# WATER QUALITY STUDY: A COMPONENT OF THE WATERSHED MANAGEMENT PLAN FOR THE CARNEROS CREEK WATERSHED, NAPA COUNTY, CALIFORNIA

Prepared For

Stewardship Support and Watershed Assessment in the Napa River Watershed:

A CALFED project

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by


Jonathan Koehler, Biologist

**Napa County Resource Conservation District**
**1303 Jefferson Street, Suite 500B**
**Napa, CA 94559**


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## 1.0 Introduction

Water quality is a key factor affecting fish and other aquatic organisms within a stream ecosystem. This is especially true of salmonids including steelhead (anadromous rainbow trout, *Oncorhynchus mykiss*), which have narrow tolerances for a variety of water quality parameters. In reaches of Carneros Creek that experience drastic seasonal recessions of surface flow during summer and fall, water quality plays a critical role in the quality of summer rearing habitat for juvenile steelhead. As stream flows diminish in late spring and early summer, steelhead and other resident fish are forced into isolated pools for the duration of the summer. During this time, water quality can quickly degrade without the flushing effects of continuous surface flow. Subsurface flow through the substrate is a vital source of new fresh water, but in the absence of agitation it contributes little or no dissolved oxygen.

Benthic macroinvertebrates are good indicators of water quality and overall stream function over time. Samples taken from several locations along the stream will reflect environmental conditions within the aquatic ecosystem. Certain organisms are highly intolerant to a variety of pollutants including sediment, nutrients, and temperature. Taxonomic analysis of such samples yields information on the benthic community which relates to water quality in the stream. Essentially the quality of the water can be determined based on what organisms are present within a given reach of stream.

## 2.0 Methods

Water quality was measured in Carneros Creek to establish a limited baseline for current conditions within the stream. The objective of this study was to establish monitoring sites along the stream and to collect water quality data using field tests that can be conducted by volunteers. These tests include dissolved oxygen (D.O.), electrical conductivity (E.C.), pH, water temperature, and air temperature. Additional information on physical habitat is also collected including water color, odor, weather, stream bed appearance, water depth, flow, and habitat change.

All water quality tests were done using the Napa County RCD stream monitoring protocol. One site was selected in the lower reach (CAR-1) near Old Sonoma Road bridge where surface water was present in late summer. Another site was established in the middle reach (CAR-2) to get a satisfactory geographic range along the stream. It was obvious at the onset of the site selection process that suitable monitoring sites would be limited by the presence of water. Surface flow was present in mid June at CAR-2, but there was no surface flow in the lower site, CAR-1. Further, sites were selected based on their potential to support fish which eliminated the far upper and far lower (below Old Sonoma road) sections of the stream. Samples were collected on an approximately monthly basis at both sites.

Dissolved oxygen, electrical conductivity (*specific conductance*), and water temperature were measured using a YSI-85 meter, which was calibrated prior to sampling. A hand held pH meter was used, which was also calibrated prior to sampling. Flow was estimated and categorized as brisk, moderate, low, or stagnant. Water depth at time of sampling was visually estimated.

## 3.0 Water Quality Monitoring Summarized Results

| PARAMETER | CARNEROS SITE 1 (CAR-1) | CARNEROS SITE 2 (CAR-2) |
|---|---|---|
| **Sample Dates** | 8/1/02, 8/15/02, 9/12/02, 10/4/02, 12/6/02 | 8/1/02, 8/15/02, 9/12/02, 10/4/02, 12/6/02 |
| **Water Temperature (°C)** | | |
| *Range* | 8.2 - 18.4 | 7.9 -16.3 |
| *Maximum* | 18.4 (8/15/02) | 16.3 (8/1/02) |
| *Minimum* | 8.2 (12/6/02) | 7.9 (12/16/02) |
| **Air Temperature (°C)** | | |
| *Range* | 12.5 - 21 | 11.5 - 23 |
| *Maximum* | 21 (8/15/02) | 23 (8/15/02) |
| *Minimum* | 12.5 (12/6/02) | 11.5 (12/6/02) |
| **Dissolved Oxygen (mg/L)** | | |
| *Range* | 1.2 - 4.2 | 2.1 - 8.8 |
| *Maximum* | 4.2 (10/4/02) | 8.8 (12/6/02) |
| *Minimum* | 1.2 (12/6/02) | 2.1 (9/12/02) |
| **Dissolved Oxygen (% Sat.)** | | |
| *Range* | 10.2 - 39.1 | 19.9 -74.1 |
| *Maximum* | 39.1 (10/4/02) | 74.1 (12/6/02) |
| *Minimum* | 10.2 (12/6/02) | 19.9 (9/12/02) |
| **pH ( units)** | | |
| *range* | 6.3 - 7.8 | 7.0 - 8.0 |
| *Maximum* | 7.8 (10/4/02) | 8.0 (9/12/02) |
| *Minimum* | 6.3 (12/6/02) | 7.0 (12/6/02) |
| **Electrical Conductivity (µS/cm)** | | |
| *range* | 923 - 1349 | 608 - 829 |
| *Maximum* | 1349 (9/12/02) | 829 (10/4/02) |
| *Minimum* | 923 (8/1/02) | 608 (12/6/02) |
| **Flow category** | No flow during sampling period. Isolated pools | Low flow during first two samples ended in Sept. then returned in Dec. |

**TABLE 1. Water Quality Summary Table**

Results from water quality monitoring provide limited baseline information on conditions within the stream environment during the late summer and fall. This is the period when cold water fish, including juvenile steelhead, in arid California streams experience the most stress from declining water quantity and quality. Water quality generally improves during winter as storms introduce fresh water. However a different set of water quality stressors can have an impact on both juvenile and adult fish. These are chiefly turbidity, extreme low temperatures, and the effects of urban and agricultural runoff. It is therefore important to conduct year-round water chemistry monitoring that is supplemented with macroinvertebrate samples throughout the stream.

Steelhead have a narrow tolerance range for DO and require generally well-saturated water to thrive. Temperature affects how much DO water can hold (Mitchell et al., 1995). As temperature rises, the amount of dissolved oxygen decreases and vice versa. When water holds all the dissolved oxygen it can hold at a given temperature, it is 100% saturated. Steelhead and other salmonids require high levels of DO saturation in order to thrive. Streams with DO levels above 90% saturation are considered best for maintaining healthy steelhead. There is a great deal of variation from one population to another in terms of how well the fish are adapted to tolerate reduced DO levels. Rainbow trout living in reservoirs for example often encounter water less than 90% saturation. Favorable levels of DO are 6 mg/L or greater. General guidelines suggest that stream dwelling rainbow trout (and steelhead) can tolerate DO levels as low as 4 mg/L before a metabolic compromise is initiated (Moyle, 2002).

Carneros Creek had low measured DO levels at both sites during the late summer and early fall. Rainbow trout were observed at sampling site CAR-02 throughout the study, suggesting that the fish were either able to tolerate low DO or had located a stratified area of the pool with higher levels than measured. These fish may have been able to tolerate lower DO levels due to the relatively cold water temperatures at this site, which would reduce metabolic rates during the warmest months. The DO levels at the lower CAR-01 site were too low to support even well-adapted juvenile steelhead during the summer rearing period.

The ranges of pH and electrical conductivity were within general guidelines for suitable rearing habitat. There was very little variation in pH at both sites. Electrical conductivity at site 2 increased as summer progressed into fall, then fell with the return of surface flow.

### 3.1 Benthic Macroinvertebrate Sampling

Benthic Macroinvertebrate (BMI) sampling was conducted in the lower reach of Carneros Creek near Old Sonoma Bridge by EcoTrust Environmental Inc in 2000 and 2001. The data from 2001 is still being analyzed by the laboratory and will be available in April, 2003. Samples were collected using the CDFG Rapid Bioassessment protocol, which collects three replicate BMI samples per site in randomly selected riffles. The protocol is designed to eliminate, or greatly reduce, sampling bias within a sample reach. Sample reaches are defined as a series of five riffles, of which three are randomly selected. Three areas along a transect within the riffle are then agitated to dislodge BMI’s within the substrate and wash them into a net. The contents of the net are then emptied into an alcohol-filled jar for analysis by a laboratory.

Table 2 summarizes the data from 2000 using standardized macroinvertebrate classifications and metrics. The data from this sampling effort are being compared to a preliminary IBI (Index of Biological Integrity) for the Russian River basin to roughly determine water quality. The IBI uses 5-6 key biological metrics calculated from a sample to rank the stream reach in terms of water quality. The following metrics were selected and integrated into a single scoring criteria: Taxa Richness, EPT Taxa, Modified EPT Index, Shannon Diversity, Tolerance Value and Percent Dominant Taxa. The EPT indices represent three sensitive taxa of aquatic insects: *Ephemeroptera* (Mayflies), *Plecoptera* (Stoneflies), and *Trichoptera* (Caddisflies). These three groups are excellent indicators of various water quality parameters including temperature, sediment, and nutrient loading. To date, no IBI has been developed in Napa County, but efforts are being made to develop such a scoring system.

To calculate a ranking for any given site, the values for each metric (e.g. Taxa richness, EPT Taxa) is compared to the Visual Distribution Score ranges and given a score of 5, 3, or 1. A score is given for each of the six metrices. These scores are then added together to form a composite score (with a possible total of 30 points) that can be compared with other sites and rated using the scale below. In general, higher composite scores indicate better water quality.

| **Biological Metric** | **Visual Distribution Score** | | |
|---|---|---|---|
| | 5 | 3 | 1 |
| Taxa Richness | ≥36 | 35-26 | <26 |
| % Dominant Taxa | ≤14 | 15-39 | >39 |
| EPT Taxa | ≥19 | 18-12 | <12 |
| Modified EPT | ≥54 | 53-17 | <17 |
| Shannon Diversity | ≥3.0 | 2.9-2.3 | <2.3 |
| Tolerance Value | ≤3.0 | 3.1-4.6 | >4.6 |

Using this preliminary IBI, a sample can be scored using the following scale:

| Excellent | Good | Fair | Poor |
|---|---|---|---|
| 30-24 | 23-18 | 15-11 | 11-6 |

The scale has been modified for Napa data, which does not include a modified EPT Index:

| Excellent | Good | Fair | Poor |
|---|---|---|---|
| 25-21 | 20-16 | 15-11 | 10-5 |

Using the modified Napa scoring criteria, the sample collected in Carneros Creek was given a score of 7, which indicates poor water quality. In order to draw conclusions based on any water quality data, including BMI samples, a sufficiently large dataset must be analyzed. In light of the very limited data currently available on BMI populations within Carneros Creek, it is prudent to only discuss the immediate implications of this data. Sampling one reach does not characterize the entire stream or even stream reach. The sample reflects conditions within a relatively narrow region of the stream and should be interpreted to reflect this limitation.

The sample contained a high number of *Baetis tricaudatus* mayflies that accounted for 67% of *Ephemeroptera* analyzed. This abundance of Baetids may reflect high levels of fine sediment. As a group mayflies are highly sensitive to pollution, but Baetids thrive in streams with large amounts of fine sediment. Baetids and Simulids accounted for 76% of the total sample, which suggests a generally unhealthy benthic distribution as reflected by this low diversity. Both taxa are relatively tolerant to pollution of various forms. In terms of abundance the sample ranked very highly, however it was dominated by these two tolerant taxa.

The dominant feeding group was collector-gatherer which accounted for 68% of the total. A more even distribution of functional feeding groups is favorable and indicates a stable stream environment. Almost no scrapers or shredders were found in the sample, which suggests a lack of organic material including woody debris.

**4.0 Conclusions:**

At the CAR-01 site several native minnows (California roach) were observed in early summer, but were not seen in later visits. It is likely that these fish survive the conditions present in the lower reaches, however young steelhead probably can not. Several young-of-year steelhead were observed in pools just upstream from this site in late summer, but it is unclear whether they survived the warmest months when temperatures increased and dissolved oxygen declined.

In the middle reach, water quality was significantly better but still not optimal for steelhead. Low levels of dissolved oxygen were measured during the summer when flows tapered off. Fish were observed in the deeper parts of the sampling pool, where they may have been in a slowed metabolic state to conserve energy. The temperature was consistently low, which may have contributed to the fish’s ability to survive periods of depressed DO.

Very limited data are available for water quality within Carneros Creek. Observations from habitat-typing surveys were consistent with general trends seen in this limited dataset (Fish Habitat). In general the lower reach had lower habitat scores and poor water quality during summer and fall. Middle reaches provided more suitable habitat and had better water quality. To fully assess the water quality in the creek over time, sampling throughout the year combined with BMI results will yield a more detailed picture of the aquatic environment.

Although not optimal, summer water quality appears to be adequate to support young steelhead in the middle reaches of Carneros Creek and despite relatively low levels of DO (Table 1), fish were observed throughout the study. In lower Carneros Creek, water quality may not be sufficient to support juvenile summer rearing steelhead due to DO depletion and elevated temperatures. Peak water temperatures were generally elevated, which combined with the absence of flow created pool conditions with extremely low DO levels.

**5.0 References**

Harrington, J., M. Born. 2000. *Measuring the Health of California Sreams and Rivers, 2nd edition.* Sustainable Land Stewardship International Institute.

Merrit, R. W., K. W. Cummins. 1996. *Aquatic Insects of North America, 3rd edition*. Kendall Hunt Publishing Co. 862pp.

Mitchell, M. K., W. B. Stapp. 1995. *Field Manual for Water Quality Monitoring.* Thomson-Shore Printers. 272 pp

Napa County RCD. 1998. *T-REX Volunteer Monitoring Program Final Report.*

# Table 2. Benthic Macroinvertebrate Bioassessemt

| | |
|---|---|
| Site | Carneros Creek |
| Date | May 2, 2000 |

| **Metrics used in a provisional Index of Biological Integrity (IBI) for the Russian River by CDFG** | |
|---|---|
| Total taxa richness | 34 |
| % dominant taxa | 66.85 |
| EPT taxa richness | 10 |
| modified EPT Index | |
| Shannon Diversity (loge) | 1.47 |
| Tolerance Value (modified HBI) | 5.85 |
| **Total Invertebrate abundance (m2)** | 9680 |

| **Number of distinct taxa by group** | |
|---|---|
| Non-insect invertebrates | 4 |
| Odonata (dragon & damselflies) | 0 |
| Ephemeroptera (mayflies) | 4 |
| Plecoptera (stoneflies) | 3 |
| Hemiptera (true bugs) | 0 |
| Megaloptera (alderflies & hellgramites) | 1 |
| Trichoptera (caddisflies) | 3 |
| Lepidoptera (aquatic moths) | 0 |
| Coleoptera (aqutic beetles) | 2 |
| Misc. Diptera (true flies) | 2 |
| Chironomidae (midge flies) | 15 |

| **% composition by group** | |
|---|---|
| Non-insect invertebrates | 2.5 |
| Odonata (dragon & damselflies) | 0 |
| Ephemeroptera (mayflies) | 13.74 |
| Plecoptera (stoneflies) | 0.35 |
| Hemiptera (true bugs) | 0 |
| Megaloptera (alderflies & hellgramites) | 0.02 |
| Trichoptera (caddisflies) | 0.72 |
| Lepidoptera (aquatic moths) | 0 |
| Coleoptera (aqutic beetles) | 0.57 |
| Misc. Diptera (true flies) | 67.16 |
| Chironomidae (midge flies) | 14.93 |

| **Functional feeding group % composition** | |
|---|---|
| Predator | 1.98 |
| Parasite | 1.1 |
| Collector-gatherer | 20.1 |
| Collector-filterer | 67.57 |
| Macrophyte herbivore | 0 |
| Piercer herbivore | 0 |
| Scraper | 0.17 |
| Shredder | 2.8 |
| Xylophage (wood eater) | 0 |
| Omnivore | 5.52 |
| Unknown | 0.75 |

| | |
|---|---|
| **Number of highly intolerant taxa** | 1 |
| % highly intolerant taxa | 0.06 |
| **Number of highly tolerant taxa** | 4 |
| % highly tolerant taxa | 0.92 |
| **% Baetis tricaudatus + Simulium** | 76.14 |
| **Long-lived taxa richness** | 7 1 |

## Water Quality Monitoring Results

Station CAR1 SampleDat 8/1/2002SampleTim 10:30:00 AM Crew jk

Last Rain Last Rain 0 Comments first sample at this site

| Result Type | Matrix | Analyte | Units | Results | Comments |
|---|---|---|---|---|---|
| Field | Air | Weather | None | PC | |
| Field | None | Habitat Change | None | N | |
| Field | Water | Color | None | B | |
| Field | Water | Depth | None | 2-3 | |
| Field | Water | Stream Bed | None | B | |
| Field | Water | Appearance | None | MD | |
| Field | Water | Flow | None | 0 | |
| Field | Water | Odor | None | E | |
| Field Obs | Air | Temperature | °C | 17 | |
| Field Obs | Water | Conductivity | µS/cm | 923 | |
| Field Obs | Water | pH | pH Units | 7.5 | |
| Field Obs | Water | Temperature | °C | 15.9 | |
| Field Obs | Water | DO | PPM | 2.17 | |
| Field Obs | Water | DO | % | 22 | |

Station CAR1 SampleDat 8/15/2002 SampleTim 11:45:00 AM Crew jk

Last Rain Last Rain 0 Comments no flow- isolated pools

| Result Type | Matrix | Analyte | Units | Results | Comments |
|---|---|---|---|---|---|
| Field | Air | Weather | None | C | |
| Field | None | Habitat Change | None | O | lower water level |
| Field | Water | Depth | None | 2-3 | |
| Field | Water | Odor | None | E | |
| Field | Water | Stream Bed | None | B | |
| Field | Water | Color | None | B | |
| Field | Water | Appearance | None | MD | |
| Field | Water | Flow | None | 0 | |
| Field Obs | Air | Temperature | °C | 21 | |
| Field Obs | Water | pH | pH Units | 7.6 | |
| Field Obs | Water | DO | PPM | 3.26 | |
| Field Obs | Water | Temperature | °C | 18.4 | |
| Field Obs | Water | Conductivity | µS/cm | 1235 | |
| Field Obs | Water | DO | % | 35.1 | |

Station CAR1 SampleDat 9/12/2002 SampleTim 10:00:00 AM Crew jk

Last Rain Last Rain 0 Comments

| Result Type | Matrix | Analyte | Units | Results | Comments |
|---|---|---|---|---|---|
| Field | Air | Weather | None | C | |
| Field | None | Habitat Change | None | O | dropping level |
| Field | Water | Color | None | B | |
| Field | Water | Odor | None | N | |
| Field | Water | Flow | None | 0 | |
| Field | Water | Appearance | None | OS | |
| Field | Water | Depth | None | 2-3 | |
| Field | Water | Stream Bed | None | B | |

| | | | | |
|---|---|---|---|---|
| Field Obs | Air | Temperature | °C | 15 |
| Field Obs | Water | Conductivity | µS/cm | 1349 |
| Field Obs | Water | pH | pH Units | 7.6 |
| Field Obs | Water | DO | % | 19.5 |
| Field Obs | Water | DO | PPM | 1.96 |
| Field Obs | Water | Temperature | °C | 14.9 |

Station CAR1 SampleDat 10/4/2002 SampleTim 10:50:00 AM Crew jk

Last Rain Last Rain 0 Comments water about .5-1 foot lower than last sample.

| Result Type | Matrix | Analyte | Units | Results | Comments |
|---|---|---|---|---|---|
| Field | Air | Weather | None | C | |
| Field | None | Habitat Change | None | O | water drop |
| Field | Water | Appearance | None | C | |
| Field | Water | Odor | None | N | |
| Field | Water | Depth | None | 0.5-1 | |
| Field | Water | Color | None | B | |
| Field | Water | Stream Bed | None | B | |
| Field | Water | Flow | None | 0 | |
| Field Obs | Air | Temperature | °C | 19 | |
| Field Obs | Water | pH | pH Units | 7.8 | |
| Field Obs | Water | Conductivity | µS/cm | 1272 | |
| Field Obs | Water | Temperature | °C | 12 | |
| Field Obs | Water | DO | % | 39.1 | |
| Field Obs | Water | DO | PPM | 4.19 | |

Station CAR1 SampleDat 12/6/2002 SampleTim 9:45:00 AM Crew jk

Last Rain Last Rain 0 Comments no fish water appears stagnant with surface

| Result Type | Matrix | Analyte | Units | Results | Comments |
|---|---|---|---|---|---|
| Field | Air | Weather | None | SO | |
| Field | None | Habitat Change | None | P | |
| Field | Water | Stream Bed | None | B | |
| Field | Water | Appearance | None | OS | |
| Field | Water | Color | None | C | |
| Field | Water | Odor | None | E | |
| Field | Water | Flow | None | 0 | |
| Field | Water | Depth | None | 1-2 | |
| Field Obs | Air | Temperature | °C | 12.5 | |
| Field Obs | Water | DO | % | 10.2 | |
| Field Obs | Water | Conductivity | µS/cm | 1142 | |
| Field Obs | Water | Temperature | °C | 8.2 | |
| Field Obs | Water | pH | pH Units | 6.3 | |
| Field Obs | Water | DO | PPM | 1.2 | |

Station CAR2 SampleDat 8/1/2002 SampleTim 11:20:00 AM Crew jk

Last Rain Last Rain 0 Comments first sample

| Result Type | Matrix | Analyte | Units | Results | Comments |
|---|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Field | Air | Weather | None | C |
| Field | None | Habitat Change | None | N |
| Field | Water | Flow | None | 1 |
| Field | Water | Appearance | None | C |
| Field | Water | Stream Bed | None | G |
| Field | Water | Depth | None | 1-2 |
| Field | Water | Color | None | C |
| Field | Water | Odor | None | N |
| Field Obs | Air | Temperature | °C | 20 |
| Field Obs | Water | DO | PPM | 4.62 |
| Field Obs | Water | pH | pH Units | 7 |
| Field Obs | Water | Temperature | °C | 16.3 |
| Field Obs | Water | Conductivity | µS/cm | 612 |
| Field Obs | Water | DO | % | 47.2 |

Station CAR2 SampleDat 8/15/2002 SampleTim 12:20:00 PM Crew jk

Last Rain Last Rain 0 Comments bridge construction beginning just

| Result Type | Matrix | Analyte | Units | Results | Comments |
|---|---|---|---|---|---|
| Field | Air | Weather | None | C | |
| Field | None | Habitat Change | None | N | |
| Field | Water | Color | None | C | |
| Field | Water | Depth | None | 2-3 | |
| Field | Water | Appearance | None | S | |
| Field | Water | Flow | None | 1 | |
| Field | Water | Odor | None | N | |
| Field | Water | Stream Bed | None | B | |
| Field Obs | Air | Temperature | °C | 23 | |
| Field Obs | Water | DO | % | 29.8 | |
| Field Obs | Water | Conductivity | µS/cm | 667 | |
| Field Obs | Water | pH | pH Units | 7.6 | |
| Field Obs | Water | Temperature | °C | 16.2 | |
| Field Obs | Water | DO | PPM | 2.92 | |

Station CAR2 SampleDat 9/12/2002 SampleTim 10:40:00 AM Crew jk

Last Rain Last Rain 0 Comments water stained with tanin. New bridge ~50'

| Result Type | Matrix | Analyte | Units | Results | Comments |
|---|---|---|---|---|---|
| Field | Air | Weather | None | C | |
| Field | None | Habitat Change | None | O | |
| Field | Water | Appearance | None | OS | |
| Field | Water | Stream Bed | None | X | |
| Field | Water | Depth | None | 2-3 | |
| Field | Water | Odor | None | N | |
| Field | Water | Flow | None | 0 | |
| Field | Water | Color | None | B | |
| Field Obs | Air | Temperature | °C | 17.5 | |
| Field Obs | Water | Temperature | °C | 13.8 | |
| Field Obs | Water | pH | pH Units | 8 | |
| Field Obs | Water | DO | % | 19.9 | |
| Field Obs | Water | DO | PPM | 2.06 | |

| | | | | |
|---|---|---|---|---|
| Field Obs | Water | Conductivity | µS/cm | 726 |

Station CAR2 SampleDat 10/4/2002 SampleTim 11:15:00 AM Crew jk

Last Rain Last Rain 0 Comments oily scum film and leaves on surface

| Result Type | Matrix | Analyte | Units | Results | Comments |
|---|---|---|---|---|---|
| Field | None | Habitat Change | None | N | |
| Field | Water | Depth | None | 2-3 | |
| Field | Water | Color | None | O | stained brown |
| Field | Water | Flow | None | 0 | |
| Field | Water | Appearance | None | S | |
| Field | Water | Odor | None | N | |
| Field | Water | Stream Bed | None | X | |
| Field Obs | Air | Temperature | °C | 20.5 | |
| Field Obs | Water | DO | PPM | 3.41 | |
| Field Obs | Water | Temperature | °C | 11.8 | |
| Field Obs | Water | pH | pH Units | 7.9 | |
| Field Obs | Water | DO | % | 31.6 | |
| Field Obs | Water | Conductivity | µS/cm | 829 | |

Station CAR2 SampleDat 12/6/2002 SampleTim 10:10:00 AM Crew jk

Last Rain Last Rain 0 Comments flow returned pool surface covered with oak

| Result Type | Matrix | Analyte | Units | Results | Comments |
|---|---|---|---|---|---|
| Field | Air | Weather | None | SO | |
| Field | None | Habitat Change | None | O | flow |
| Field | Water | Odor | None | N | |
| Field | Water | Depth | None | 2-3 | |
| Field | Water | Appearance | None | C | |
| Field | Water | Flow | None | 1 | |
| Field | Water | Color | None | C | |
| Field | Water | Stream Bed | None | B | |
| Field Obs | Air | Temperature | °C | 11.5 | |
| Field Obs | Water | DO | % | 74.1 | |
| Field Obs | Water | Temperature | °C | 7.9 | |
| Field Obs | Water | Conductivity | µS/cm | 608 | |
| Field Obs | Water | DO | PPM | 8.79 | |
| Field Obs | Water | pH | pH Units | 7 | |