*) was found in the lower river segment, approaching the downstream extent of the foothill dams, and there were differences observed in BMI assemblage quality above and below the foothill reservoirs. While these differences are likely due to flow, temperature and fluvial geomorphology effects of the dams themselves, isolating the effects of these individual factors without suitable biological references established in valley and lower foothill regions of California is not within the scope of this evaluation.

In addition to a comparison of native versus introduced species composition, physical habitat suitability and water quality can be used as potential indicators of watershed or river health. Physical habitat scores, included as part of BMI monitoring, indicated a consistent ranking of Merced River monitoring sites as either optimal or suboptimal aquatic habitat, with occasional marginal scores at monitoring sites closest to the San

Joaquin River confluence. *In situ* water quality parameters (e.g., temperature, dissolved oxygen, pH, turbidity, and conductivity) collected in conjunction with the fish and BMI surveys were also generally good, with the exception of low dissolved oxygen concentrations (< 5 mg/L) at a few monitoring sites in the upper river segment during fall 2007 and throughout the most downstream reaches of the lower Merced River during spring 2007. The Merced Alliance *in situ* water quality results are in general agreement with 2004–2006 monitoring results reported by the East San Joaquin Water Quality Coalition (ESJWQC), which indicate periodic low dissolved oxygen and pH in the mainstem Merced River near Cressy (RM 27). ESJWQC (2007) results also indicate occasional exceedances in the mainstem Merced River to Regional Water Quality Control Board Basin Plan Water Quality Objectives or other local water quality objectives for several parameters not measured during the Merced Alliance surveys, including metals (i.e., lead), bacteria (i.e., *Escherichia coli*), pesticides (i.e., chlorpyrifos), and toxicity to aquatic invertebrate and algal bioindicators (i.e., *Ceriodaphnia dubia* and *Selensatrum capricornutum*) (ESJWQC 2007). Several additional exceedances were recorded within agricultural drainage canals that discharge to the lower Merced River (ESJWQC 2007). Additionally, the lower Merced River from McSwain Reservoir (approximately RM 56) to the confluence with the San Joaquin River (RM 0) is listed as water quality impaired under Section 303(d) of the Clean Water Act for mercury, and organophosphate and organochlorine pesticides (chlorpyrifos, diazinon, and group A). Combined, the ESJWQC and Merced Alliance results indicate a need for water quality improvement in the lower segment of the Merced River.

In summary, the results of the Merced Alliance biological monitoring indicate that while native communities of fish, BMI, and birds appear to be intact and functioning in the Merced River, they are altered from natural conditions by the presence of introduced species, habitat loss, and decreased water quality, the latter being particularly important in the lower river segment. While these three factors currently appear to be limiting the health of the Merced River, a more formal evaluation combining specific watershed health metrics with the contemporary Merced Alliance data is warranted to best address the question of overall river health. It is hoped that the baseline data provided by the Merced Alliance biological assessment surveys will enable future researchers and stakeholders to refine estimates of river health over time. Importantly, by raising awareness and understanding of the Merced River watershed among its stakeholders, the Merced Alliance has helped to ensure that habitat availability and water quality in the watershed will continue to be topics of concern for residents and local government. The results of the Merced Alliance study also have regional implications because the Merced River is a significant component of the San Joaquin Basin and Bay-Delta system. The contemporary biological baseline data provided through the Merced Alliance study may help inform larger, regional efforts to improve habitat and water quality.

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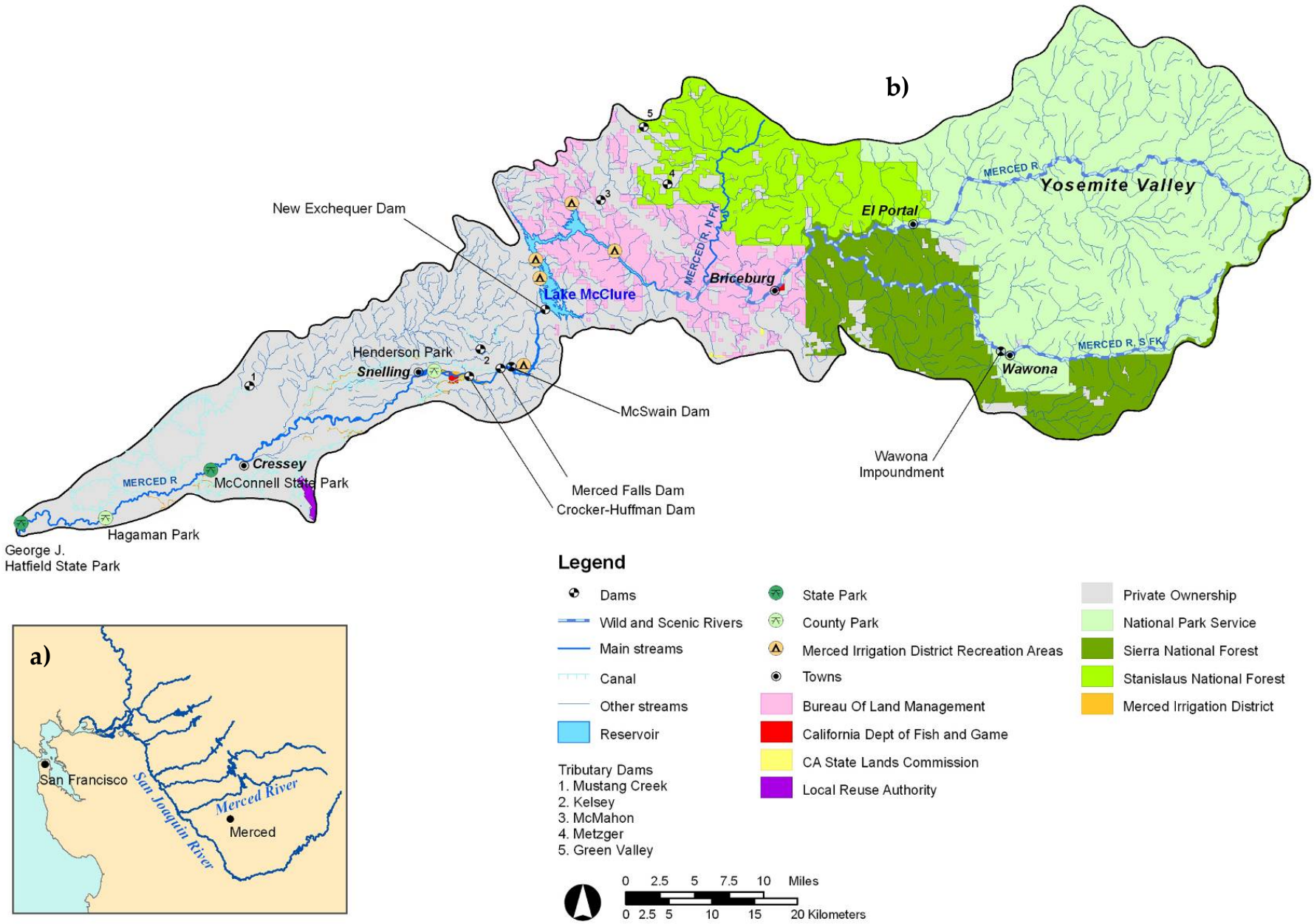
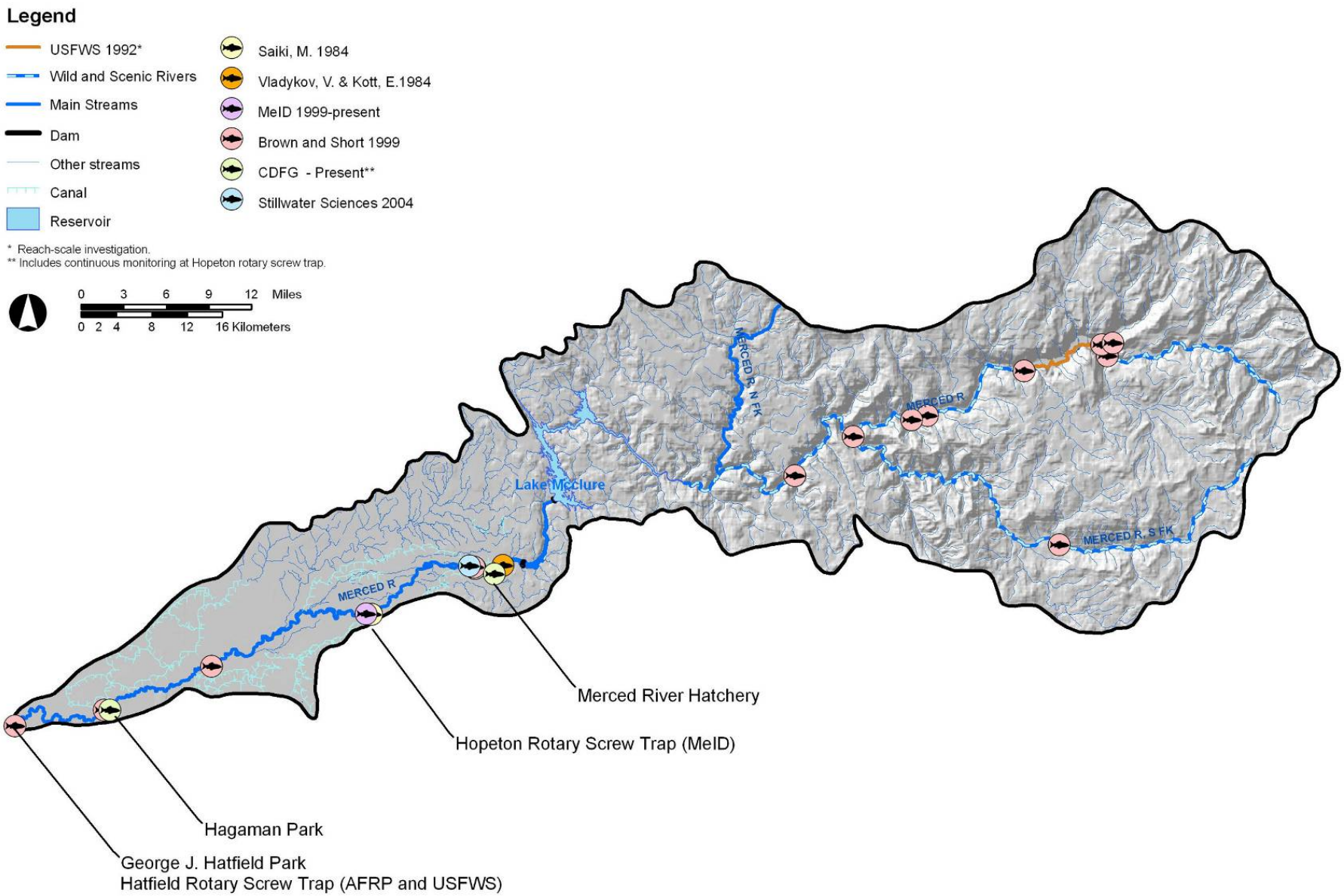
FIGURES



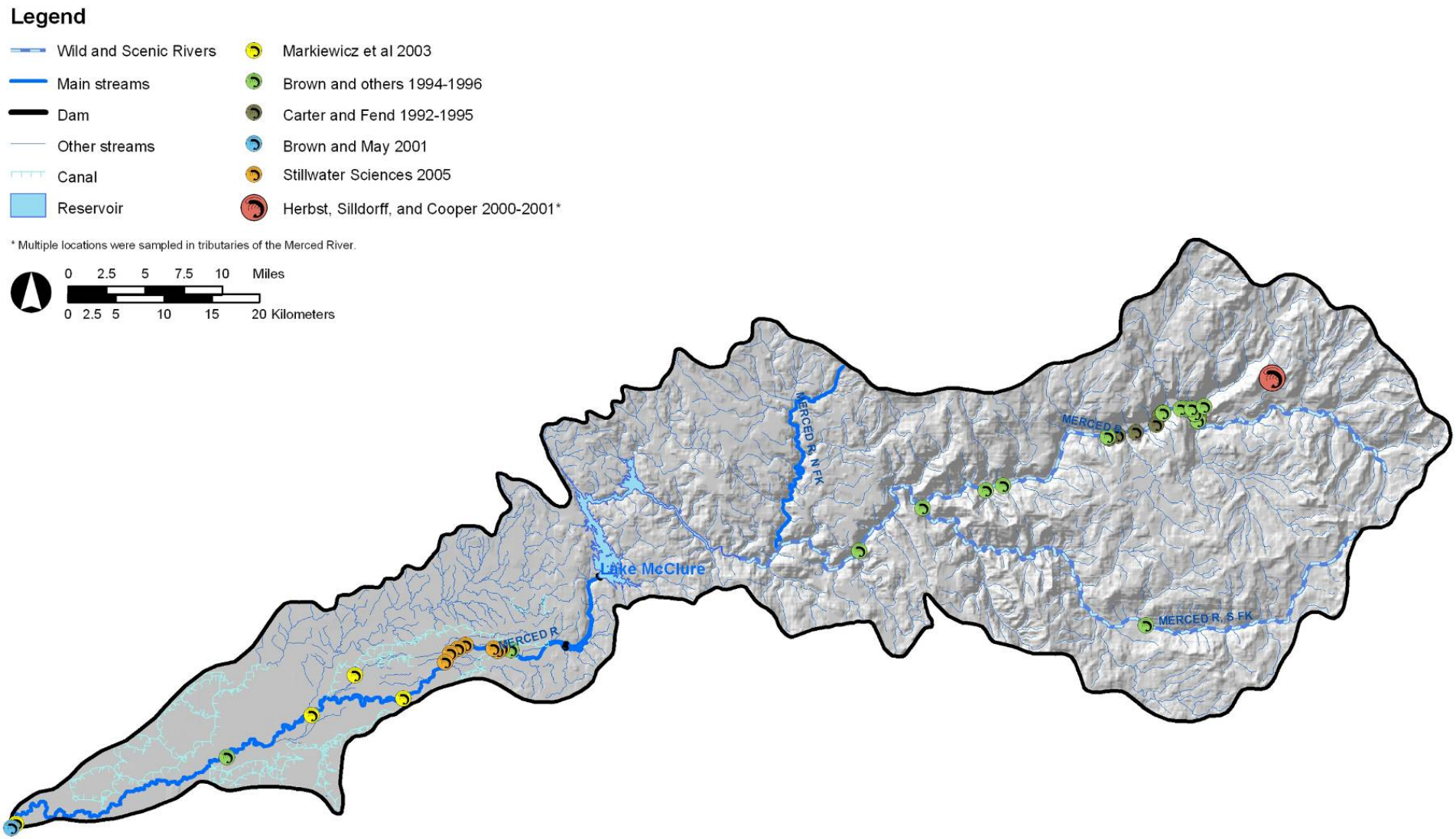
Stillwater Sciences

Figure 3-1. Merced River watershed, project location, and land use. a) Location of the Merced River as a tributary to the San Joaquin River, flowing north and eventually into the San Francisco Bay-Delta. b) The Merced River is shown with Lake McClure bisecting the upper and lower segments at New Exchequer Dam. Land use along the upper river is primarily federal, while in the lower river it is primarily private and agricultural.



Stillwater Sciences

Figure 5-1. Monitoring site locations for existing fish data on the Merced River.



Stillwater Sciences

Figure 5-2. Monitoring site locations for existing BMI data on the Merced River.

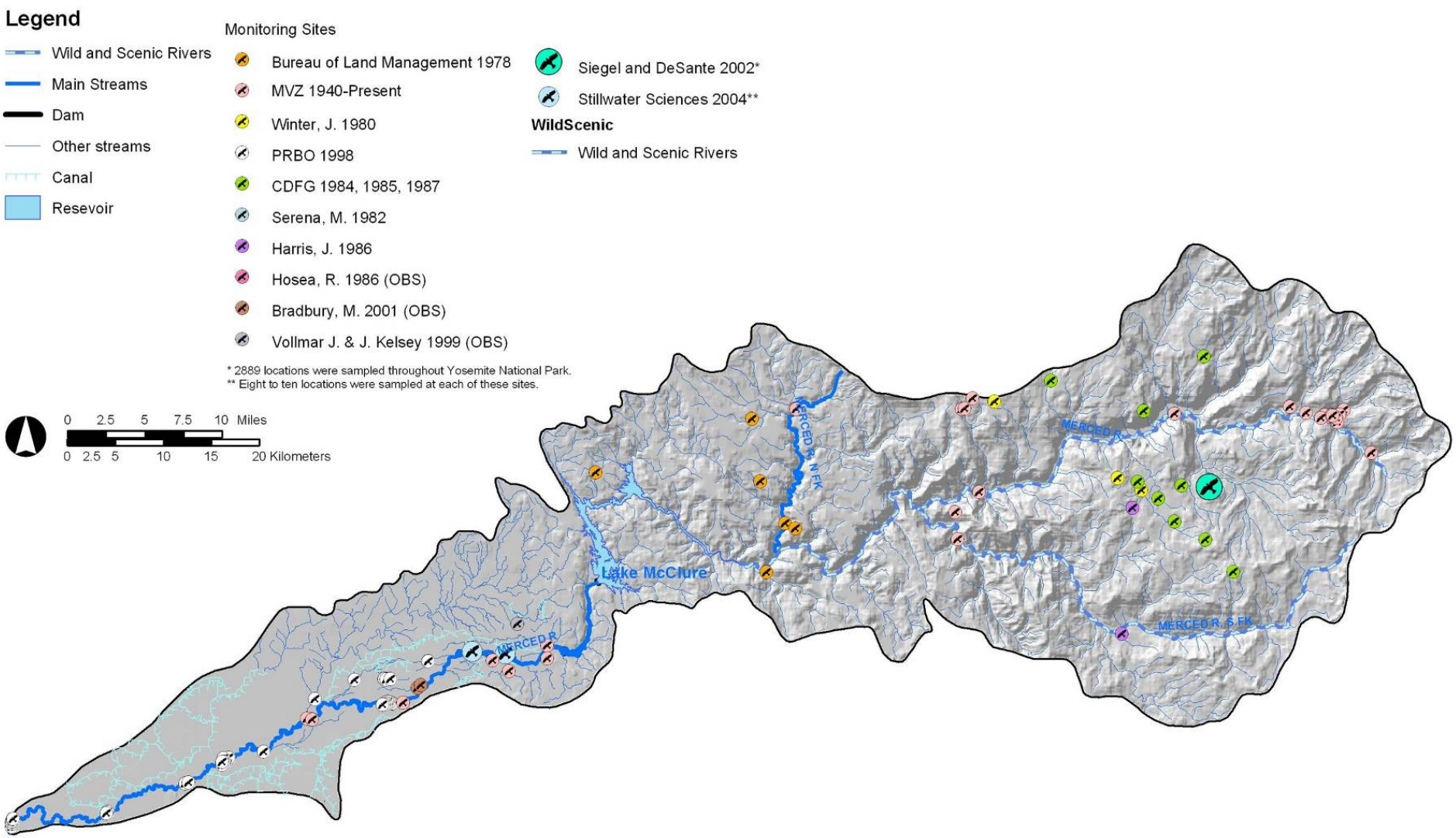


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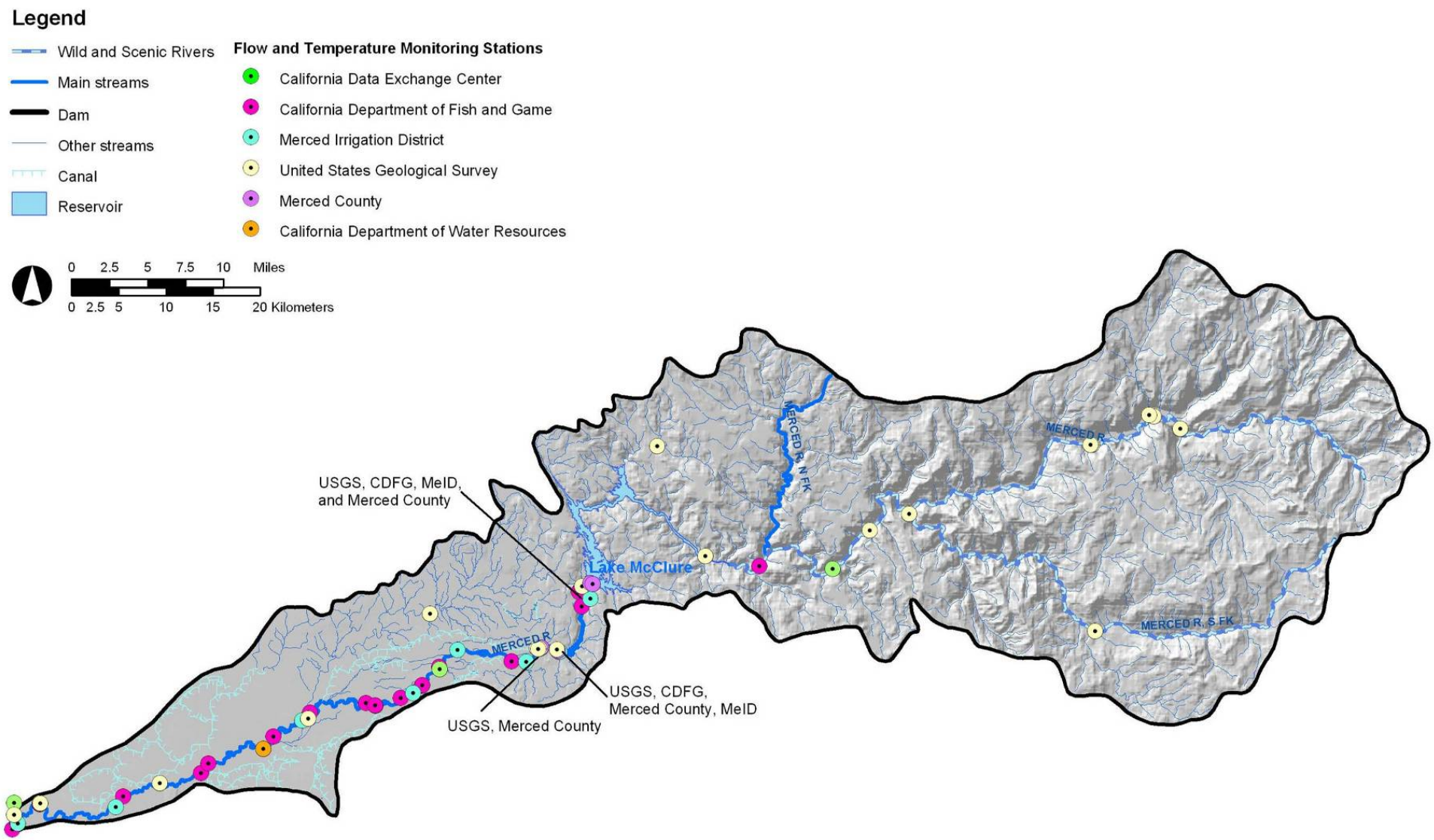
Figure 5-3. Monitoring site locations for existing avian data on or near the Merced River.



Stillwater Sciences

Figure 5-4. Existing flow and temperature monitoring stations on the Merced River.

APPENDIX A
MERCED RIVER ALLIANCE PROJECT PHOTOGRAPHS

Merced Alliance Outreach and Education: Forums and Tours

Directors of the East Merced and Mariposa RCDs tour Exchequer Dam, "The Dam that divides us" in June 2006.

Professor Roger Bales, UC Merced, explains possible effects of global warming on Sierra snow pack at the October 2006 water forum.

Participants listen at the March 2007 Field Day.

Participants of tour Lake McClure as part of the January 2008 water forum.

Merced Alliance Outreach and Education: River Fairs and Watershed Day

The BLM River Ranger provides water safety tips for rafters at Watershed Day on the upper Merced River.

An Alliance partner's booth at the River Fair on the lower Merced River.

Participants test the pH of common substances at Watershed Day.

An EMRCD board member explains RCD projects at the River Fair.

Merced Alliance Outreach and Education: Learning How to Monitor Water Quality

Families learn how to use a sample arm at Introduction to Citizens' Water Quality Monitoring.

Children look for 'water bugs', BMI, at the Introduction to Citizens' Water Quality Monitoring.

Participants listen to explanation of parameters measured in citizen' water quality monitoring projects.

Stakeholders from lower Merced communities attend water quality monitoring training with upper Merced volunteers.

Merced Alliance Outreach and Education: Place-based Watershed Education

Students use the watershed model to explore water quality concepts.

Snelling students float the Merced River for a water-side view of its resources.

Student demonstrates dissolved oxygen titration test.

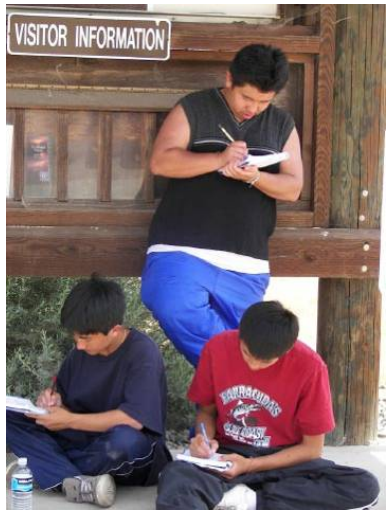
Students visit the salmon hatchery on the Merced River.

Merced Alliance Outreach and Education: Place-based Service Learning

Merced High School Writers' Club at their restoration project.

The Merced Wildlife Refuge, site of the restoration project.

Students planting natives species at the Refuge.



Students write about their experience in their journals.

Merced Alliance Biological Monitoring: Seasonal Fish Surveys

Boat electrofishing surveys (summer 2006).

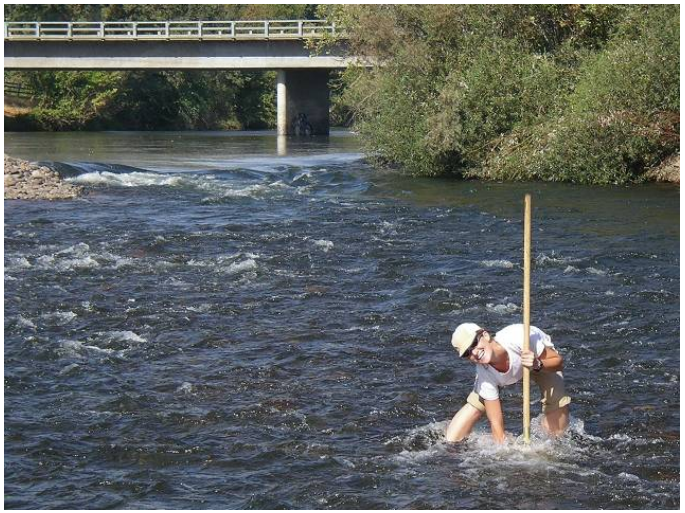
Seining surveys (fall 2006).

Snorkel surveys (spring 2008).

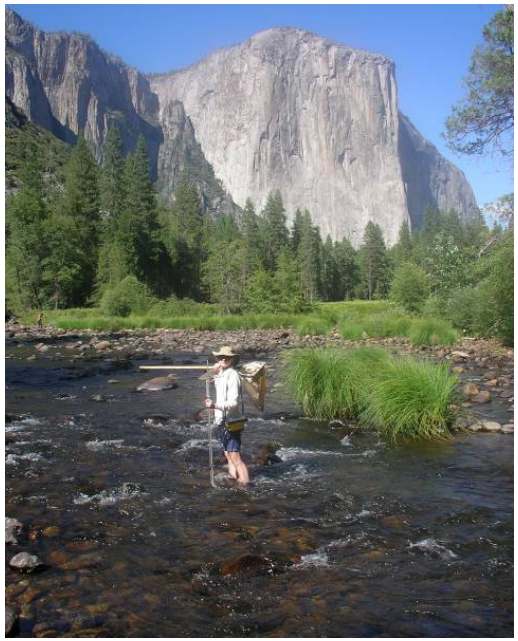
Backpack electrofishing (fall 2006).

Merced Alliance Biological Monitoring: Benthic Macroinvertebrate Surveys

Dredger Tailings Reach (2006).



Gravel Mining 1 Reach (2006).



Yosemite Valley Reach (2007).

Merced Falls Reach (2007).

Merced Alliance Biological Monitoring: Seasonal PRBO Avian Surveys

Merced River, George J. Hatfield State Park. (Photo: Julian Wood, PRBO)

Blue and pink flagging marks a PRBO point count location in a dense riparian area, George J. Hatfield State Park. (Photo: Julian Wood, PRBO)

PRBO point count survey in an area used for recreation, George J. Hatfield State Park. (Photo: Julian Wood, PRBO)

Finding a point count survey location in dense riparian habitat using a handheld GPS unit. (Photo: Jeanne Hammond, PRBO)

APPENDIX B
ITEMS OF SUBMITTAL FROM MERCED RIVER ALLIANCE PROJECT GRANT AGREEMENT

Grant Agreement No. 04-306-555-0
The Merced River Alliance Project

Items for Submittal

TASK	Items for Review #	Due Date	Date Submitted
EXHIBIT A – SCOPE OF WORK			
1.0 QUALITY ASSURANCE PROJECT PLAN AND MONITORING PLAN			
	1.1 QUALITY ASSURANCE PROJECT PLAN	August 2005	09/20/08
	1.2 MONITORING PLAN	August 2005	09/20/08
2.0 WORK TO BE PERFORMED BY GRANTEE			
	2.1 MONITOR AND TRACK SUCCESS TOWARD MEETING PROJECT DESIRED OUTCOMES		
	2.2 ESTABLISH AND BUILD MERCED RIVER ALLIANCE	Ongoing	09/20/08
	2.2.1 Submit a list of Alliance members	Ongoing	09/20/08
	2.2.2 Alliance coordination meeting agendas	July 2005 May 2006 March 2007 November 2007	09/20/08
	2.2.3 Create and maintain an Alliance mailing list	July 2005 and ongoing	02/20/08
	2.2.4 Schedule and conduct Alliance meetings biannually	November 2005 February 2006 July 2006 February 2007 July 2007 February 2008	11/20/05 11/20/06 03/20/08
	2.2.5 Schedule and conduct two annual joint RCD and watershed group meetings. Upper and lower reach watershed coordinator staff will work together to develop agendas, advertise meeting dates, and generate a key outcome memorandum.	July 2005 July 2006 July 2007	11/18/05 11/20/06 03/20/08
	2.2.6 Form work group with Alliance participants that will meet annually to prioritize potential future activities	October 2005 October 2006 October 2007	04/20/06 06/20/06 09/20/06 10/20/06 12/20/06 03/20/07 12/20/07 01/20/08
	2.2.7 Project Manager will meet with Alliance coordinators monthly	Monthly throughout duration of project	08/20/05 through 08/20/08
	2.3 BIOLOGICAL MONITORING PLAN AND QUALITY ASSURANCE PROJECT PLAN		
	2.3.1 Biological Monitoring and Assessment Plan with QAPP elements	October 2005 (draft will be circulated for review in October 2005)	Draft circulated for review 10/31/05 Final submitted 1/30/06
	2.4 CONDUCT BIOLOGICAL ASSESSMENT MONITORING		
	2.4.1 Educate and obtain voluntary landowner access agreements	February 2006	Due date revised to "as needed" in support of biological survey timing

TASK	Items for Review #		Due Date	Date Submitted
		2.4.2 List of existing data on habitat and biological conditions on the Merced River	August 2005	9/15/05
		2.4.3 Integrate existing digital photography for the Merced River Watershed into the Geographic Information Systems database	August 2005	No deliverable
		2.4.4 Aquatic habitat maps	February 2006	Spring 2006
		2.4.5 Conduct field reconnaissance and field preparations	March 2006 and ongoing	No deliverable
		2.4.6 Conduct fish monitoring	July 2006 November 2006 April 2007 July 2007 October 2007 March 2008	Between 07/19/06 and 03/16/08[a]
		2.4.7 Conduct avian monitoring	May 2006 June 2006 fall/winter 2006 May 2007 June 2007 fall/winter 2007	Between 05/04/06 and 02/16/08[b]
		2.4.8 Conduct macroinvertebrate monitoring	September/October 2006 June/July 2007 September/October 2007	Between 09/13/06 and 10/05/07[c]
		2.4.9 Annual monitoring reports	March 2007 May 2008	04/25/07 and 09/30/08
	2.5 PROJECT PROMOTION			
		2.5.1 Promote Project awareness to stakeholders, communities, students and government agencies in key communities in the Merced River Watershed	July 2005 and ongoing	01/20/06 through 09/20/08
		2.5.2 Newsletter and mailing list to 500 stakeholders	July 2005 January 2006 August 2006 January 2007 August 2007 January 2008	02/20/06 through 03/20/08
		2.5.3 Develop and maintain website	June 2005 and ongoing	08/09/05 through 08/20/08
		2.5.4 Obtain landowner access agreements for watershed tour	May and June 2006	NA (no tours on private land)
		2.5.5 Develop watershed tour materials and conduct bus tour of watershed	June and July 2006	06/16/06 05/20/07 10/20/07 11/20/07
		2.5.6 Conduct Merced River watershed fair (2 fairs); materials and fair (1 in Lower and 1 in Upper)	April/May 2005 March/April 2006	08/19/05 09/20/06 06/20/07
		2.5.7 Conduct six community outreach forums/workshops	October 2005 January 2006 October 2006 January 2007 October 2007 January 2008	12/20/05 03/20/06 10/20/06 06/20/07 12/20/07 01/20/08
		2.5.8 Form team to implement Adopt-a-Watershed curriculum	June 2005 and ongoing	08/20/05 through 04/20/08

TASK	Items for Review #	Due Date	Date Submitted
	2.5.8.1 List of team members	June 2005 and ongoing	08/20/05 through 11/20/07
	2.5.8.2 Identify two schools and grade levels to implement Adopt-a-Watershed curriculum	June-September 2005	01/20/06 through 06/20/08
	2.5.8.3 Conduct four collaborative citizen monitoring events in schools with the Mariposa Co. Rural Connections Science Van	May 2006 November 2006 May 2007 November 2007	04/20/07 through 06/20/08
	2.5.10 Citizen Monitoring event in lower reach	September 2006	10/20/07
	2.5.10.1 Recruit six volunteers from the lower reach of the Merced River stakeholder group to participate in upper Merced River citizen water quality monitoring training	April 2006	05/20/06 02/20/08
	2.5.10.2 Merced River lower reach stakeholder participation in water quality testing snapshot event		10/20/07 02/20/08
	2.5.11 Six newsletter articles on volunteer water quality monitoring events	July 2005 January 2006 August 2006 January 2007 August 2007 January 2008	02/20/06 through 03/20/08
	2.6 DRAFT AND FINAL PROJECT REPORTS		
	2.6.1 Draft project report	May 31, 2008	07/20/08
	2.6.3 Final project report	August 5, 2008	09/30/08
EXHIBIT B - INVOICING, BUDGET DETAIL AND REPORTING PROVISIONS			
5.0 STANDARD REQUIREMENTS CERTIFICATION FORM		As needed	
6.0 REPORTS			
	6.1 PROGRESS REPORTS BY THE 20TH OF THE MONTH (INCLUDES INVOICES)	Monthly	08/20/05 through 10/20/08
	6.2 EXPENDITURE/INVOICE PROJECTIONS	Quarterly	09/20/05 01/20/06 04/20/06 08/20/06
	6.3 GRANT SUMMARY FORM	Day 90	08/29/05
	6.4 NATURAL RESOURCE PROJECTS INVENTORY PROJECT SURVEY FORM	Before final invoice	
EXHIBIT C – SWRCB GENERAL CONDITIONS			
7.0	COPY OF FINAL CEQA/NEPA DOCUMENTS	January 2006	04/20/07 08/20/07
	SIGNED COVER SHEETS FOR ALL PERMITS	As needed	
EXHIBIT D – GRANT PROGRAM TERMS & CONDITIONS			
1.0 PAEP		December 2005 (draft in September 2005)	01/20/06

[a] See Table 7-5 in Final Report, Vol. II for specific fish survey dates.
[b] See Table 7-23 in Final Report, Vol. II for specific avian survey dates.
[c] See Table 7-16 in Final Report, Vol. II for specific BMI survey dates.

APPENDIX C
LIST OF SUBCONTRACTORS FOR THE MERCED RIVER ALLIANCE PROJECT

The Merced River Alliance Project
List of Subcontractors

Bioassessment Services
Tom King
24988 Blue Ravine Rd. #108
Folsom, CA 95630
916-985-2260

Brute Force Multimedia Graphics
1278 North Farris Avenue
Fresno, CA 93728

City Press
7622 N Maroa Avenue
Fresno, CA 93711
(559) 449-1117

Earthwater Institute (Adopt a Watershed)
P. O. Box 1850
Hayfork, CA 96041

Ecological Farming Association
406 Main Street, Suite 313
Watsonville, CA 95076
(831) 763-2112

Fresno Trade Bindery and Mailing
1766 North Helm Avenue, Suite 105
Fresno, CA 93721
(559) 456-3893

Great Valley Museum
1100 Stoddard Avenue
Modesto, CA 95350
(209) 575-6196

Gwen Huff
120 Gold Creek Circle
Folsom, CA 95630

Cindy Lashbrook
12230 Livingston-Cressey Road
Livingston, CA 95334
(209) 394-1420

John Muir Laws
231 Crestmont Drive
San Francisco, CA 94131
(415) 682-8115

Keri Neal Creative Services
2456 Madeline Loop
Cedar Park, Texas 78613

Nancy McConnell
8717 188th St SE
Snohomish, WA 98290
(360) 563-4927

Terry McLaughlin
6739 Deer Meadow Way
Midpines, CA 95345
(209) 966-7102

Merced County Parks and Recreation
Old Courthouse Museum
21st and N Street
Merced, CA 95340
(209) 385-7426

Teri Murrison
2 South Green Street
Sonora, CA 95370
(209) 533-5521

PRBO Conservation Science
3820 Cypress Drive #11
Petaluma, CA 94954

Professional, Print and Mail, Inc.
2818 E. Hamilton Avenue
Fresno, CA 93721
(559) 237-7468

Stillwater Sciences
2855 Telegraph Avenue
Suite 400
Berkeley, CA 94705
(510) 848-8098

Sunshine Rafting Adventures
P. O. Box 1445
Oakdale, CA 95361
(209) 848-4800

Via Adventures, Inc.
300 Grogan Avenue
Merced, CA 95340
(209) 384-1315

Elinor Holly Warner
P. O. Box 5008-201
Mariposa, CA 95338
(209) 966-2221

Karen Whipp
731 E. Yosemite Ave., Suite B
PMB304
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