VOLUNTEER MONITORING HANDBOOK

for the

Lagunitas Watershed Water & Habitat Quality Monitoring Program

Prepared by
Salmon Protection and Watershed Network (SPAWN)

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VOLUNTEER WATERSHED MONITORING HANDBOOK

Lagunitas Watershed Water & Habitat Quality Monitoring Program Manual

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I. Introduction

For over 5 years the Salmon Protection and Watershed Network (SPAWN) has been organizing and implementing a very important water quality and habitat quality monitoring program in the Lagunitas Creek Watershed of Marin County. This watershed supports the largest wild run of endangered coho salmon in Central California, and protection and restoration of this run has important consequences for the recovery of the entire species. The data collected by SPAWN staff and volunteers will be used to evaluate water and habitat quality for watershed organisms and humans and will be shared with the community and government organizations. The information gained through monitoring can then be used to make informed decisions on habitat restoration, fish rescue and relocation, community development, and inform regional and local water quality regulators and policy.

The Lagunitas Watershed is currently listed on the RWQCB 303(d), "Impaired Water Body List" because levels for pathogens, nutrients, and sediment pollutants exceed the State water quality standards. The Regional Water Control Quality Board (RWQCB) funding a two-year SPAWN project to conduct physical and biological water quality monitoring in 2004 and 2005, and has included SPAWN in its volunteer monitoring of fecal coliform from 2006 through the present. The current program will continue to locate problem areas and evaluate the current pollutant levels for some of these constituents, when testing supplies and budgets allow, and maintain detailed records of conditions to support salmon conservation efforts. This information will be used to help calculate Total Maximum Daily Loads (TMDL) for pollutants in Lagunitas Creek and tributaries, direct SPAWN efforts to address critical needs of salmonids, and be shared with the larger scientific and salmon restoration community.

A TMDL defines the maximum amount of a pollutant that a body of water can receive and still meet water quality standards, determines the relative contributions of different pollutant sources, and designates the amount of pollutant allowable from each of those sources.

A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and non-point sources. The calculation must include a margin of safety to ensure that the water from a particular source can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality.

The Clean Water Act, section 303, establishes the water quality standards and TMDL programs:

> "Clean water is essential for fishing, swimming, drinking, agriculture, protecting wildlife habitat, and other beneficial uses. Since 1972, when Congress passed the federal Clean Water Act, the San Francisco Bay Regional Water Quality Control Board has made great strides toward restoring polluted water bodies. Yet, a number of water bodies still do not meet standards established to protect beneficial uses. As part of the effort to solve these remaining water quality problems, the San Francisco Bay Regional Water Quality Control Board is developing Total Maximum Daily Loads (TMDLs)." – The Clean Water Act

II. Commitment to SPAWN Monitoring Team

A minimum 1 season, or 3 months, commitment is required. Testing will occur weekly and will include approximately 8-16 sampling stations. In addition, there will be subsequent, site-specific testing done on an as-needed basis. Winter sampling sessions will likely coincide with or follow a rainfall. Summer testing will be varied based on flow conditions in tributaries, with sites that lack flow having different needs than sites that have consistent flow or standing water. Groups of 2-3 people will be performing the monitoring at each session, which will require approximately 3-5 hours per session, and typically will take place in the morning.

III. Water Quality Monitoring At the selected stream sites, field measurements are made at the site using portable test equipment and recorded on data collection forms, and at some times water will be collected and bottled and sent to a lab for analysis.

Field Measurements

Water quality measurement can be performed in the field nd routinely recorded with hand held devices such as water quality meters with probes, multiprobes, or with in situ data loggers like the HOBO temperature logger. This type of data collection is the most common at SPAWN, and typically occurs once a week at sites of historical relevance and critical habitats. These measurements typically include**:**

- **pH:** A measure of the acidity or alkalinity of the water. Most aquatic organisms need water that is in the mid-range, not too acidic or too alkaline. pH levels between 6 and 9 are considered safe for aquatic life.

- **Dissolved Oxygen (DO):** The amount of oxygen in the water that is available for respiration by fishes and other biota; this reflects the difference between the consumption and production of oxygen and is another indication of water quality often related to nutrients. Excess nutrients in water encourage the growth of organic matter, which dies and is decomposed by bacteria, which in the process can deplete oxygen needed by other species for respiration. The test equipment provides a reading, which is milligrams-per-liter (mg/L), which equates to parts-per-million (ppm). Salmonids do best with levels of at least 7 mg/L. Levels below 5 mg/L can negatively affect a wide range of organisms.

- **Conductivity:** Conductivity measures the amount of dissolved solids in water, typically salts and minerals, which indicate possible animal waste or over-fertilization. Our equipment measures Electrical Conductance (EC), a measure of electrical current flow through a solution and is expressed in units of microSiemens (*u*S), and Total Dissolved Solids (TDS), in units of parts-per-million (ppm). Conductivity can tell us a lot about the nature of a stream - for example, low-conductivity streams typically have less groundwater input than high-conductivity streams, i.e., they are "precipitation-dominated." Thus, they also have more dynamic flow and temperature regimes than streams fed primarily by groundwater. In freshwater systems conductivity generally ranges between 100 and 400 *u*S.

- **Temperature:** Temperature is a crucial variable that impacts the health of a stream system. With increased temperature, a body of water holds less dissolved oxygen. With human related impacts such as removal of riparian habitat, diversion of water and global climate change, temperatures on a creek can exceed tolerable limits for many species.

Based on studies, the lethal temperature limit for coho salmon and steelhead can be 16.8^0 C or greater.

Lab Analyses

Water quality measurements that require laboratory analyses also require external funding and laboratory contracting, and are performed whenever possible:

- **Fecal Coliforms:** The presence of fecal coliform bacteria indicates that human or animal wastes that potentially can contain a variety of disease-causing pathogens are present. Possible sources in the watershed include septic systems, livestock and wildlife.

- **Nitrate+Nitrites (NO3+NO2):** This parameter is an indicator of excess non-natural nutrients that can result in the mortality of fish and other aquatic species. Nitrate can stimulate algal growth at 0.2 mg/L or lower and is potentially toxic to developing fish and amphibians at levels >2.0mg/L. (See Appendix D and E).

- **Ortho-phosphate:** This substance comes from substances containing phosphoric acid compounds such as soaps, detergents, inorganic fertilizers, and livestock feedlot runoff. It can result in the mortality of fish and other species. Levels over 0.1mg/L can contribute to excessive algal growth. (See Appendix D and E).

- **Metals:** The presence of metals can be from natural geologic or anthropogenic (human) sources, and in minute amounts are necessary micronutrients but at high concentrations are toxic contaminants. Metals commonly responsible for contamination of watersheds that have toxic effects to salmonids and aquatic life are copper (Cu), nickel (Ni), cadmium (Cd), and zinc (Zn). Other heavy metals with toxicity include mercury (Hg), lead (Pb), and arsenic (As).

- **Organic Contaminants:** These substances contain carbon as a molecular backbone and include a wide range of hydrocarbons, pesticides, and industrial chemicals, all of which are very toxic. Hydrocarbons are commonly derived from combustion and include PAH and dioxin compounds. Pesticides such as DDT, diazinon, pyrethrin, and glyophosate can be derived from natural products, but are engineered to be poisonous to wildlife and this disrupt natural food webs. Industrial organic chemicals such as PCBs, PBDEs, and phthalates can persist in the environment for decades and many have endocrine disrupting properties.

Sample Collection

The team lead coordinates with SPAWN staff to ensure the necessary preparation steps are carried out prior to the sampling day. This may include visiting the office prior to the sampling to check-out, set-up, and calibrate the equipment. Team meets the morning of the monitoring to prepare gear and supplies and calibrate equipment. At each sampling site physical water quality is measured, photos are taken, and 1-3 water samples may be collected in the appropriately labeled bottles and placed in a cooler for shipment to the lab. When all the sites have been sampled, the bottles for lab analysis must be either dropped off at the pick up location or delivered directly to the lab. Upon transferring the bottles to any other party a Chain of Custody form is filled out and submitted with the samples. The Data Sheets are delivered to SPAWN staff for data compilation and processing.

Preparation for Sampling
In an effort to assure that you are prepared for your sampling session, you should check all of the gear and make sure that you have the tools you will need. Below is a list of tasks and gear that you will need. Some of these tasks can be done the night before.

Tasks to do in the days before sampling

- ❑ Make sure the lab sample pickup arrangements have been secured (confirm w/SPAWN)
- ❑ Review list of sites and specific locations to be sampled (discuss with SPAWN). Record Site numbers and names in first field of data collection sheet, Chain of Custody form (COC), and Bottle Labels (Critical for organizing, and saves time in the field)
- ❑ Take inventory of remaining bottles and make sure you have enough bottles for next 1-2 sampling events (Alert SPAWN if we are running low).
- ❑ Carry several sample bottles, data sheets, and COC forms that are not labeled to have as back-ups if water samples are compromised, bottles broken, or forms completed incorrectly.

Tasks to do in the morning before leaving for the field

- ❑ Purchase ice (used to keep water samples cool)

- ❑ Check/Calibrate DO and pH/Conductivity/Temp meters. A hard copy of the complete instructions are in the cases with each piece of equipment and in the appendix of this guide.

Supply List:

- Volunteer Manual
- Site List
- Map and directions to sites and site logistics
- Data Sheets – to record pH, Conductivity, DO and Temperature measurements, time sample collected and other info (downloadable at http://www.spawnusa.org/naturalist_resources.html)
- Chain of Custody Forms – for the courier or lab at drop-off
- Collection bottles: Three types of bottles are used, take along 3 extras in case of contamination:
  - -500 mL bottles w/a fixing agent (sulfuric acid) for Nitrate+Nitrites
  - -500 mL bottles with no fixing agent for Ortho-phosphates
  - -100 mL bottles containing a small pellet to stabilize Fecal Coliforms
  - -40 mL vials with fixing agent (for occasional testing of aromatic compounds.
- Labels (if not pre-labeled)
- Cloth for drying off labels
- Pens: 2 ballpoint pens, and 1-2 "ultra-fine point" sharpies, 1-2 "fine point" sharpies
- Plastic baggie for disposal of trash
- Extension Arm Sampler, Bucket with Rope (backup)

- Collection cup for 'grabbing' water samples
- Modified collection cup for collection of fecal samples
- DO Meter
- pH/Conductivity/Temperature Meter
- HOBO temperature logger
- Thermometer (backup)
- Waders and boots (as needed)
- Cooler with bag of ice
- Rubber gloves
- SPAWN Volunteer Water Quality Team Business Cards

<u>Starting Your Sampling</u>

In general, it is recommended that you begin your sampling at 9am in the morning at the uppermost reach of the watershed (Woodacre) and travel downstream. This will place you closer to your drop off point when you are finished sampling. All sites are either on public property or private property where we have secured permission.

<u>Arriving at your site</u>

Here is a suggested chronology procedure upon arriving at a site. Feel free to adapt a procedure that works best for you.

- ❑ Write sampling time on bottle labels for that site AND on data sheets before collecting sample – usually add 1-3 minutes to the current time.
- ❑ Place the 500 ml bottle (<u>w/no fixing agent</u>) ortho-phosphate designated for that specific site in extension arm sampler
- ❑ Extend arm to reach flowing water, fill the bottle as full as you can with water.
- ❑ Pour water from this bottle into the 500 ml bottle w/fixing agent (nitrate-nitrite)and 100 ml bottle (fecal coliform). Bottles must be at least 90% full. (repeat until bottles are sufficiently filled).
- ❑ Fill bottle attached to extension arm, cap the bottle and remove.
- ❑ Attach the DO probe to the clamp on the side of the extension arm, place in the stream, measure DO and record on data sheet
- ❑ Remove DO probe and place the collection cup on the end of the extension arm
- ❑ Rinse cup a least 3 times in creek and then collect a sample of water for the pH/Conductivity/Temp analysis.
- ❑ Take measurement from sample in cup
- ❑ If needed, retrieve or replace HOBO temperature logger once a month.
- ❑ Pack up and head to your next site.

<u>Field Measurement Data Collection</u>

Always conduct field measurements of physical water quality from an actively flowing stretch of creek (not in backwaters, stagnant ponds or back eddys). Field measurements can be taken from the creek bank or using the sampling pole to take a grab sample, and there are special considerations when measuring each physical parameter, as described below.

- **Creek measurements from the bank:** Take care when taking measurements along the bank of the creek to not disturb the native vegetation or disrupt the bank integrity.
- **Creek measurements from a grab sample:** If safe access to the bank of the creek is not possible, then the best method to measure the creek water quality with a probe is to

secure the probe to the sampling pole and carefully lower it into the creek flow. This should only be performed with a probe that has a cable long enough to reach the creek, the meter itself should never be lowered on the sampling pole. Alternatively, take a grab sample of the creek water using the sampling pole (see photos) and quickly place the probes into the sampling container to record measurements.

- **pH:** Accurate pH Measurements generally do not require extra time or probe handling, but waiting for the reading to stabilize is recommended.
- **Dissolved oxygen:** The dissolved oxygen probe consumes oxygen while taking the measurements, so submerging the probe in flowing creek water or swirling of the sample when it is in a container is critical to an accurate reading.
- **Conductivity:** Accurate conductivity Measurements generally do not require extra time or probe handling, but waiting for the reading to stabilize is recommended.
- **Temperature:** The thermometer on most probes can take 2-3 minutes to equilibrate, so taking an accurate measurement can take some time. It is recommended that temperature readings be performed last to allow time for the probe to reach a stable temperature. Measurements may not be as accurate if the remote, grab sampling method is used, so be sure to indicate on your data sheet that the measurements were taken from a grab sub-sample and not from flowing creek water. The longer the sample stays in the grab container, the more likely the temperature reading does not reflect the conditions in the creek.
- **HOBO temperature logger:** The HOBO temperature logger should always be secured to a rock or fixed substrate to provide a consistent reading from a single location and to each retrieval. A brightly colored ribbon indicating “SPAWN” and the creek placement must be secured to the top to the HOBO. Many of the temperature loggers also record light intensity, so before deploying them, be sure they are clean and free from algae and dirt, and when deploying them be sure there are no immediate obstructions blocking light from reaching the logger.

Sample Collection and Handling

Make sure that your sample does not contain any solids such as bugs, twigs or leaves. However if your sample has a couple of large particles in it, don’t worry about it. Always collect water and test water from an actively flowing stretch of creek (not in backwaters, stagnant ponds or back eddys). Be sure to check with SPAWN staff to confirm any special sample collection and handling needs for projects that involve sample collection for laboratory water quality analyses.

- When pouring into a bottle it is best for one person to hold the bottles and caps (don’t touch the inside of the cap or the rim of the bottles, as that will contaminate the sample), while the other pours the water into the bottles. If contamination does occur, discard the sample (recycle the bottle at the office) and get a new bottle and label to replace it.
- Do not overfill the bottles, as some of them have fixatives in them. Fill the bottle with the acid fixative last, and be very careful not to over-spill and get the acid on the holder’s hands, the ground or into the creek.
- In cases where you are only collecting one 100ml sample for the lab, open the bottle, shake the small preservative tablet onto the lid, place the bottle in the specially designed holder, collect your sample, drop the preservative tablet back into the bottle and cap the bottles tightly and place upright in the cooler (Remember, no fingers in the cap or bottle!).

Figure 1. Grab sample collection from the middle of flow using the sampling pole. This photo shows the sample collection into a laboratory sample bottle, but this technique can also be used to collect a grab sample for water quality measurements with field probes if the creek bank or flow conditions make bank access difficult.

Recording Time of Collection
Mark the time of the pour on the label of each bottle. For documentation purposes make sure you write the same time on all bottles sampled from one site and also make sure to write that specific time on the Chain of Custody form. At each site, you can pre-mark the time by adding about 1-3 minutes to the current time. It's easier to label a DRY bottle than a wet one, so wipe the bottle dry if it's damp, before writing. Once you collect the sample, make sure to write the time on the chain of custody form and the SPAWN data sheet.

Delivery of samples to the lab
In most cases samples will be dropped off to a RWQCB staff member at the Point Reyes National Seashore's maintenance building, and specific instructions for this location are listed in the Appendix. However, in some cases, volunteers will need to deliver the samples to the lab directly.

Always make sure that you have made the necessary arrangements with the Lab or the courier to hand off samples. Take an inventory of supplies before contacting lab and make sure to request more bottles for future samplings if needed. Meet the lab courier at SPAWN office, Point Reyes National Seashore or other designated location. Upon meeting the courier, you should count and check all bottles and paperwork, fill out the rest of the Chain of Custody form and sign, and have courier or driver sign the COC as well. Retain a copy of the COC for SPAWN records, if possible make a photocopy of singed COC, and return it to SPAWN staff with other data sheets.

Data Management
Water quality data management is essential to the accurate communication and reporting of the measurements acquired in this program. Both field and laboratory data is to be recorded in electronic formats and stored on the SPAWN computer server in the proper file directory. The standard procedure for water quality data management is described below.

1) **Field datasheet or laboratory results report quality control error check:** Immediately after returning from the field or receiving a laboratory report, each data sheet or report

page must be checked by all team members for errors and omissions. Writing on field data sheets that is hard to read should be clarified while the information is still current, and any unknown symbols or references on lab reports should be identified and clarified. Any blank fields or data omissions should be filled out correctly or completed with a horizontal dash (-) if no data was acquired or completed to indicate that the data was not applicable (N/A). Recorded measurements should be closely scrutinized to ensure they follow normal trends and indicate a normal range of measurements, and if they do not, SPAWN staff and Project Managers should be immediately notified.

2) **Data entry into Excel workbook:** The raw data from each datasheet or lab report should be entered into the assigned Excel workbook as soon as possible. The Excel workbooks are to be stored in the TIRN Shared Files/Spawn/Water Quality Project folder. When data entry is complete, the person who performed the data entry must make a notation on each original datasheet or report form with their name or initials and the date data entry was completed.
3) **Data quality control (QC):** After data entry is completed, it is checked over by someone other than the person who completed the data entry. Any discrepancies are discussed and corrected in the Excel workbook. When data QC is complete, the person who performed the data QC must make a notation on each original datasheet or report form with their name or initials and the date data QC was completed.
4) **Electronic data storage and reporting:** The Excel workbooks are to be stored in the TIRN Shared Files/Spawn/Water Quality Project folder. This folder should be backed-up regularly by the SPAWN Operations Director. Reports should be generated twice a year, and it is recommended to produce them in October and April of each year to cover Spring/Summer and Fall/Winter conditions, respectively.

III. Habitat Quality Monitoring

Habitat quality monitoring directly complements the water quality monitoring and is an important component of SPAWN's conservation and restoration programs. Habitat conditions can greatly influence surrounding water quality, whether it is increased water temperature caused by lack of overstory riparian vegetation shade or increased sediment runoff from lack of understory bank vegetation, the two conditions are intimately dependent on each other. The Habitat monitoring is used by SPAWN staff to make decisions concerning timing and location of juvenile salmonid rescue and relocation, prioritize habitat restoration efforts, identify habitat conservation needs, and can be the first indicator of illegal development, hazardous waste dumping, or violations of the Stream Conservation Area ordinance.

The habitat quality monitoring team leader coordinates with SPAWN staff to ensure the necessary equipment is prepared and any special landowner access communications are carried out prior to the monitoring day. The team meets the morning of the monitoring and organizes supplies, equipment, and data sheets, typically for both the habitat monitoring and concurrent water quality monitoring. At each sampling site physical habitat typing is performed, habitat quality is assessed, and photos are taken. When all the sites have been monitored, the data is entered in the Habitat Monitoring database and photos are downloaded off the camera and filed in the SPAWN computer. Original copies of paper data sheets are delivered to SPAWN staff for storage.

Preparation for Monitoring

In an effort to assure that you are prepared for your habitat monitoring session, you should check all of the gear and make sure that you have the tools you will need. If you are not familiar with the habitat typing or habitat quality assessment methods, you should review this Handbook carefully and refer to the Appendices and References for more detailed information. Below is a list of tasks and gear that you will need. Some of these tasks can be done the night before.

Tasks to do in the days before monitoring

- ❑ Review list of sites and specific locations to be monitored, and discuss with SPAWN staff if there are any special access restrictions.
- ❑ Check the status of the digital camera memory card and battery level. If either appears low, take steps to ensure they will be ready for full monitoring session the next day (charge the battery or download and erase memory card).
- ❑ Carry several data sheets and if possible spare camera batteries, camera memory cards, and a transect measuring tape have as back-ups.

Supply List:

- o Volunteer Monitoring Handbook
- o Site List
- o Map and directions to sites and site logistics
- o Data Sheets to record Habitat Quality
- o Pens: 2 ballpoint pens, and 1-2 "ultra-fine point" sharpies, 1-2 "fine point" sharpies
- o Plastic baggie for disposal of trash
- o Digital Camera with associated batteries and memory cards
- o Compass
- o Transect measuring tape to measure length and width of assessment area
- o Stadia rod to measure creek depth
- o Waders and boots (as needed)
- o SPAWN Volunteer Water Quality Team Business Cards

<u>Starting Your Monitoring</u>

In general, it is recommended that you begin your sampling at the uppermost reach of the watershed (Woodacre), travel downstream, and be performed concurrently with water quality monitoring. This will place you closer to the office for data entry and photos downloading and well as closer to the drop off point for water samples when you are finished sampling. All sites are either on public property or private property where we have secured permission.

<u>Arriving at your site</u>

Here is a suggested chronology procedure upon arriving at a site. Feel free to adapt a procedure that works best for you.

- ❑ Write sampling site location time on data sheets before completing all assessments.
- ❑ Briefly survey the area and complete Habitat Typing information
- ❑ Conduct a through survey for Habitat Quality, taking time to look for trash, identify plants, and wait for fish and aquatic life to present itself. Record all observations and determine Habitat Quality score.
- ❑ Perform photo monitoring
- ❑ Pack up and head to your next site

Habitat Typing

The field crew should measure the area to be assessed for habitat typing and habitat quality assessment with the transect measuring tapes or use permanent structures to identify the area, such as bridges, fence lines, or structures. The area assessed should not be longer than the standard 100' transect measuring tape, and this will complicate the assessment. If a large area longer than 100' is to be assessed, it should be broken into several sections and separate data sheets and notebook entries should be completed. The field crew should, to the best of its ability, identify the Level II Habitat Type of the creek on the data sheet, and if needed indicate the transition between and identification of different habitat types. If field crews can not identify the Level II quality of the habitat type, a Level I type can be assigned. The following list of habitat types and their hierarchy has been adopted from the California Stream Habitat Restoration Manual, and should be used by SPAWN field crews.

<u>Level I Habitat Types:</u>
RIFFLE: (Riffle, Cascade, Flatwater)

POOL: Main Channel Pool, Scour Pool, Backwater Pool)

<u>Level II Habitat Types:</u>
RIFFLE:(Low-Gradient Riffle, High-Gradient Riffle, Cascade, Bedrock Sheet)

FLATWATER: (Pocket Water, Run, Step Run, Glide, Edgewater)

POOL: (Plunge Pool, Mid-Channel Pool, Dammed Pool, Step Pool, Channel Confluence Pool, Trench Pool, Lateral Scour Pool - Root Wad Enhanced, Boulder Formed, Bedrock Formed, and Log Enhanced, Corner Pool, Secondary Channel Pool, Backwater Pool - Boulder Formed, Root Wad Formed, and Log Formed)

<u>Habitat Typing Procedure</u>

1) Lay out transect measuring tapes or use permanent structures to identify the area to be assessed less than 100' and record site identification on data sheet. If a large area longer than 100' is to be assessed, it should be broken into several sections and separate data sheets and notebook entries should be completed.
2) Identify the Level II Habitat Types of the creek on the data sheet, indicating the location of the start and end of specific habitat type along transect or permanent marker. If field crews can't identify the Level II quality of the habitat type, a Level I type can be assigned. For example, San Geronimo Creek under the old landslide at the SPAWN house is "Pool, bedrock formed, root wad enhanced; dry secondary channel, low-gradient riffle" in Fall of 2009.
3) Record relevant habitat types on data sheet.

Habitat Quality Assessment Scoring

The habitat typing is used to identify basic instream habitat features, and the Habitat Quality Assessment Scoring of the riparian and SCA area will complement this effort and water quality monitoring. The combined watershed monitoring approach will allow recording of watershed changes in a repeatable structure to accurately gauge changes over time. The Scoring system below is easy to train, and could be accurately and precisely performed by high school age students with minimal training. The ideal riparian habitat score using this system would be 10, with a score of 0 indicating very poor habitat such as an exposed concrete ditch without flow. The Habitat Quality Score is comprised of separate analyses of Bank Condition, Creek Flow, Riparian Vegetation Density, and Riparian Vegetation Quality. A summary of these separate scoring scenarios is below:

Bank Condition: score each side and divide by 2
Bank is 60% slope or less, covered in 70% vegetation or greater = 3
Bank is 60% slope or greater, covered in 70% vegetation or greater = 2
Bank is less than 70% vegetation with bare sediment exposed = 1
Bank is near vertical with bare sediment exposed = 0

Creek Flow
Creek flow spans width of gravel or substrate bed = 3
Creek flow visible, covering less that width of bed = 2
Subsurface creek flow with isolated pools = 1
No flow, bed is dry = 0

Riparian Vegetation Density: score each side and divide by 2
Dense overhead canopy blocks sun, midstory, and understory vegetation = 3
Overhead canopy blocks some sun, dense midstory and understory vegetation = 2
Sparse overhead canopy, dense midstory and understory vegetation = 1
No overhead canopy, some midstory and understory vegetation = 0

Riparian Vegetation Quality: score each side and divide by 2
Dominant vegetation is native species = 1
Dominant vegetation is non-native species = 0

Habitat Typing Procedure

4) Visually scan are identified by transect measuring tapes or use permanent structures to used to assess Habitat Type. If a large area longer than 100’ is to be assessed, it should be broken into several sections and separate data sheets and notebook entries should be completed.
5) Complete the scoring matrix, using measing tapes and stadia rods where needed to determine plant density and bank slope. For example, San Geronimo Creek under the old landslide at the SPAWN house Fall 2009 is a score of 7; Bank Condition = 2, Creek Flow = 2 , Riparian Vegetation Density = 2, and Riparian Vegetation Quality =1.
6) Record relevant habitat types on data sheet.

Photo Monitoring

Photo monitoring at each site is performed to augment the habitat typing and habitat quality assessment information. Photo monitoring can be done alone, but is best when performed with a completed habitat assessment as well. It is very important that field crews attempt to reproduce the exact location and angle of typical photos from each site at Permanent Photo Points so that comparisons can be made over time of changes occurring in that frame of reference. In addition to Permanent Photo Points, field crews should occasional take Landscape and Opportunistic photos. SPAWN field crews should pay special attention to unusual new construction activities, tree cutting, and other potential SCA violations for Opportunistic photos.

<u>Permanent Photo Points</u> – consistent photos from pre-determined monitoring locations.
1) Document the make, model, and settings of the camera on the Habitat Assessment data sheet. Adjust the zoom of the camera to wide angle, so a broad area is included.
2) Stand at the pre-determined location for photo monitoring for each site (see Appendix)
3) Hold the camera at eye level, and frame the photo to show the desired area, noting pre-determined reference landmarks (see Appendix).
4) Record compass heading of camera direction.
5) Take photos and record the digital image # on data sheet.
6) Repeat steps 2-5 to record multiple Permanent Photo Points at a single monitoring station, such as upstream and downstream from the golf cart bridge at Roys Pools.
7) Turn off digital camera between monitoring sites to conserve batteries.

SPAWN uses the RWCB sites (WS-17 through WS-22) in the San Geronimo Valley for weekly Permanent Photo Points, with photos taken both in the upstream and downstream direction.

<u>Landscape Photos</u> – show a big picture of surrounding habitats and structures.
1) Stand at identifiable location and record this on data sheet.
2) Hold the camera at eye level, and frame the photo to show the desired areas.
3) Record compass heading of camera direction.
4) Take photos and record the digital image # on data sheet.
5) Repeat steps 1-4 to record multiple Landscape Photos from a single location, such as Roys Pools restoration on both sides of bridge.
6) Turn off digital camera between monitoring sites to conserve batteries.

Landscape photos of Restoration sites should be taken by Monitoring crews on a seasonal basis, and special attention should be paid to capturing new planting to document success or failure rate of plantings, help SPAWN staff determine maintenance needs, and for use in reporting.

<u>Opportunistic Photos</u> – document an unusual situation or specific project.
1) Stand at identifiable location and record this on data sheet.
2) Hold the camera at eye level, and frame the photo to show the desired areas. Make sure to frame important landmarks or structures to help identify unique situation.
3) Record compass heading of camera direction.
4) Take photos and record the digital image # on data sheet.
5) Repeat steps 1-4 to record multiple Opportunistic Photos from a single location, such as tree cutting in multiple areas of a single parcel.
6) Turn off digital camera between monitoring sites to conserve batteries.

Opportunistic photos should be taken of wildlife sightings, sediment laden stormwater runoff, trash and debris deposits, construction in the SCA, and any potential SCA violations.

<u>Data and Photo Management</u>
Habitat quality assessment data and photo management is essential to the accurate communication and reporting of the measurements acquired in this program. All field notes, assessment data, and digital photographs are to be recorded in electronic formats and stored on

the SPAWN computer server in the proper file directory. The standard procedure for this data management is described below.

1) **Field datasheet and notebook quality control error check:** Immediately after returning from the field, each data sheet or notebook page must be checked by all team members for errors and omissions. Writing on field data sheets that is hard to read should be clarified while the information is still current, and any blank fields or data omissions should be filled out correctly or completed with a horizontal dash (-) if no data was acquired or completed to indicate that the data was not applicable (N/A). Recorded measurements should be closely scrutinized to ensure they follow normal trends and indicate a normal range of conditions, and if they do not, SPAWN staff and Project Managers should be immediately notified.
2) **Data entry into Excel workbook:** The raw data from each datasheet or notes from the notebook should be entered into the assigned Excel workbook as soon as possible. The Excel workbooks are to be stored in the TIRN Shared Files/Spawn/Habitat Quality Project folder. When data entry is complete, the person who performed the data entry must make a notation on each original datasheet or notebook page with their name or initials and the date data entry was completed.
3) **Photo downloading:** Immediately after returning from the field, and whle performing data entry, connect the digital camera to the computer and download the photos for that day's monitoring. Photos are stored in TIRN Shared Files/Spawn/Habitat Photo Monitoring/"Creek Name". Within the parent folder "Habitat Photo Monitoring" are folders for each creek monitored, and San Geronimo Creek is divided into geographic sections with separate folders. There is also a folder named "copies SCA violations" where we can store photos taken to document bad construction, tree cutting, and other SCA violation, and one copy of each photo in this folder should match another copy in the correct Creek folder.
4) **Photo and file naming:** All photos should be labeled with a filename that conforms to the following pattern: Creek_site ID#_#of photo in sequence_date using 6 numbers.jpg. The "Creek" designation is the name of the creek or tributary, and abbreviations can be used (i.e. SG for San Geronimo, Wood for Woodacre etc.). The "_#of photo in sequence" designation would translate to "_1_" for the first photo taken on site, "_2_" for the second photo taken, and so on. The "date using 6 numbers" should be formatted with 2 numbers for month, day, and year, so that July 31, 2009 is written 073109. All photos should be stored as high-resolution jpg files. For the second photo taken on East Fork Woodacre Creek at the standard RWQCB sampling site on July 31, 2009, the file name would be "EWood_WS17_2_073109.jpg".
5) **Data quality control (QC):** After data entry, notebook transcription, and photo downloads are completed, they are checked over by someone other than the person who completed the data entry. Any discrepancies are discussed and corrected in the Excel workbook. When data QC is complete, the person who performed the data QC must make a notation on each original datasheet or report form with their name or initials and the date data QC was completed.
6) **Electronic data storage, photo storage, and reporting:** The Excel workbooks are to be stored in the TIRN Shared Files/Spawn/Habitat Quality Project folder. This folder should be backed-up regularly by the SPAWN Operations Director. Reports should be generated twice a year, and it is recommended to produce them in October and April of each year to cover Spring/Summer and Fall/Winter conditions, respectively.

Sampling Plan

The Sampling Plan for SPAWN's Watershed monitoring program is project driven, and will conform to the needs to specific, funded monitoring goals. SPAWN has partnered with the RWQCB to collect samples for fecal coliform analyses, and when contacted by the Board will typically conduct sampling at the 10 RWQCB sites (WS-17 through WS-26) on five consecutive Tuesday mornings.

Monitoring Schedule

For regular field measurements of physical water and habitat quality, weekly monitoring trips will be made with organization and leadership from SPAWN staff and field work conducted primarily by SPAWN interns, volunteers, and AmeriCorps Watershed Stewards Project members serving with SPAWN. When contacted by the Board will typically conduct sampling at the 10 RWQCB sites (WS-17 through WS-26) on five consecutive Tuesday mornings.

Monitoring will often be driven by seasonal needs of coho salmon monitoring, conservation, and restoration. During times of spawning, dissolved oxygen and temperature measurements are critical to identifying if water quality conditions are adequate for proper development of embryos and alevins. Additional monitoring and sampling will be conducted as needed, for example during heat waves, droughts, or emergency spills.

Monitoring Sites

A complete list of monitoring sites is presented in Appendix I, and the RWQCB sites that are commonly monitored and sampled are presented below.

RWQCB Sampling Stations for Field Measurements and Lab (Fecal coliforms)

- WS-17 East fork Woodacre Creek
- WS-18 West Fork Woodacre Creek
- WS-19 Woodacre Creek
- WS-20 San Geronimo Creek at Roys Pools
- WS-21 Montezuma Creek
- WS-22 Arroyo Creek
- WS-23 San Geronimo Creek - Inkwells
- WS-24 Lagunitas Creek below Devil's Gulch Creek
- WS-25 Lagunitas creek below Cheda Creek
- WS-26 Lagunitas creek at Platform bridge

Acknowledgements

This manual would not have been possible without a grant from the USEPA and Regional Water Quality Control Board (RWQCB) 319h Citizen Monitoring Program and SPAWN's membership. Several individuals devoted countless hours to creating this document. Megan Isadore helped produced an early draft of this document. Dan Best compiled and added key information as well as edited the document. Peter Krottje of RWQCB wrote the sections listed appendices E and F. Leslie Ferguson, Peter Krottje and Dale Hopkins of RWQCB have provided valuable support for structuring this program. We thank all of the volunteers to date who have made this program a success.

This project has been funded wholly or in part by the USEPA Assistance Agreement. The contents of this document do not necessarily reflect the views and policies of the USEPA, the State, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.”

APPENDICES

A. Site Map and Directions to Drop Off Site

B. Sample Data Sheet

C. Chain of Custody Form

D. Nutrients And Dissolved Oxygen In North Bay Streams

E. Chemical Monitoring In Lagunitas Creek—What's Being Monitored and What Does It Mean?

F. Use of pH/Conductivity/Temperature and DO Meters

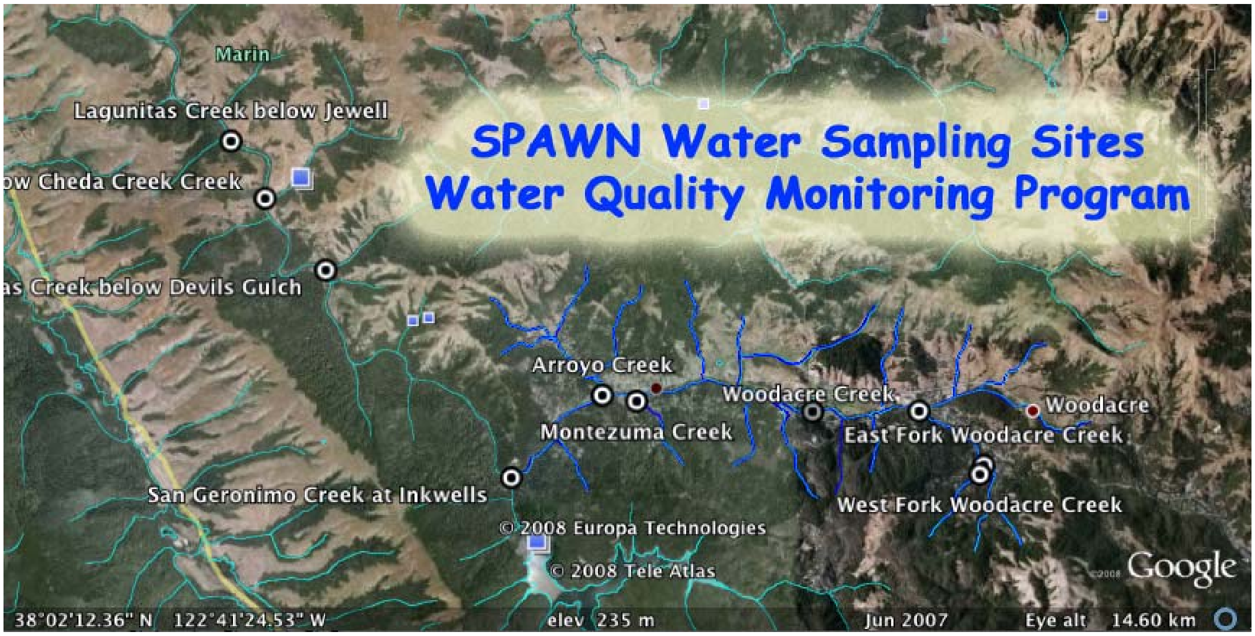
G. Bottle Label Guidelines

H. Contact Information

I. Site Numbers and Names

J. Habitat Types, Levels I-IV

Appendix A: Site Map



Drop Off Site Directions

Water Quality Sampling Drop Off Site – Point Reyes National Seashore

Need to have samples dropped off by noon each Tuesday.

Drop samples off at Point Reyes National Seashore's Maintenance building in the special refrigerator.

This is located in 'Buildings and Utilities' office – located across from Resource Management Office. Go through the door and turn left into the first office. There should be some sign with references to 'Water Management'. There should be a refrigerator in the corner of the room. Consider leaving them in the cooler if there are too many to fit in the refrigerator. If you leave the cooler, make sure that they will remain cold. Make sure to leave a note indicating SPAWN samples.

Farhad Ghodrati will pick up between 12:00 and 12:30.

If you are confused about where to go, ask for Brannon Ketcham or Greg Brown at the National Seashore Office.

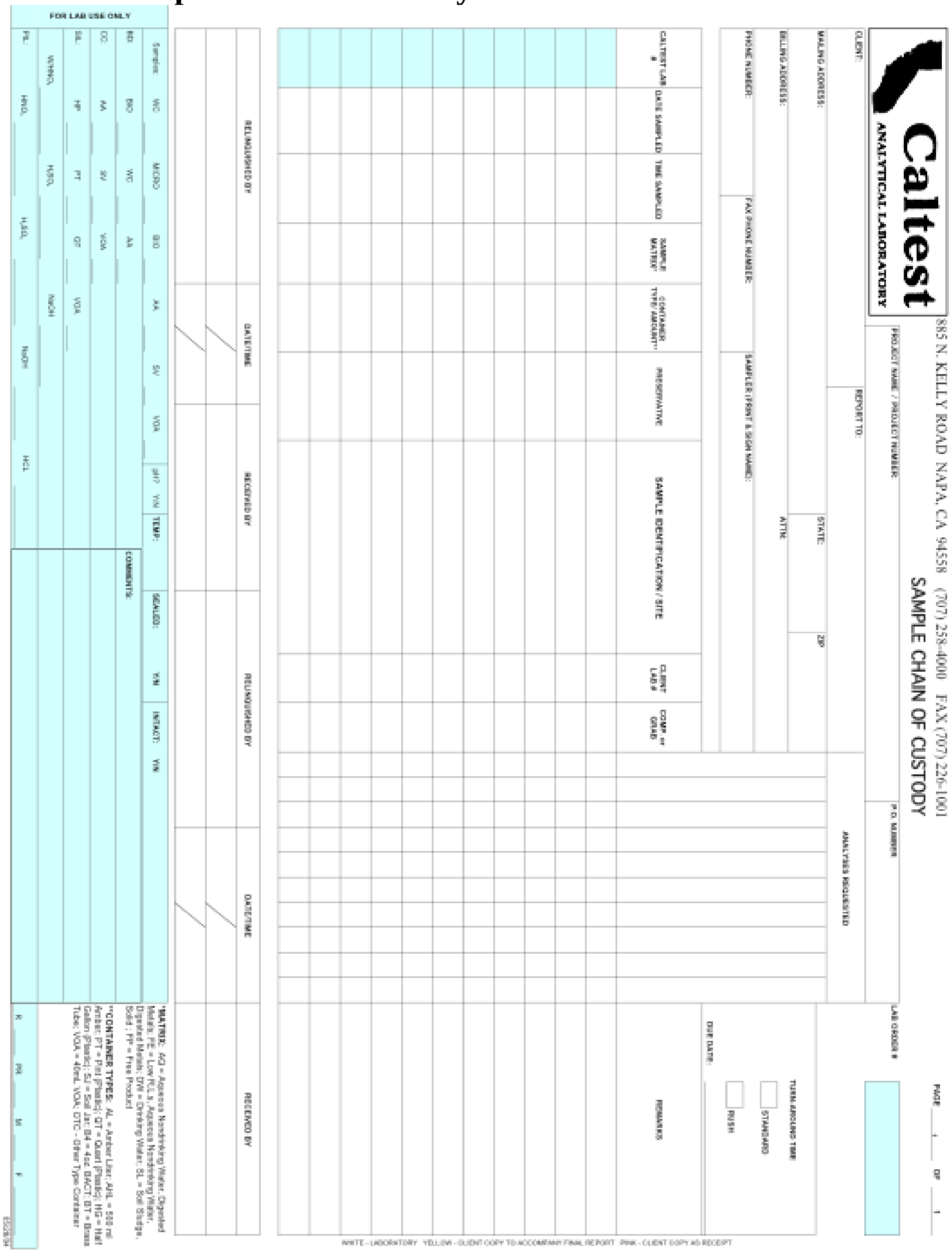
Appendix B: Sample Data Sheets

RWQCB/SPAWN Water Quality Monitoring Program - Lagunitas Watershed

Date:____________ Collected By:____________

Site #	Location	Time Collected	Temp (C)	DO	Conduc-tivity	PH	Fecal Coliforms	Nitrate+Nitrite	Ortho-phosphates	Comments

Appendix C. Sample Chain of Custody Form



Information you need to fill out the hard copy forms…………..

Name: SF RWQCB
Address: 1515 Clay St., Suite 1400, Oakland, CA 94612
Report to: Peter Krottje(RWQCB)/Paola Bouley (SPAWN)
Sampler(s): *List names of all samplers*
Client Sample ID: *Fill in SPAWN station number*
Date/Time Sampled: *List the exact as indicated on the SPAWN datasheet*
Comments:

Appendix D. Nutrients And Dissolved Oxygen In North Bay Streams (By Peter Krottje, RWQCB)

Nutrients

In an environmental context the term "nutrients" generally refers to the primary plant growth nutrients, nitrogen and phosphorus. These elements are essential for life and are ubiquitous in the environment. Because of their key role in ecosystem function, excessive levels of nutrients affect aquatic systems in a wide range of ways. Many types of human activities—particularly those associated with human or animal waste disposal or fertilizer application—can result in excessive loading of nutrients to waterbodies, and for this reason nutrient-related impairment is a widespread problem.

Adverse impacts of excessive nutrient loading can be placed into two general categories: eutrophication and toxic effects. Eutrophication is the excessive and undesirable growth of algae and aquatic plants caused by excessive levels of nutrients. Eutrophication typically occurs at somewhat lower nutrient concentrations than toxic effects. Toxic effects can apply to aquatic life inhabiting the waterbody or to humans consuming the water. Either of these modes of water quality impairment can affect the entire aquatic food web, from algae and other microscopic organisms, through the benthic macroinvertebrates (principally aquatic insect larvae), through the fish, to the mammals and birds at the top of the web.

Eutrophication in streams

Nutrient supply is a primary limiting factor for plant growth in aquatic systems. Under natural conditions, competition for nutrients keeps concentrations low, and most organisms are therefore adapted to low nutrient conditions. High nutrient levels disrupt aquatic systems by promoting explosive growth of a limited variety of opportunistic organisms—algae or weedy plant species—that are capable of rapid nutrient uptake and growth. These organisms can overrun aquatic habitat, deplete oxygen, and in some cases release toxic substances. Eutrophication impairs aquatic habitat uses through broad impacts on the entire biological community. Recreational uses are impaired through aesthetic problems associated with algae or aquatic plant growth.

One way to broadly categorize aquatic algae is by their general growth form: algae that drift freely in the water column are referred to as phytoplankton, while algae that grow attached to the bottom or other solid substrates in the water are called periphyton. Phytoplankton blooms are the predominant symptom of eutrophication in lakes and other non-flowing waterbodies, while excessive periphyton growth is the predominant symptom in streams.

Many interacting factors determine periphyton growth rates. Some of the most important factors (illustrated in Figure 1) are:

- External nutrient loading—nutrients entering the stream via surface runoff, groundwater seepage, or precipitation—is the primary source of nutrients for algal growth. The form of nutrients entering the water also affects algal growth rates. Dissolved inorganic nutrients (nitrate, ammonia, ortho-phosphorus) are generally more available to algae, and tend to have a greater stimulatory effect on algal growth than organic and particulate forms of nutrients.

- Internal loading can also be a significant nutrient source. Internal loading is the release of nutrients stored in the sediment or in decaying biomass back into the water column, where it is again available for algal uptake.
- Light is essential for photosynthesis, and therefore the shade provided by riparian vegetation can be a major limiting factor on algae growth in streams.
- Streamflow can influence algal growth in two ways. Very low flows have been shown to inhibit algal growth by limiting nutrient transport to and into growing algal masses. Extremely high flows inhibit biomass accumulation by detaching algae and transporting it downstream. In most of California high winter flows scour virtually all of
- Grazing of algae by benthic macroinvertebrates is important in controlling the accumulation of algal biomass, and under some circumstances can prevent excessive algal growth even when nutrient and light conditions are optimal for growth.

All of these factors vary a great deal from location to location, complicating efforts to predict periphyton growth, and underscoring the need to collect site-specific data in potentially nutrient-impaired streams.

Periphyton growth in Bay Area streams occurs primarily from late spring though early autumn. This is the period when temperatures and light levels are optimal for algal growth, and when scouring high flow conditions are absent. However, it is also the period when external nutrient loads are lowest. Loading through surface runoff is low or completely absent in the summer months, so external loading occurs almost exclusively through groundwater seepage—sometimes associated with septic tank leachate. Limited loading combined with rapid uptake by the growing mass of algae tends to result in declining nutrient concentrations throughout the summer months. Eventually nutrient concentrations may become so low that they limit further algal growth. The exact nutrient levels at which algal growth limitation begins to occur vary, but are generally less than 0.5 mg/L for total nitrogen and 0.1 mg/L for total phosphorus. If nutrient concentrations fall to limiting levels early in the season, only a modest standing crop of algae will be produced; if limiting concentrations do not occur until later, or if nutrient levels remain high all summer, large, problematic quantities of algal biomass may develop.

Whether nitrogen or phosphorus limits algal growth depends on the ratio of these elements in the water. Algae utilize nitrogen and phosphorus at a ratio of about 7:1 by mass. A ratio of these elements significantly narrower than 7:1 means that there is a greater supply of phosphorus than nitrogen, relative to algal needs, and nitrogen is limiting growth. A wider ratio than 7:1 implies the opposite: phosphorus limits growth. A ratio close to 7:1 suggests that either or both elements may be limiting. Nitrogen appears to be the limiting nutrient in the Lagunitas Creek system, and in most Bay Area freshwater systems. Therefore, we are most interested in controlling nitrogen loads in these waters, while phosphorus is less important.

Nutrient toxicity

Nutrient toxicity can result from either of two forms of nitrogen: un-ionized ammonia and nitrate. Un-ionized ammonia (NH_3) is acutely toxic to a wide range of aquatic life at very low concentrations. Un-ionized ammonia is typically not measured directly, but is calculated as a function of measured total ammonia (NH_3 plus NH_4^+), pH, and temperature. Under warm, high pH conditions, total ammonia concentrations as low as 2 mg-N/L (2 ppm) may result in un-ionized ammonia toxicity to salmonids. It is possible, but unlikely, that toxic levels of ammonia occur in the Lagunitas system.

A growing body of literature suggests that nitrate may be chronically toxic to aquatic life—especially fish and amphibian eggs—at levels as low as 2 mg-N/L. Nitrate concentrations in several North Bay streams, including Lagunitas Creek, have been observed to exceed this value. Toxicity of nitrate to different forms of aquatic life is not well understood, and more research is needed to determine if this is a problem in the listed waterbodies.

Dissolved Oxygen

Oxygen depletion is an important effect of eutrophication due to its direct negative impact on aquatic life. Most native aquatic organisms found in streams are adapted to high levels of dissolved oxygen, and when oxygen levels fall, these organisms must either leave the system or die. Factors that consume oxygen in aquatic systems include decomposition, bacterial oxidation of ammonia to nitrate (nitrification), and respiration by aquatic organisms. In pristine streams these processes are fairly slow relative to reoxygenation from the atmosphere, and dissolved oxygen levels remain near equilibrium with the atmosphere, that is, near 100% saturation. Excessive nutrient loading can drastically accelerate algal-related oxygen-consuming processes—respiration by living algal cells, and decomposition of dead algal material—causing severe oxygen depletion.

Dissolved oxygen monitoring must take into account the natural fluctuations that result from algal production of oxygen as a by-product of photosynthesis. Photosynthesis occurs only during daylight hours, while oxygen-consuming processes occur 24 hours a day. As a result, daytime oxygen levels are often high—sometimes supersaturated—in nutrient-impaired systems. Concentrations typically peak late in the afternoon when photosynthetic oxygen production dominates, and are lowest in the pre-dawn hours, when respiration and decomposition are dominant (Figure 2). In seriously impaired streams, oxygen levels can range from 0% to over 200% saturation over a 24-hour period. For this reason, daytime dissolved oxygen measurements are not as useful as pre-dawn measurements, or, even better, continuous monitoring. However, daytime measurements do provide useful data because supersaturated conditions in the daytime indicate that oxygen depletion is occurring at night.

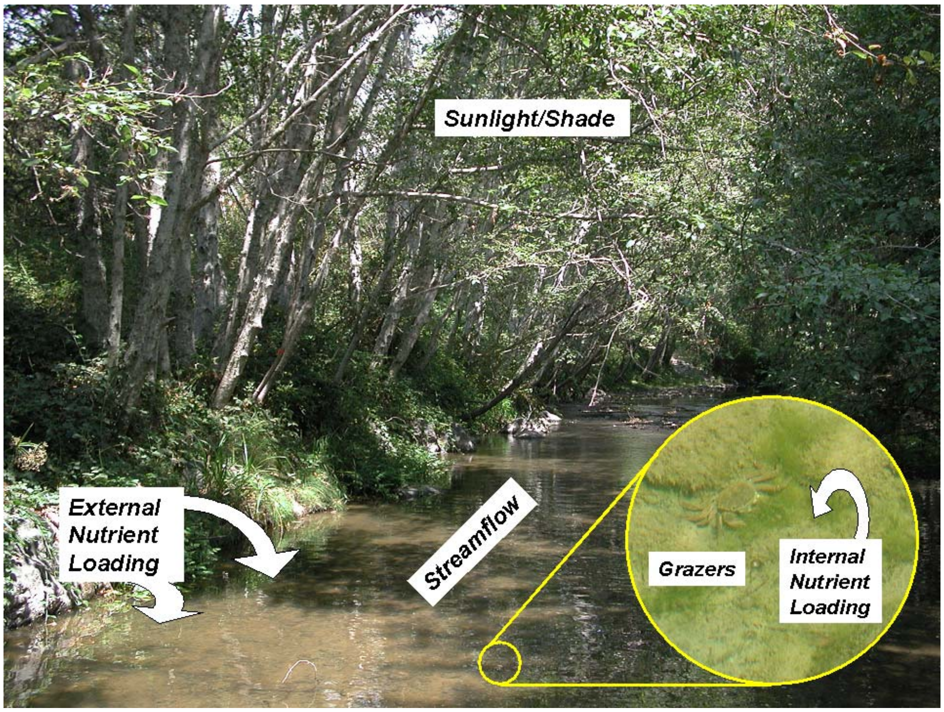


Figure 1. Some factors influencing periphyton growth in streams.

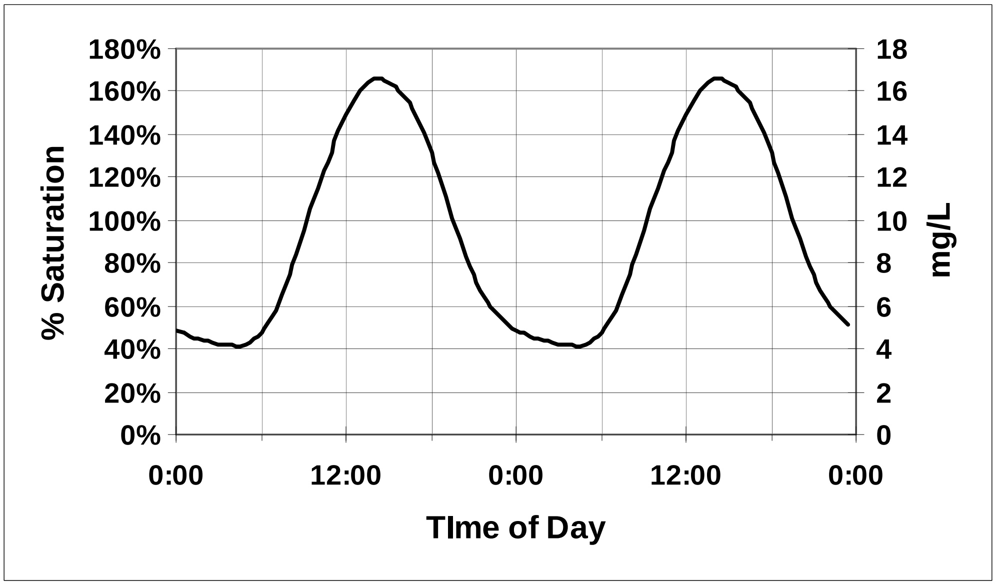


Figure 2. Typical dissolved oxygen curve in a nutrient-impaired stream.

Appendix E. Chemical Monitoring In Lagunitas Creek—What's Being Monitored And What Does It Mean?

(By Peter Krottje, RWQCB)

- "Nutrients" usually refers to various forms of the essential plant growth elements, nitrogen and phosphorus. Algae growing attached to the stream bottom and other solid substrates in the stream (aka, periphyton) is the most common symptom of excessive nutrients in Bay Area freshwater streams. Excessive periphyton growth impairs aquatic habitat by depleting dissolved oxygen and by smothering bottom habitat. Other factors, such as sunlight/shade, streamflow, and abundance of algae-consuming fish and macroinvertebrates can influence algal growth response to elevated nutrient loading.
- The most problematic nutrient form in the Lagunitas watershed is nitrate (NO_3). Nitrate can stimulate excessive algal growth at concentrations of 0.2 milligrams per liter (mg/L) or lower, and is potentially toxic to developing fish and amphibians at levels >2.0 mg/L. (For cost efficiency purposes we often analyze for nitrate plus nitrite, rather than just nitrate. Nitrite concentrations are almost always negligible in streams.)
- Ortho-phosphate (PO_4) is another nutrient form that may cause algal problems in this watershed. Any values above the laboratory detection limit (0.1 mg/L) may contribute to excessive algal growth.
- Adequate levels of dissolved oxygen are essential for fish and other aquatic organisms. DO can be reported as concentration in milligrams per liter, or as percent saturation. Daytime DO values significantly above or below 100% saturation indicate problems—either excessive algae growth or excessive oxygen-consuming organic material. Salmonids do best at DO concentrations of at least 7 mg/L. Levels below 5 mg/L can have negative effects on a wide range of aquatic organisms.
- Hydrogen ion activity, expressed as pH, is an important aspect of the aquatic chemical environment. Unless a serious spill occurs, Lagunitas Creek is unlikely to have pH values that are harmful to aquatic life *per se*—any pH between 6 and 9 is OK. We are mostly interested in pH as a means to detect temporal or spatial changes in the creek. A significant change in pH from one sampling date to another, or between one site and another downstream site may indicate an input to the steam (e.g., polluted runoff, a spill, or an illicit discharge) that should be investigated.
- Specific conductance is a measure of the salt content of the water. Dissolved salts raise the electrical conductivity of water—high specific conductance equals high salt content. In freshwater systems, specific conductance can be reported directly in units of microSiemens per centimeter (µS/cm), or the equivalent micromhos per centimeter. (In brackish or marine waters, these units are often converted to salinity, usually expressed as parts per thousand (ppt). One ppt is equivalent to about 2,000 µS/cm.) Conductivity in natural freshwater streams tends to range between 100 and 400 µS/cm. Just as with pH, specific conductance is unlikely to present an environmental problem in and of itself, but is monitored mostly to identify unusual inputs to the stream. Sewage, for instance, has a somewhat elevated specific conductance relative to most freshwater streams.

Appendix F. Use of pH/Conductivity/Temperature and DO Meters:

pH/Conductivity/Temperature Equipment (HI991300)Set-Up, Calibration and Measurement

(For more detail refer to complete instruction sheet included in equipment case and in this appendix)

This equipment should be calibrated the morning of each sampling day

pH Measurement Set-Up

- If the probe has not been stored with its tip soaking in solution, it must be soaked in pH 7.01 solution for at least 1 hour prior to use. Remove the protective plastic cap from the end of the probe, fill cap with solution, re-insert probe.

pH Calibration

- Press the **SET/HOLD** button until **pH** is displayed
- Press and hold the **MODE** button until **CAL** is displayed
- Place the probe into buffer solution (4, 7 or 10), it will automatically calibrate. Leave in solution until clock symbol disappears. *(Please dispose of solutions in designated container – for proper disposal. Do not pour down the drain..)*
- Press the **MODE** button to return to Measurement mode
- Replace plastic cap

Conductivity Calibration

- Press the **SET/HOLD** button until **EC** is displayed
- Press and hold the **MODE** button until **CAL** is displayed
- Release the button and immerse the probe in **HI7031** calibration solution
- Tap probe gently on side of container, Stir gently……once the calibration has been automatically performed, the LCD will display OK for 1 second and return to normal measurement mode.

pH/Temperature Measurement

- Remove plastic protective cap from probe
- Rinse off the probe with some of the sample to be measured
- Press MODE button until “pH” mode is displayed on the screen

- Submerge probe into sample and stir gently. When the stability symbol (looks like a clock) disappears, record the pH (and temperature) measurement displayed.

Conductivity Measurement

- Place the probe in the sample to be tested
- Toggle to the EC mode with the SET/HOLD button
- Tap the probe lightly on the side of the container to remove any trapped air bubbles and stir gently
- When the stability symbol disappears (looks like a clock), record the reading on the Data Sheet.

Storage of pH/Conductivity Meter

- Always replace plastic cap before transporting between sites and storing, as the glass bulb on the tip of the probe is fragile. At the end of the day, refill the plastic cap with pH 7 buffer solution and store the probe wet.
- When done for the day, dry off the equipment and place in the storage box. If equipment needs to dry further, leave open in the box when you return to the office.

Dissolved Oxygen Meter Equipment (HI9142)Slope Calibration and Measurement

Slope calibration should be performed the day or morning before every sampling while Zero calibration only needs to be performed when the membrane is replaced (seasonally or in case of damage).

DO Slope Calibration

- Rinse the probe in clean water
- Dry the probe tip and allow a few minutes for the LCD readout to stabilize
- Press and hold the CAL key
- Adjust the slope trimmer on the tip of the meter to read "100%" on the LCD, while still holding the CAL button (the slope calibration screw is located furthest from the probe connection). A small screwdriver is in the container for adjustments.
- Release the CAL key and the LCD will display the value in ppm of oxygen

DO Measurements

- Remove plastic protective cap from probe, and if stream flow can not be reached at arms length safely, attach probe to clamp on sampling pole.
- Submerge the probe into a moving stretch of the stream, ensuring the temperature sensor is also immersed. For an accurate reading, a water movement of 0.3m/sec is required at minimum, which is typically provided by a moving stream. Make sure the temperature sensor on the side is also submerged.
- When the reading stabilizes, record the measurement on the Data Sheet. In general, this will take anywhere between 30 seconds and 2 minutes. After 2 minutes the readings might continue to increase slowly. Nevertheless, record after 2 minutes.

Storage of DO Meter

- Always replace plastic cap before transporting between sites and storing. If the membrane on the probe dries out, you will need to replace with a new one. Instructions for this are in the case. However this should be done days prior if needed.
- When done for the day, dry off the equipment and place in the storage box. If equipment needs to dry further, leave open in the box when you return to the office.

Appendix G. Bottle Label Guidelines

Bottle Label Guidelines

Client: RWQCB/SPAWN
Sample Site: (*Indicate site number and name*)
Analyze for: (*Most likely either Fecals, Nitrate+Nitrite, Ortho-phosphate*)
Date:
Collection Time: (*Very Important! do on site when bottle is dry – make sure your data sheets and all sampling bottles have the exact same time listed on them.*)

MAKE SURE TO WRITE THE SITE NUMBER ON THE TOP OF THE BOTTLE. THIS WILL ENABLE YOU TO EASILY FIND THE BOTTLES IN YOUR COOLER!!

Appendix H. Contact Information:

Farhad Ghodrati Regional Water Quality Control Board (RWQCB). Tests water quality in other areas of the Tomales Bay Watershed. SPAWN usually meets Farhad at Point Reyes National Seashore at noon to drop off samples. Call to coordinate beforehand.
Office – (510) 622-2331
Cell - (510) 332-7322
Home – (925) 687-0815

Chris Pincetich (SPAWN) at office (415) 488-0370 x102
Cell (530) 220-3687

Paola Bouley (SPAWN) at office (415) 488-0370 x111
at home (415) 488-4443

Peter Krottje: RWQCB Lab Coordinator(510) 622-2382 wk
Dale Hopkins: RWQCB Contract Manager (510) 622-2362

Brannon Ketcham: Pt Reyes Natl. Seashore Hydrologist (415) 464-5192

Cal Test Laboratory – Samples are sent to this lab for analysis (707) 258-4000
Bill Svobooda x29
Todd Albertson x19

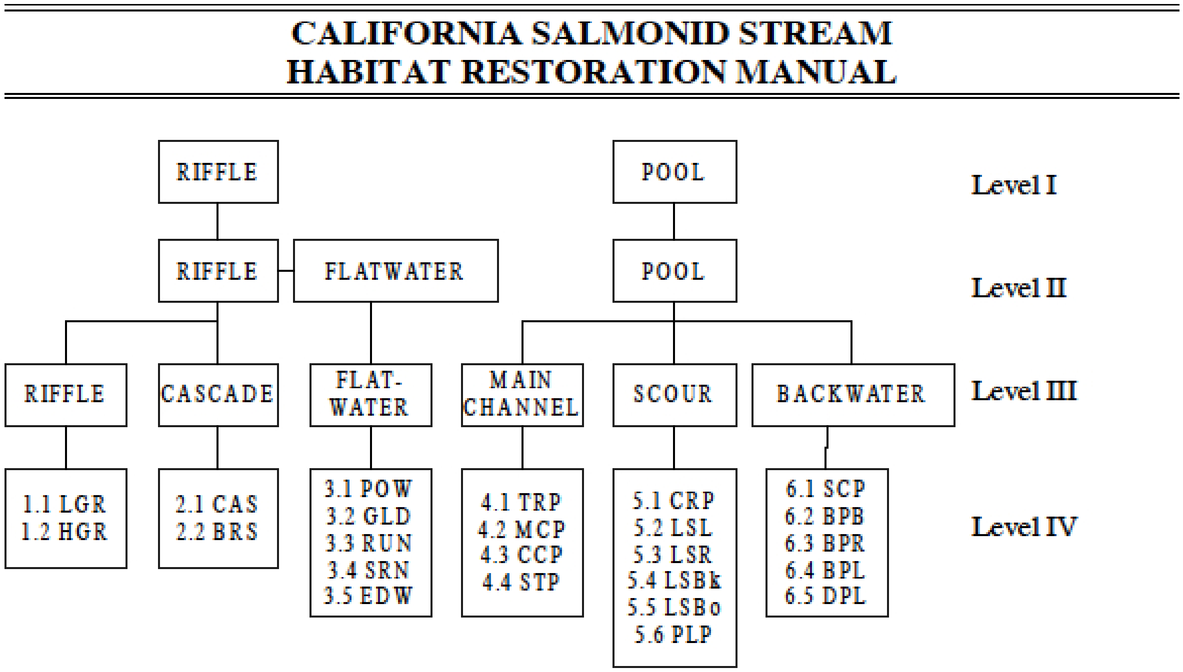
SPAWN Water Team Members – See Current Handout

Appendix I. Site Numbers and Names

SPAWN/RWQCB Water Quality Testing Program
Lagunitas and San Geronimo Creeks and Tributaries

Site #	RWQCB#	Site Name
1		San Geronimo Creek - Upper San Geronimo Creek Above Woodacre
2	WS-19	Woodacre Creek at SGV Dr. Bridge
3		San Geronimo Creek - San Geronimo MMWD Water Treatment Plant
4	WS-20	San Geronimo Creek - Downstream Roy's Pools, downstream edge of SGV Dr. Bridge
5		San Geronimo Creek - Forest Knolls Montezuma Ave Bridge
6	WS-23	San Geronimo Creek - Inkwells - just below lowest pool
7		Lagunitas Creek - just below confluence with SG Creek
8		Lagunitas Creek - S.P. Taylor Park, access point upstream of picnic area bridge
9		Lagunitas Creek - just upstream of Devils Gulch
10		Devil's Gulch Creek - 5 m upstream of where it drains into Lagunitas Creek
11	WS-26	Lagunitas Creek - Old Tocaloma Bridge
12		Lagunitas Creek - Above Shafter and below Horsetrail
13		Blank
14		Lagunitas Creek - Above Shafter and above Horsetrail
15		Larsen Creek (pool at Storm Drain that drains from upper campus - pool upstream of Environmental Education Center)
16		Larsen Creek - on US side of SFD under-crossing
17		San Geronimio Creek - Downstream of Forest Knolls Bridge and downstream of Montezuma Cr (on Kent Julins Property)
18	WS-21	Montezuma creek - downstream of Public Park in Forest Knolls
19	WS-22	Arroyo Creek - At upstream side of Castro Rd. Culvert
21		San Geronimo Cultural Center Parking Lot (brown water found flowing from utility cover in asphalt)
22		Creamery Creek- just upstream of San Geronimo Creek
23		Larsen Creek - Pool at base of root wad, downstream of SFD Blvd UC
24		Larsen Creek – 10 m Upstream of Burn Site
25		Larsen Creek - Pool adjacent to burn site
26		San Geronimo Creek - Castro Pool at corner of Castro Rd and SFD
27		San Geronimo Creek - Upstream of Woodacre Creek Bridge
28		San Geronimo Creek - Upstream of Forest Knolls and 5761 of Sir Francis Drake
29	WS-24	Lagunitas Creek – below Devil's Gulch Creek
30	WS-25	Lagunitas Creek – below Cheda Creek (19.21 mile marker – when heading West)
31		Lagunitas Creek – below Jewell (19.88 mile marker – when heading West)
32		Spring Creek
33		Cintura Creek
34		Blueline Creek
35		Deer Camp Canyon Creek
36		Willis Evans Canyon Creek
37		Spirit Rock Creek
38		North Fork San Geronimo Creek
39		Flanders East Creek
40		Flanders West Creek
41	WS-17	East Fork Woodacre Creek
42	WS-18	West Fork Woodacre Creek
43		Lagunitas Creek - Swimming Hole

Appendix J. Habitat Types, Levels I-IV



LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE
Low Gradient Riffle (LGR)
High Gradient Riffle (HGR)

CASCADE
Cascade (CAS)
Bedrock Sheet (BRS)

FLATWATER
Pocket Water (POW)
Glide (GLD)
Run (RUN)

Step Run (SRN)
Edgewater (EDW)

MAIN CHANNEL POOL
Trench Pool (TRP)
Mid-Channel Pool (MCP)
Channel Confluence Pool (CCP)
Step Pool (STP)

SCOUR POOL
Corner Pool (CRP)
L. Scour Pool - Log Enhanced (LSL)
L. Scour Pool - Root Wad Enhanced (LSR)

BACKWATER POOLS
Secondary Channel Pool (SCP)
Backwater Pool - Boulder Formed (BPB)
Backwater Pool - Root Wad Formed (BPR)
Backwater Pool - Log Formed (BPL)
Dammed Pool (DPL)

ADDITIONAL UNIT DESIGNATIONS
Dry (DRY)
Culvert (CUL)
Not Surveyed (NS)
Not Surveyed due to a marsh (MAR)

L. Scour Pool - Bedrock Formed (LSBk)
L. Scour Pool - Boulder Formed (LSBo)
Plunge Pool (PLP)