California Regional Water Quality Control Board

San Francisco Bay Region

Fire Response Monitoring Plan v2.0

1 Purpose

Surface waters within and downstream of areas affected by the recent wildfires in Sonoma and Napa Counties include impaired waterbodies, endangered species habitat, and the source water for drinking water systems. During storm events, surface waters may be affected by pollutants in runoff from burn areas. Watershed partners (e.g. EPA, USACE, Napa and Sonoma RCD, City and County staff) have been working to implement post-fire best management practices (BMPs) within areas that were burned in an effort to prevent pollutant laden stormwater from entering storm drains and reaching surface waters. Monitoring conducted by Regional Water Board staff will help identify areas where BMPs are functioning to effectively remove pollutants and areas where priority should be placed on increased or alternative BMP implementation.

Table 1 – Monitoring Design Summary.

Management Question	Are Post Fire BMPs Effective for Protection of Surface Water Beneficial Uses? (i.e., Sensitive Aquatic Resources and Drinking Water Sources)
General Design	Comparison of Surface Water Runoff from Burn Affected Areas to Water Quality Objectives and Historic or Reference Site Data, Where Available, and Comparison to a Reference Non-burned Site
Target Flow Conditions	Post-Fire Base Flow, Subsequent Peak Storm Flow Conditions
Selection of Burned Catchment	Surface Water in or Below Burned Urban Area Within the Sonoma Creek and Napa River Watershed
Selection of Comparison Site	Same or Similar Site with Pre-Wildfire Data Availability
Indicators	Water Chemistry, Field Measurements
Timing	Prior to First Flush, During Three Subsequent Qualifying Storms (1.0 Inch or Greater within 24 Hour Period)

2 Monitoring Plan Overview

The Regional Water Board is interested in ensuring that sufficient BMPs are in place to protect downstream beneficial uses such as sensitive aquatic habitat and sources of drinking water in impacted watersheds. Some BMPs used to control erosion could also help reduce chemical contaminant loading, including revegetation and application of mulch material such as straw wattles, inlet filtration devices, and others. This monitoring effort will help the Regional Water Board identify locations for BMP implementation as well as assessing the efficacy of any BMPs that have already been installed.

This monitoring effort will evaluate the need for BMPs in urban areas severely impacted by the fire. Post-fire stormwater runoff threats and impacts to the beneficial uses in surface waters downstream of burned areas will be assessed by monitoring water column chemistry. Chemical analyses will target constituents known to become elevated in response to fire and that have potential impacts on drinking water and aquatic life. Staff will evaluate threats and potential impacts to beneficial uses by comparing concentrations of contaminants detected in surface water with water quality objectives established to protect those uses. Where readily available, staff will compare results to pre-fire data for similar parameters and between the fire-impacted and reference sites.

2.1 Sample Locations

Not all areas affected by the recent fires need be monitored to inform successive BMP management decisions. The information gained from this targeted sampling may be extrapolated to assist management decisions beyond the areal extent of monitoring, based upon similarities in land use, fire impacts, and BMP deployment. The Regional Water Board staff will collect samples at three or four locations located downstream of burned areas and one unburned, reference stream for each watershed as indicated in Tables 2 and 3.

The sampling sites shown in Figures 1 and 2 have been strategically chosen to assess stormwater runoff from urban locations damaged by fire, relative to the following:

- Land use and density of burned structures
- Vulnerable aquatic habitat
- Availability of previous or companion water quality data
- Site permission and accessibility

Table 2 – Sonoma Creek Watershed Sampling Sites.

Site Code	Site Name	Latitude	Longitude
206CALASC	Calabazas Creek above Sonoma Creek	38.363	-122.525
206GRA050	Graham Creek 300m u/s of Sonoma Crk confluence (unburned reference site)	38.36704	-122.541
206SONCYP*	Sonoma Creek at Cypress Ave	38.4122	-122.554
206SON160	Sonoma Creek at Glen Ellen	38.36376	-122.526
206YUL010**	Yulupa Creek above confluence with Sonoma Creek at Warm Springs Rd	38.3793	-122.553

*Pre-storm baseline sampling occurred upstream on Sonoma Creek at 206SON280 (38.43542, -122.55) because this location was dry on Nov 2, 2017
**Only sampled during storm flows because stream was dry during baseline sampling event.

Table 3 – Napa River Watershed Sampling Sites.

Site Code	Site Name	Latitude	Longitude
206MLK100	Miliken Creek at Hedgeside Ave	38.33827	-122.269
206NAP020*	Napa River at public dock on Main and 3rd Street	38.298	-122.283
206RED400	Redwood Creek d/s of Pickle Crk at Mt Veeder and Redwood Rd. intersection	38.33388	-122.371
206RIC100	Ritchie above gabion wall in Napa-Bothe State Park (unburned reference site)	38.55078	-122.521
206SOD200**	Soda Creek ~2.1km u/s Silverado Trail xing at private bridge	38.370006	-122.284792

*Site added to compliment SFEI Non-Target Analysis Study
**Pre-storm baseline sampling occurred at 206SOD900 (38.4108, -122.296) because this location was dry on Nov 2, 2017.

2.2 Sample Collection Timing

Staff will collect samples from the locations in Figures 1 and 2 on four occasions; pre-storm, during first flush of the initial qualifying storm of the season, and again during two subsequent qualifying storms. Qualifying storm events shall be considered those storms which have a predicted rainfall of 1.0 inch or greater within a 24-hour period.

First flush monitoring is designed to collect samples near the start of overland runoff to capture the highest pollutant concentrations of the storm event during lower stream flow rates at the beginning of the storm. First flush conditions have the greatest potential for adverse impacts to aquatic species and sources of drinking water. Obtaining first flush water quality samples provides the ability to evaluate monitoring results and determine if additional BMPs are necessary to reduce pollutant concentrations in storm water discharge.

The timing of monitoring for this effort has been determined based upon the likelihood of rainfall conditions to cause erosion or transport of pollutants from the landscape into surface waters. Pre-storm monitoring will be conducted to evaluate existing surface water conditions before the threat of significant pollutant movement associated with a first flush storm event. Pre-storm sampling will provide a baseline for assessment of BMP effectiveness during the first flush storm event. The four sampling events conducted in accordance with this monitoring plan will allow staff to understand the current conditions of surface water, alterations in those conditions related to first flush, and improvements in surface water quality realized in response to any management decisions made as a result of the first two monitoring events.

2.3 Monitoring Parameters

Wildfire alters the hydrologic response of watersheds, including peak discharge resulting from rain events, transport of sediment, and rate of erosion and deposition. Increased storm runoff and transport of contaminants by stormwater runoff after a wildfire raises concerns about water quality. Some of the concerns for water quality after a fire include erosion and transport of ash or other materials containing chemicals created or left exposed in burned areas. If sedimentation rates are high, they can alter and often destroy fish habitats and spawning beds, damage drinking water infrastructure, and increase risk of flooding.

Fertilizer is a major component of fire retardants, often consisting of ammonia and phosphate or sulfate ions. Previous studies have shown that a single retardant drop directly into a stream may be sufficient to raise the concentration of ammonia enough to elicit a lethal response in fish and other aquatic organisms. Effects such as this are dependent upon the waterbody size, flow conditions and the volume of retardant reaching the waterway. Additionally, ashes remaining after a fire can impact the environment and ecosystems by raising soil and water pH levels. Post-fire research shows that ash can generate caustic alkalinity in contact with rainwater producing pH levels >12.

Research also shows that fire affected areas contain increased concentrations of contaminants including nutrients (e.g. nitrates and phosphorus), polycyclic aromatic hydrocarbons (PAHs), copper, zinc, mercury, lead and other metals. Several of these pollutants, especially heavy metals, can be detrimental to human health and are often toxic to aquatic life. High levels of nutrients can encourage the development of harmful algal blooms and in the case of Napa and Sonoma County wildfires, downstream waters are already listed as impaired for these constituents. Many pollutants often attach to suspended particles and enter the water. Therefore, an increase in turbidity or total suspended solids (TSS) can often indicate potential pollution, not just a decrease in water quality related to sediment.

The Regional Water Board staff have reviewed available fire response literature, considered the parameters anticipated to be elevated as a result of wildfire, and developed a list of monitoring analytes. Targeted monitoring analytes consider: 1) correlation to fire impacts, 2) potential impacts to water resources, and 3) potential for management practices to mitigate threats or impacts identified through this monitoring effort. In addition to rainfall, Table 4 provides the list of analyses and field parameters to be performed during this effort.

3 Data Evaluation

The Basin Plan specifies numerous water quality objectives for the protection of inland surface waters which include: color, tastes and odors, suspended material, biostimulatory substances, sediment, turbidity, pH, dissolved oxygen, temperature, and chemical constituents. Staff will compare monitoring data results to the water quality objectives, and to past data collected at or near these sites during similar times of year, to evaluate whether surface water downstream of fire-impacted areas is meeting water quality objectives for the protection of beneficial uses and whether the impacts are likely caused due to insufficient or ineffective BMPs resulting in pollutant laden stormwater runoff to surface water. This assessment will be conveyed in a timely manner to staff working with entities in the watershed to inform and prioritize implementation of new or additional BMPs where needed for pollutant control.

3.1 Monitoring Quality Assurance and Control

The protocol for sample collection and analyses will follow the State of California Surface Water Ambient Monitoring Program Standard Operating Procedures (SOP) and Quality Assurance Program Plan (QAPrP). The QAPrP serves as an umbrella document for use by each of the Surface Water Ambient Monitoring Program's (SWAMP's) contributing projects. It describes the program's quality system in terms of organizational structure; the functional responsibilities of management and staff; the lines of authority; and the interfaces for those planning, implementing, and assessing all activities conducted.

3.2 Data Management

After sampling and analysis, the Regional Water Board staff shall enter this data into a spreadsheet and loaded to the K drive (K:Fire_response/data). This version can be readily shared with other resource managers. The decision about whether to load these data to CEDEN will be determined at a later date.

3.3 Distribution list for water quality data:

Shari Gardner (Friends of the Napa River)
Derek Acomb (CA Fish and Wildlife)
Caitlin Cornwall (Sonoma Ecology Center

Table 4 – Monitoring Analytes

General	**Nutrients**	**Metals**	**PAHs**
Alkalinity	Ammonia	Aluminum^{T,D}	Acenaphthene
Hardness	Nitrate	Arsenic^{T,D}	Acenaphthylene
Sulfate	Total Nitrogen	Cadmium^{T,D}	Anthracene
Total Organic Carbon	Orthophosphate	Chromium^{T,D}	Benzo (a) anthracene
Total Dissolved Solids	Total Phosphorus	Copper^{T,D}	Benzo (a) Pyrene
Total Suspended Solids		Iron^{D}	Benzo (b) flouranthene
Dissolved Oxygen^{F}		Lead^{T,D}	Benzo (g,h,I,) Perylene
pH^{F}		Manganese^{D}	Benzo (k) Fluoranthene
Specific Conductance^{F}		Mercury^{T,D}	Chrysene
Temperature^{F}		Nickel^{T,D}	Dibenzo (a,h) anthracene
Turbidity^{F}		Selenium^{T,D}	Fluoranthene
		Zinc^{T,D}	Fluorene
			Ideno(1,2,3-C,D)Pyrene
			Naphthalene
			Phenanthrene
			Pyrene

^{F}Field Measurement
^{T}Total
^{D}Dissolved

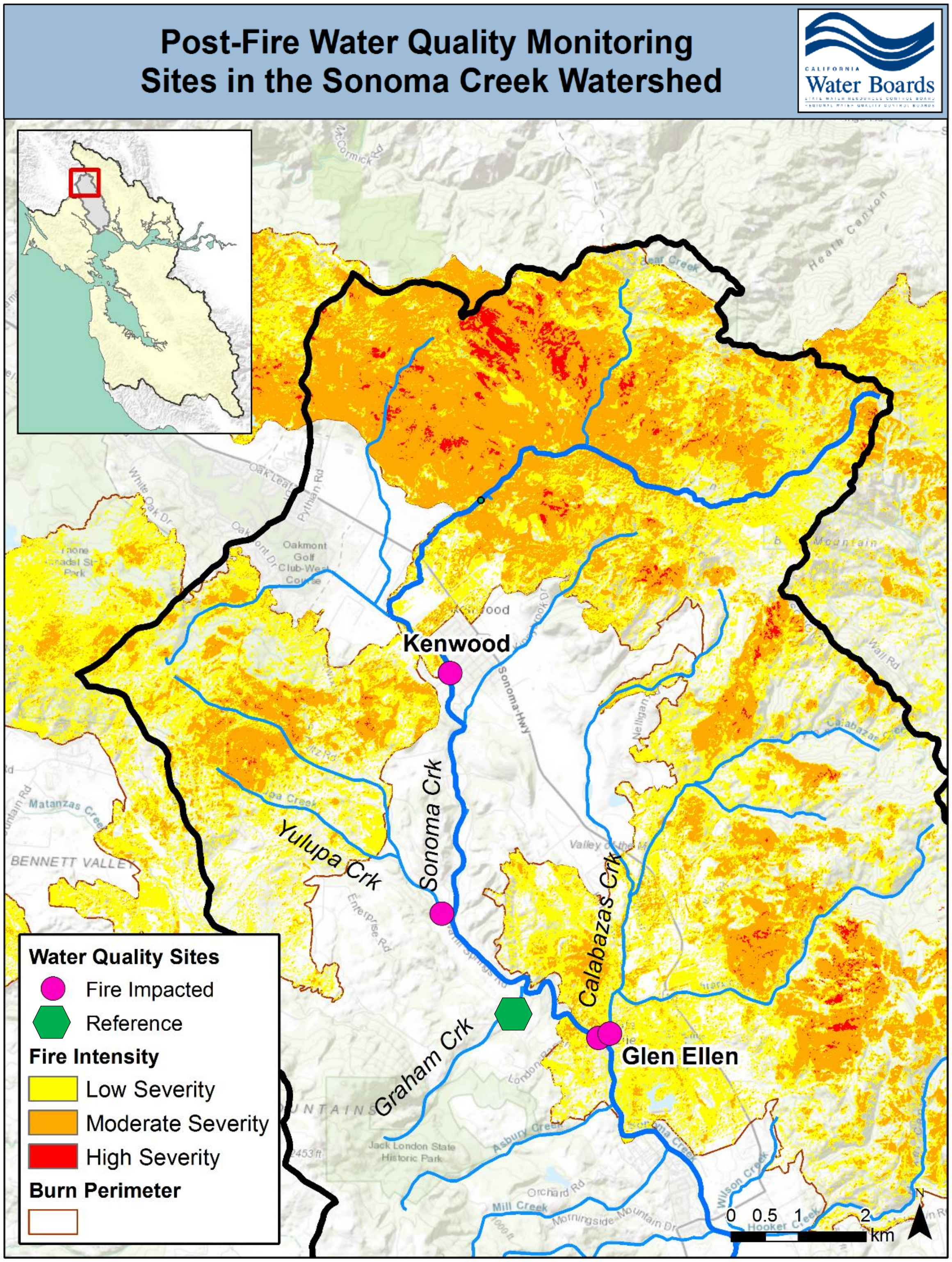

Figure 1 – Post-Fire Water Quality Monitoring Sites in the Sonoma Creek Watershed

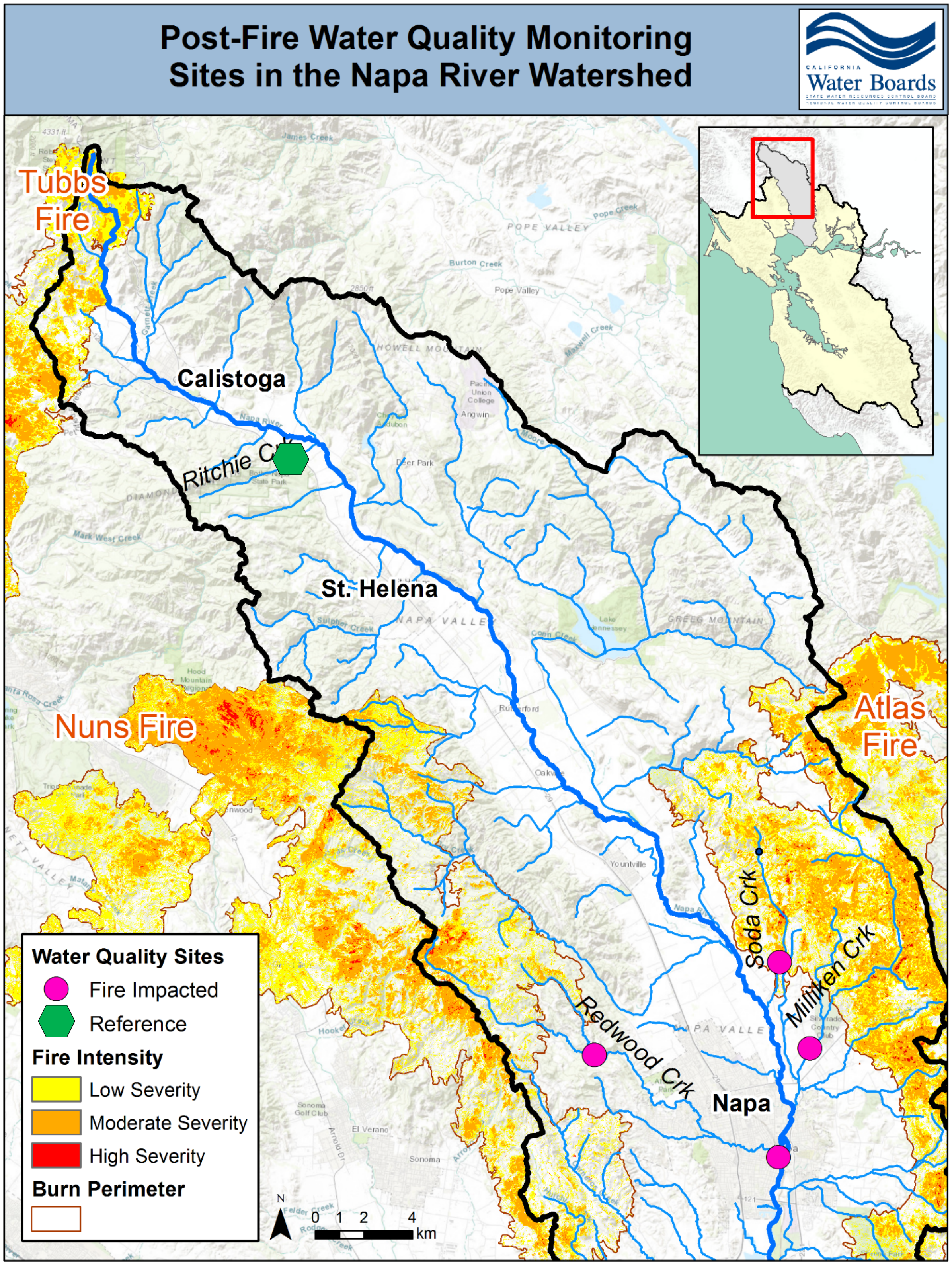

Figure 2 – Post-Fire Water Quality Monitoring Sites in the Napa River Watershed