QUALITY ASSURANCE PROJECT PLAN
MONITORING PARAMETERS & PROTOCOL REFERENCES
FOR
THE NAPA RIVER RUTHERFORD & Oakville to Oak Knoll REACH

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INTRODUCTION

This Quality Assurance Project Plan (QAPP) provides monitoring parameters, protocol and references for the Napa River Rutherford Reach Restoration Project (Rutherford Restoration Project) and Oakville to Oak Knoll Reach Restoration Project (OVOK Restoration Project), which are being partially funded by the EPA San Francisco Water Quality Improvement Grant Program. This document has been developed by the Napa County Public Works Department (County), the Napa County Flood Control and Water Conservation District (District), and the Napa County Resource Conservation District (RCD), to support the monitoring of the Rutherford and OVOK Restoration Project's. The purpose is to define the scope and schedule of the parameters to be monitored in the Rutherford and OVOK Restoration Project reaches. This document also provides citations for the reference documents to be used for carrying out the protocols for those monitoring parameters. This document is intended for use by local landowners and vineyard managers, District maintenance staff, and environmental and regulatory agency staff.

This QAPP pertains to the monitoring protocols outlined in the long-term monitoring plan for the Rutherford and OVOK Restoration Project's. Monitoring will provide a basis to evaluate the long-term success of the restoration actions implemented as part of the Project's. In association with the monitoring program a long-term maintenance program has been developed by the District to ensure the restoration elements function in a manner that meet the goals and objectives of the restoration Project's and the needs of riverfront landowners.

BACKGROUND

The Napa River Rutherford and OVOK Restoration Projects are designed to restore and enhance long-term river and floodplain function, improve the quality and resilience of aquatic and terrestrial riparian habitat, and reduce property damage and sediment delivery associated with ongoing bank erosion processes. Restoration elements and features of the Project included widening the river channel, reducing channel bank erosion, improving the quality and resilience of aquatic and terrestrial habitat, and to enhance overall channel and floodplain function along the Napa River. These restoration efforts are part of a longstanding public-private partnership that includes local government agencies, local non-profits, private landowners and supporting State and Federal funding agencies. Local funding for the restoration work comes from Measure A, a half-cent sales tax that voters passed to help fund flood protection projects and watershed enhancement projects within Napa County.

Prior to agriculture and development in the Napa Valley, the Napa River, its floodplain, and riparian corridor supported extensive forest and wetland habitats. Much of this habitat has been reduced over time. Prior to development, the Napa River was a broad, shallow river system with multiple channels. The Napa River is now generally confined to a single channel that is often deeply incised. Much of the river corridor is bound by flood control berms at the top of the river banks to protect neighboring properties from flooding. The confined channel and berms disconnect the river from its floodplain on the valley floor. This confinement keeps the channel zone fairly homogenous in terms of instream complexity features such as bars, benches, pools, alcoves, etc. This lack of geomorphic complexity results in a less diverse riparian community and reduced quality and quantity of instream habitat for native aquatic species such as Chinook

salmon, steelhead, and California freshwater shrimp. The confined Napa River has also affected local agricultural landowners. The constricted channel condition has resulted in bank erosion and slumping in several locations; resulting in the loss of valuable vineyard land and infrastructure.

PROJECT LOCATION

Rutherford Restoration Project

The project area is located along a 4.5-mile reach of the Napa River south of the City of Saint Helena, extending from Zinfandel Lane in the north to Oakville Cross Road in the south. Historic changes in land use and management in the Napa River Watershed have resulted in confinement of the river into a narrow channel, loss of riparian and wetland habitats, accelerated channel incision and bank erosion, and reduction in the quality and quantity of instream habitat for salmonids and other native fish. Additionally, because of this ongoing degradation, properties along the 4.5-mile Rutherford Reach of the Napa River have been subject to bank instability and failure leading to the loss of valuable vineyard land and costly repairs.

OVOK Restoration Project

The project area is located along 9.5 mile reach of the Napa River south of Oakville, extending from Oakville Cross Road in the north to Oak Knoll Avenue in the south. The OVOK Restoration Project reach suffers from channel incision with bank collapse, erosion of channel bedforms (riffles, bars, pools) important to salmonids and a reduced riparian corridor due to lack of a functional floodplain. As the river erodes its bed and deepens, the banks collapse, affecting property, directly contributing find sediment to the river and impairing beneficial uses. The incision of the Napa River channel over the past fifty years has numerous causes including gravel mining and dredging, municipal reservoir development, channel clearing and straightening, and levee construction. Many of these practices are no longer used but their effects remain. The incision of the main river channel is no progressing up tributaries, increasing erosion, loss of habitat and damage to property.

PROJECT GOALS

The goals for the Project include the following:

- Minimize the need for ongoing channel stabilization and repair work by establishing a more self-sustaining channel design which reduces maintenance needs;
- Enhance geomorphic channel forms and processes to support a more diverse and complex instream condition;
- Increase river and floodplain interactions where possible;
- Increase and enhancing riverine, riparian, and floodplain habitat functions, with a focus to improve habitat for fish and wildlife;
- Remove and manage invasive nonnative vegetation and replant with native vegetation that will not promote Pierce's disease in vineyards while enhancing the complexity and width of the riparian corridor;
- Support the sediment reduction and habitat enhancement goals of the Napa River Sediment Total Maximum Daily Load (TMDL);

PROJECT COORDINATION

The Napa River Rutherford Project and OVOK Projects are made up of a diverse group of stakeholders involved in the planning, prioritization, implementation, monitoring and maintenance within the respective Project Reaches. Restoration work along the Napa River was originally organized by the Rutherford Dust Society (RDS), a non-profit association of Napa Valley vintners and grape growers. RDRT has fostered the Rutherford Restoration Project from its inception in May 2002 to the present with 95% participation and cooperation of the landowners and land managers. The restoration work within the Rutherford Restoration Project reach motivated landowners downstream in the OVOK Restoration Project reach to continue the restoration efforts along the Napa River.

In 2005, as lead agency, Napa County entered into a Memorandum of Understanding (MOU) with partner organizations, including the Napa County Flood Control and Water Conservation District (District), Napa County Department of Public Works (NCDPW), Napa County Resource Conservation District (RCD) and the Rutherford Dust Society (RDS), which identifies each party's role and responsibilities. Resource agencies such as the RWQCB, NOAA/NMFS, CDFG, and ACOE are involved with the Project review and technical guidance process in concert with County, District, RCD and the design engineer for each Phase of final design and construction.

Through careful and transparent communication, the County, District and RCD has developed a collaborative working relationship with riverfront landowner's to incorporate their interests in the project design, while ensuring real improvements to aquatic habitat, water quality and riparian habitat restoration. Successful planning and implementation has recruited the continued enthusiastic participation of numerous local stakeholder groups and Agencies; hired consultants to complete the Conceptual Plan for the 4.5 mile Rutherford Reach of the Napa River (2003); hired consultants to bring the Conceptual Plan to final design; hired contractors to implement the Rutherford Project Reach, hired consultants to bring the OVOK Project to final design, and hired contractors to begin implementation within the OVOK Reach. A Joint Project Team supports implementation of both the Rutherford and Oakville Restoration Projects, project partners meet periodically to align project goals, share lessons learned and best practices and strategize on both technical, administrative and project funding needs.

ESA PWA was the engineering design firm for the Conceptual Project Design for the entire Rutherford Reach in 2002 and OVOK Conceptual Design in 2012. ICF Jones and Stokes was the engineering design firm for the Rutherford Project Phase 1, Reaches 1 and 2. ESA PWA was the engineering design firm for Phase 2, Reach 3; Phase 3 Reach 4; and Phase 4, Reach 8 and for the entire OVOK Project Sites 1-23. The OVOK Project is being designed by ESA PWA and is being constructed in phases as funding allows.

In total there are 70 participating landowners in the Rutherford and OVOK Project Reaches who have agreed to fund the long-term maintenance and monitoring of the restoration projects. Landowners within each project reach formed a Landowner Advisory Committee (LAC) comprised of the respective landowner representatives and supported by District staff. Participation in the LAC is open to any landowner, or their representative, who have river frontage within the Rutherford and OVOK Restoration Project reach. The respective LAC's requested that the District Board adopt a Special Benefit Zone Project, funded through a property tax assessment program under procedures established in the District Act, to conduct maintenance and monitoring in the Rutherford and OVOK Project reaches of the Napa River. This proposed

Special Benefit Zone is referred to as the Rutherford Reach River Maintenance District (Rutherford Maintenance District) and Oakville to Oak Knoll River Maintenance District (OVOK Maintenance District). The LAC's meets two times yearly to review, evaluate, and prioritize annual maintenance activities based on the maintenance surveys, landowner maintenance requests, and available funding, and to review and approve the annual maintenance report.

All maintenance activities are conducted under regulatory permits issued in conjunction with the Rutherford and OVOK Restoration Project's, with oversight by the District.

The Project managers, principal team members, and their associated roles are identified below.

Napa County Flood Control and Water Conservation District (NCFCWCD)
http://www.countyofnapa.org/FloodDistrict/ 804 First Street, Napa CA 94559; (707) 259-8600
The County finalizes grants agreements and receive grant match funding; contracts with landowners; completes environmental review, hires contractors, and oversees construction of the project. The Flood Control District works with the landowners to establish the maintenance program and agreements.

Napa County Department of Public Works (NCDPW),
http://www.countyofnapa.org/PublicWorks/
1195 Third Street, #201, Napa CA 94559, (707)253-5341
Napa County Public Works has dedicated consistent staff to the administration and oversight of the phased construction Project for each of these first three phases.

Richard Thomasser, Project Director (*Since 2002*),
Richard.Thomasser@CountyofNapa.org
Project Director, and manager of County Measure A match funds, Mr.Thomasser is a Registered Geologist with extensive project management experience, including 8 years on the Rutherford Project. He also directs operations, maintenance and monitoring of the environmental award-winning Napa River/Napa Creek Flood Protection Project, which involves management of a multidisciplinary team of professionals and facilitation of design and construction of 7 miles of river for a total cost of over $400 million, and is managed within the framework of several regulatory jurisdictions and with multiple community stakeholders.

Shaun Horne, Watershed Specialist (*Project Team Member Since 2011*)
Shaun.horne@CountyofNapa.org
Mr. Horne is an environmental scientist with expertise in watershed management, restoration planning, vegetation ecology, stream biology, GIS mapping, environmental permitting, grant writing, project management and landowner coordination. He is the OVOK Project Manager and is in charge of coordinating maintenance and monitoring activities. He oversees the District's Stream Maintenance Program, Streambank Stabilization Cost-Share Program, and assist with mitigation planning and environmental compliance.

Andrew Butler, County Project Engineer (***Phases 2-3***),
Andrew.butler@CountyofNapa.org
Andrew Butler, Project Engineer, is licenced Professional Engineer with experience designing flood protection projects, habitat restoration structures, streambank stabilization features, and

hydrological models. He currently oversees the Napa River Flood Protection Project design, construction and infrastructure maintenance.

Ron Critchley, County Construction Inspector (***Phases 1-3***),
Ron.Critchley@countyofnapa.org
Ron Critchley, has over 30 years of construction implementation experience with Napa County, and will remain on for his sixth consecutive year as inspector of the Napa River Restoration construction work.

Napa County Resource Conservation District
http://www.naparcd.org/
Jefferson Street, Suite 500B, Napa CA 94559; (707) 252-4188
Napa County RCD serves as fiscal sponsor and host to RDRT, in keeping with its mission to support citizen stewards of the Napa Valley. In conjunction with Napa County and the RDS, the RCD sponsors the Landowner Liaison, solicits funding for the Project, advocates on behalf of landowners to promote their interests, obtains right of entry agreements, hosts landowner advisory committee meetings, and conducts landowners outreach and public education about the Rutherford Project. RCD also provides technical oversight and conducts watershed and Project specific monitoring.

Leigh Sharp, RCD District Manager, Project Sponsor ***(Since2002)***,
Leigh@NapaRCD.org;
Ms. Sharp administers the contracts with the County for Project facilitation, outreach and monitoring and manages the RCD staff who conduct monitoring and outreach.

Jonathan Koehler, Fisheries Biologist (*Project Team Member Since 2004*);
Jonathan@NapaRCD.org;
Mr. Koehler has over twelve years of professional experience conducting field assessments that combine aquatic ecology and geomorphic processes. He holds a Master of Science degree in biology with an emphasis in aquatic ecology from California State University Hayward. Recent work has focused on streams within Napa County, where he has monitored native fish populations, conducted stream habitat assessments, conducted bird monitoring efforts, and assessed amphibian habitat. Mr. Koehler is familiar with California red-legged frog identification and habitat assessment and has conducted several breeding pond surveys throughout Napa County. In addition he worked as a permitted biologist studying red-legged frog populations in San Mateo County from 1998-2001. Mr. Koehler has presented his work at several scientific conferences; recent papers are available online at www.napawatersheds.org. In addition to field biology, Mr. Koehler has extensive experience with water quality monitoring and aquatic bioassessment through the collection of benthic macroinvertebrates. He is also proficient with GIS mapping and analysis and has presented results of biological studies at the annual ESRI conference in San Diego. Mr. Koehler has been with the District since 2001.

Paul Blank, Hydrologist (***Since 2008***),
Paul@NapaRCD.org;
Paul Blank is a hydrologist for the Napa County Resource Conservation District (RCD), where he has worked since 2004. Paul's responsibilities include streamgaging, stream channel surveying, installing and maintaining hydrological monitoring equipment, processing water level and stream flow data, and hydrologic modeling related to local flooding, fisheries, and erosion

control studies. Paul also participates in the RCD's community education program by developing and delivering hydrology-related presentations to students and community groups. Paul has a bachelor's degree in Earth Science, from U.C. Santa Cruz. He previously spent seven years with an environmental consulting firm, Environmental Resolutions, Inc. of Petaluma, California, at which he worked his way from Technician to Staff Geologist to Project Manager, and performed all aspects of soil and groundwater assessment and remediation of leaking underground storage tank sites.

Project Design and Engineering Consultants: ESA PWA (Since 2002)
http://www.pwa-ltd.com/
ESA PWA, 550 Kearny Street, Suite 900, San Francisco CA 94108, (415) 262-2347
The team from ESA PWA, the premier river restoration environmental consulting firm, has incorporated the most up to date science in fisheries and river geomorphology in preparing the final restoration design for Reaches 3 and 4, and 8, and will continue their basis of design approach downstream in Reaches 5, 6, 7 and 9. The ESA PWA team has over 10 years of experience designing and implementing complex riverine restoration projects. The team includes restoration ecologists, geomorphologists, hydrologists, and engineers with specific experience preparing construction documents, overseeing project construction, and conducting post-construction monitoring.

Jorgen Blomberg, MLA, Project Designer *(Since 2008)*,
JBlomberg@esassoc.com
Jorgen Blomberg, MLA is applying the same Basis of Design he used to design and construct Phase 2 last year to Phase 3. With a Masters in Landscape Architecture and over 15 years experience in designing comprehensive, multi-objective river restoration projects, Mr. Blomberg applies his working knowledge of native plant materials, riparian ecosystem and permitting procedures to practical and creative projects solutions with an emphasis on biotechnical streambank stabilization applications

Ann Borgonovo, Project Engineer *(Since 2008)*,
a.borgonovo@pwa-ltd.com
Ann Borgonovo, PE, VP of ESA PWA, has over 17 years experience in hydraulic engineering, focusing on restoration design and project management, and specializes in translating restoration concepts based on geomorphic studies into construction documents.

Andy Collison, PhD, Project Fluvial Geomorphologist (***Since 2002***),
a.collison@pwa-ltd.com
Dr.Collison, PhD, is a senior fluvial geomorphologist with over 15 years experience working with unstable river channels and on the development of restoration and river management plans. Dr. Collison created the Conceptual Design for the Rutherford Project in 2003 and the 9 mile Oakville Project adjoining downstream, and remains an advisor to the Project.

Resource Agency Staff
Resource Agency personnel providing Project review and technical guidance include: Josh Fuller, NOAA/NMFS Fisheries Biologist, Marjorie Caisley, CDFG Engineering Hydrologist, Suzanne Gilmore, CDFG, Leslie Ferguson, RWQCB Fisheries Biologist, Mike Napolitano (***Since 2002***), RWQCB Geologist; Ann Riley, RWQCB Restoration Specialist, Sahyre Cohen, ACOE.

EXAMPLES OF SIMILAR WORK

Napa County is undertaking a comprehensive approach to restoring the 55 mile mainstem Napa River to decrease sediment loading from channel incision and bank erosion. Napa County is working with stakeholders to prioritize implementation of the TMDL restoration projects currently underway, and funds a Joint Project Team comprised of representatives of the Rutherford and Oakville Restoration Projects to ensure technical consistency and TMDL compliance compatibility among these existing projects and to phase restoration of additional reaches. The Rutherford Restoration Project (8% of the River length) is the County's pilot reach-scale restoration project on the mainstem begun in concert with the RCD in 2002. Integral to the Napa River restoration, the County repaired the Zinfandel Lane fish barrier in summer 2011 at the upstream end of the Rutherford Project, which will increase the quantity of accessible salmonid habitat in the watershed. The St. Helena Flood Control project is located just upstream of the Zinfandel Lane Project, which widened the river channel, reduced local flooding and enhanced instream and riparian habitat. The California Land Stewardship Institute (CSLI) and ESA PWA (formerly Philip Williams & Assoc.) completed the conceptual restoration design for the OVOK Restoration Project (16% of the River length). The 7 mile Napa River Flood Control Project (13% of the mainstem) is located in the City of Napa at the mouth of the River. In 2015 the RCD initiated the Bale Slough/Bear Creek conceptual restoration design, an important tributary to the Napa River. All of these projects have been designed following Napa County's "Living River Guidelines".

Napa County staff overseeing the Rutherford and OVOK Restoration Projects currently direct the Napa River/Napa Creek Flood Protection Project, which involves management of a multidisciplinary team of professionals and facilitation of design and construction of 7 miles of river for a total cost of $400 million. The District is overseeing Napa County's Watershed and Stream Maintenance Program, monitoring of the Napa River Flood Project, arundo management, the Streambank Stabilization Cost-Share Program, and is responsible for maintenance of the County wide stream and rain gauge network. RCD staff is overseeing watershed wide studies including fisheries monitoring, scour and permeability monitoring, conceptual level river and riparian restoration studies, oak woodland restoration projects, and environmental education programs.

ESA PWA completed the conceptual design for the entire 4.5 mile reach, and the final design for Reaches 3-4 and successfully oversaw construction implementation of Rutherford Reach 2-8. They were involved in the development of OVOK Restoration Project Conceptual Design for the entire 9 mile reach. ESA PWA designed the Oakville Bridge Replacement and Fish Passage Project, which was completed in 2015 and designed a biotechnical streambank stabilization project on Hopper Creek for the Town of Yountville. They are currently working on the Milliken Creek Flood Reduction Project and on the implementation of the OVOK Restoration Project.

Data Generation and Acquisition

MONITORING PROGRAM OVERVIEW

Monitoring is intended to assess short and longer term changes in pollutant loads, stream channel geometry, capacity and stability; quality of aquatic and riparian habitat, success of invasive species removal and re-vegetation; and stakeholder participation over the life of the grant and beyond. For detailed description of monitoring protocols and parameters please review the *Napa*

River Rutherford Reach Restoration Project Monitoring Plan and the *Napa River OVOK Reach Restoration Project Monitoring Plan.* Monitoring in the Rutherford and OVOK Reach is conducted by the District and RCD and is designed is to measure the response and evaluate the effectiveness of restoration actions related to the implementation. This includes a series of monitoring survey's to assess if restoration features are inundating at the design discharge elevation, providing slow water habitat with appropriate velocities to support steelhead rearing habitat; reducing streambank erosion and the input of fine sediment; and to evaluate riparian vegetation communities. Monitoring parameters have been chosen to measure changes in targeted resource categories in response to stream enhancements and are periodically adapted based on survey results. We are employing a Before/After Control/Treatment BACI approach for measuring change. We anticipate that the duration of the monitoring program will coincide with the currently proposed 20-year extent of the maintenance program.

MONITORING SURVEYS

Monitoring methods are designed to provide data on the structural and physical characteristics of each restoration site over the life of the project. Both pre- and post-restoration monitoring will be completed to document changes and examine trends that result from the restoration actions. Monitoring parameters are outlined in Table 1 & 2 below, the frequency of the surveys will vary depending on protocols and budget.

The Project's monitoring plans has several components, including:

1. Annual reconnaissance of the entire project reach to observe current project conditions and identify if any immediate adaptive management actions are needed;
2. Topographic survey of post construction as-built cross sections to provide a basis to evaluate how instream habitat structures are performing at representative high and low flow events;
3. Detailed channel transect, longitudinal profile, and habitat type surveys designed to characterize the long term habitat response to changing channel conditions based on flow variation and vegetation establishment;
4. Phased vegetation establishment surveys to track plant establishment and guide adaptive management of re-vegetated areas; and
5. Photo-monitoring at defined stations to capture changes over time.

The District and RCD developed a geodatabase to support the monitoring survey, which is utilized annually to establish a continuous long term data set. Data sheets, aerial photographs, and GPS units are used to support the associated monitoring surveys. Photos and drawings are produced to document survey activities and support survey findings. The frequency of monitoring is outlined in Table 2. For evaluation of project effectiveness, data will be collected to measure changes in the relationship between the channel, its floodplain, and associated habitats. The frequency of the monitoring is determined by grant and regulatory requirements as well as by technical experts on the monitoring team who review and evaluate the monitoring data. Annual monitoring reports are developed and submitted to resource agencies, landowners, and posted on a public website for the general public.

MAINTENANCE PROGRAM OVERVIEW

The monitoring program overlaps with the maintenance program allowing for an adaptive management program to be employed to ensure project goals and objectives are being achieved.

The annual maintenance program is intended to protect the environmental value of the Rutherford and OVOK Restoration Project. The adaptive management strategy is designed to reduce the risks of streambank erosion and failure throughout the project reach through early problem identification and routine preventative action. The maintenance program is not intended to address catastrophic streambank failure, emergency repairs, or significant streambank erosion in areas not treated by the Restoration Projects. Emergency repairs would be implemented by individual landowners in coordination with the District. Other non-emergency treatments that fall outside the scope of the maintenance program, because of scale or cost, may be incorporated into the design of future phases of the Restoration Projects. The maintenance program includes activities to, address debris jams, erosion related issues, downed trees, and control target invasive Pierce's disease host plants.

The objectives of the Maintenance Program are to:

- Prevent bank erosion through vegetation management, large woody debris (LWD) realignment and/or relocation, debris/large trash removal, and biotechnical stabilization.
- Maintain the function of constructed instream habitat enhancement structures.
- Control target non-native invasive and Pierce's disease host plant species, to the extent practicable.
- Enhance native riparian vegetation communities and promote the development of a complex riparian canopy.

ANNUAL MAINTENANCE SURVEYS

An annual longitudinal survey of the entire project reach is prescribed to identify maintenance needs as part of the maintenance program. District staff in coordination with the LAC's will conduct routine annual survey to identify and assess issues of concern relative to the program objectives. The survey will focus on identifying, mapping, and assessing:

- Actively eroding streambanks, including effectiveness of prior stabilization measures
- Areas of excessive vegetation growth, and/or accumulations of LWD or trash that are contributing to streambank erosion
- Storm-related damages to streambank stabilization and aquatic habitat enhancement structures
- Weed eradication and revegetation sites.

Standard data sheets have been established for the maintenance survey, which are utilized annually to establish a continuous long term data set. Data sheets, aerial photographs, and GPS units are used to document the nature and extent of the problem, and to identify recommended treatments or remedial actions. Photos are taken to document each problem site. The results of the survey are compiled into a report and presented to the LAC's for review. It may also be necessary to conduct interim river surveys shortly after large storm events (< 10-year flood event) to identify areas that may require immediate treatment to prevent additional streambank failure, and to protect existing infrastructure and environmental resources. The annual surveys will also be used as a tool to determine when more in-depth monitoring cross section surveys are required.

Table 1. Monitoring Parameters and Protocols by Category

Pollutant Load / Erosion Reduction
Streambank Stability (Failing graded slopes, mass wasting, slumps, etc)
Cross Section Transects

Stream Channel Geometry, Capacity, & Stability
Channel Adjustment: Bed Deposition or Scour
Inspection of Riffles and Pools Associated with Installed Instream Structures
Cross Section Transects and Local Longitudinal Profiles
Bankfull Width to Depth Ratio: Entrenchment
Cross Section Transects
Flood Stage / High Water Mark
Cross Section Transects
Bank Stability
Cross Section Transects (Rates of Widening at reference vs. restored cross sections)
Channel planform network (Primary and secondary Channels)
Photodocumentation of constructed alcoves

Aquatic Habitat Quality
Channel Substrate Size Distribution / Riffle Median Grain Size (D50) / Percent Cover of Fines
Wolman and/or Grid Pebble Count Protocol
Riffle Habitat Area
Cross Section Transects Habitat Type Survey and Local Longitudinal Thalweg Profile at Selected Locations of Installed Structures
Residual Pool Depth (Change in Pool Storage of Fines)
Cross Section Transects and Local Longitudinal Thalweg Profile at Selected Locations of Installed Structures
Area of High Flow Refugia Within Bankfull at Constructed Alcoves
In-Channel Survey; Velocity Profile; Photodocumentation
Large Woody Debris Logs and Jams (>12 inch diameter, or clump of >4 pieces)
In-Channel Survey (GPS in and rank based on risk to bank stability or channel obstruction)

Riparian / Floodplain Habitat Quality
Areas requiring weed control
Annual In-channel Survey: Landowner Request Forms
Restoration Planting Survival
Cross SectionTransect: Direct count
Invasive Species Removal Treatments
Success of Arundo donax removal treatments
Photo taken at each Arundo donax site location before and after treatment

Stakeholder Participation
LAC participation in maintenance and monitoring oversight
Meeting minutes; annual reports

Table 2. Monitoring Parameter Protocols and Frequency

Pollutant Load / Erosion Reduction

Monitoring Parameter	Protocol	Reference Sources	Frequency
Streambank Stability	Cross Section Transect	Fitzpatrick et al (1998) Rosgen (1996)	Post Significant Channel Forming Event

Stream Channel Geometry, Capacity, & Stability

Monitoring Parameter	Protocol	Reference Sources	Frequency
Channel Adjustment: Bed Deposition or Scour	Inspection of Riffles and Pools Associated with Installed Instream Structures	Flosi et al. (1998) Gerstein (2005) Harrelson et al (1994)	Post Significant Channel Forming Event
Channel Adjustment: Bed Deposition or Scour	Cross Section Transect and Local Longitudinal Thalweg Profile Survey	Gerstein (2005) Harrelson et al (1994)	Post Significant Channel Forming Event
Bankfull Width to Depth Ratio: Entrenchment	Cross Section Transect	Fitzpatrick et al (1998) Rosgen (1996)	Post Significant Channel Forming Event
Flood Stage / High Water Mark	Cross Section Transect	Fitzpatrick et al (1998)	Post Significant Channel Forming Event
Bank Stability	Cross Section Transect *(Rates of Widening at reference vs. restored cross sections)*	Gerstein and Harris (2005) Nossaman et al. (2007)	Post Significant Channel Forming Event
Channel Planform Network (Primary and Secondary Channels)	Photodocumentation of Constructed Alcoves	Fitzpatrick et al (1998)	Post Significant Channel Forming Event

Aquatic Habitat Quality

Monitoring Parameter	Protocol	Reference Sources	Frequency
Riffle Habitat Length	Habitat Type Survey	Flosi et al (1998)	Post Significant Channel Forming Event
Residual Pool Depth (Change in Pool Storage of Fines)	Cross Section Transect and Local Longitudinal Thalweg Profile at Selected Locations of Installed Structures	Lisle (1987)	Post Significant Channel Forming Event
Area of High Flow Refugia Within Bankfull at Constructed Alcoves	In-Channel Survey; Velocity Profile; Photodocumentation	Flosi et al. (1998)	Post Significant Channel Forming Event

Large Woody Debris Logs and Jams (>12 inch diameter, or clump of >4 pieces)	Habitat Type Survey *(GPS in and rank based on risk to bank stability or channel obstruction)*	Gerstein (2005) Flosi et al. (1998)	Post Significant Channel Forming Event
Riparian Shade Cover Over the Thalweg	Channel Cross Section Transect and Local Longitudinal Profile	Flosi et al. (1998) Nossaman et al. (2007)	Post Significant Channel Forming Event

Riparian / Floodplain Habitat Quality

Monitoring Parameter	Protocol	Reference Sources	Frequency
Areas requiring weed control	Field Survey	Harris (1999, 2005)	Annual
Restoration Planting Survival	Cross Section Transect: Direct count (See Assessing Survival of Planted Vegetation, p. 6)	Nossaman et al. (2007) Harris (1999, 2005)	Post Significant Channel Forming Event
Number of Pierce disease plants	Vegetation Survey	Herrick et al (2005 a) Interagency Technical Reference (1996)	Post Significant Channel Forming Event
Riparian Vegetation Buffer Width	Cross Section Transect	Harris (1999, 2005)	Post Significant Channel Forming Event
Herbaceous Composition: Relative abundance of native plant cover versus non-native plant cover	GIS multispectral/multi band aerial imagery mapping	Herrick et al (2005 a) Interagency Technical Reference (1996)	Post Significant Channel Forming Event

Invasive Species Removal Treatment

Monitoring Parameter	Protocol	Reference Sources	Frequency
Success of invasive species removal treatments	Photo before and after treatment		As Events Occur

Stakeholder Participation

Monitoring Parameter	Protocol	Reference Sources	Frequency
Landowner participation in adaptive riparian monitoring and management	Opinion surveys of effectiveness	FISRWP (2001)	Annually or as Events Occur

Assessment and Oversight

REPORTING

The District is responsible for oversight of project maintenance and monitoring, as part of its responsibilities as lead construction agency and holder of regulatory permits. The District and RCD will collaborate on the survey work and development of the annual Monitoring Report and Maintenance Report to inform stakeholders of potential issues and to quantify progress towards project goals. The District will function as the organizational sponsor for the archiving of digital and physical copies of all field data sheets, photo documentation, GIS layers, and reports associated with the Project. The LAC's help prioritize maintenance actions, provide guidance for the annual maintenance survey, and to coordinate access required for the maintenance and monitoring program elements with local landowners and vineyard managers. Each year prior to the Annual Stream Maintenance and Monitoring Survey, which takes place in June, Napa County convenes the team to review, edit and update the monitoring protocols to ensure that the appropriate data is being collected to satisfy permit requirements, biological data needs, and to inform restoration Project design and channel maintenance needs. Protocols are reviewed for efficiency. Data collection methods are updated to facilitate reporting. Updated protocols are incorporated into the *Monitoring Plan for the Napa River Rutherford Reach Restoration Project* and for the *Monitoring Plan for the Napa River OVOK Reach Restoration Project.* The program is guided by an adaptive management framework to ensure the quality of the monitoring data and resiliency of the restoration features.

The Annual Monitoring Report will present the findings of the monitoring surveys performed in any given year. The Annual Maintenance Report will present the findings of the maintenance survey and adaptive maintenance activities proposed for a given year. The reporting process ensures that landowners have information regarding how maintenance and monitoring funding is being spent within the respective project reaches. The monitoring reports ensure that resource agencies, and the local community receive information relating to the physical and biological conditions of the river and overall function of the restoration elements. An outline of each report is presented below.

Annual Maintenance Report will include;

- Overview of annual maintenance surveys
- Description of work completed
- Table outlining maintenance and monitoring costs
- Discussion of existing conditions and observed changes

Annual Monitoring Report will include;

- Summary of annual monitoring activities
- Discussion of monitoring data collected
- Overview of monitoring results
- Review of previous monitoring findings, trends and changes observed

Data Validation and Usability

DATA COLLECTION AND STORAGE PROCEDURES

Jeremy Sarrow serves as the QA/QC officer for the Rutherford Restoration Project and Shaun Horne for the OVOK Restoration Project at the District. Monitoring data is collected and mapped in the field during annual surveys directly onto handheld computers equipped with GPS and cataloged by individual attributes with customized GIS software in order to catalog, sort and report specific data post survey. Additional field data is also collected by pen and paper on standardized monitoring forms and later transferred to digital files. Before and after photos of the restoration sites and of *Arundo donax* treatment areas are taken at specific locations and stored in digital file folders organized by site. Digital data files are shared with Napa County, and the RCD. Napa County cannot afford to get an independent review of the raw data, but instead relies on collaborating professionals to review the quality of the data. Distilled data is checked via a peer review system. Field staff from Napa County and the RCD review and edit the results of the data entered and analyzed by peers for outliers, and inconsistencies. Reports are peer reviewed by the survey team, and by Project managers at Napa County, for content and analysis. All monitoring reports, and requested original data files including photos, created by Napa County, the RCD, and other Project consultants are housed and archived annually by members of the survey team and stored on the Napa County computer server which is backed up daily by Napa County ITS staff and will be held on the Napa County server in perpetuity. Additionally, reports which summarize and display data collected during annual monitoring surveys is available to the public and can be downloaded directly from the Watershed Information Center & Conservancy of Napa County (http://www.napawatersheds.org/).

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