Idaho State Department of Agriculture
Division of Agricultural Resources

Squaw Creek
Water Quality Monitoring Report
April 2005 through October 2005

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ISDA Technical Report Summary W-15

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Introduction

The Idaho State Department of Agriculture (ISDA) working in conjunction with the Squaw Creek Soil Conservation District (SCD) conducted a water quality monitoring program on Squaw Creek. The mainstem of Squaw Creek resides primarily within Gem County with several tributaries partially residing in Boise and Valley Counties. Squaw Creek is located within Hydrological Unit Code (HUC) 17050122, drains approximately 218,880 acres and confluences with Black Canyon Reservoir. Squaw Creek is not currently listed on the State of Idaho's 303(d) listing for impaired water bodies.

There were four stations established on Squaw Creek. SQC-5 was established as a background site near 2nd and 3rd Fork Road, SQC-4 at Perkins Lane, SQC-3 at Morgan's, and SQC-2 at Butte Road (Figure 1).

A fifth station (LSQ-1) was established on Little Squaw Creek approximately 1.5 miles upstream from its confluence with Squaw Creek (Figure 1).

Monitoring was conducted every two weeks from April through October 2005. Squaw Creek and Little Squaw Creek had a total of 16 samples collected during this monitoring period.

Analytical parameters collected were suspended sediment concentration (SSC), total phosphorus (TP), dissolved phosphorus (DP), and Escherichia coli (*E-coli*). Phosphorus was chosen as the nutrient of interest due to the requirement of 34% TP reduction on the Payette River to meet the Snake River Hells Canyon Total Maximum Daily Load (TMDL). On-site parameters measured were dissolved oxygen, percent saturation, pH, total dissolved solids, conductivity, and discharge.

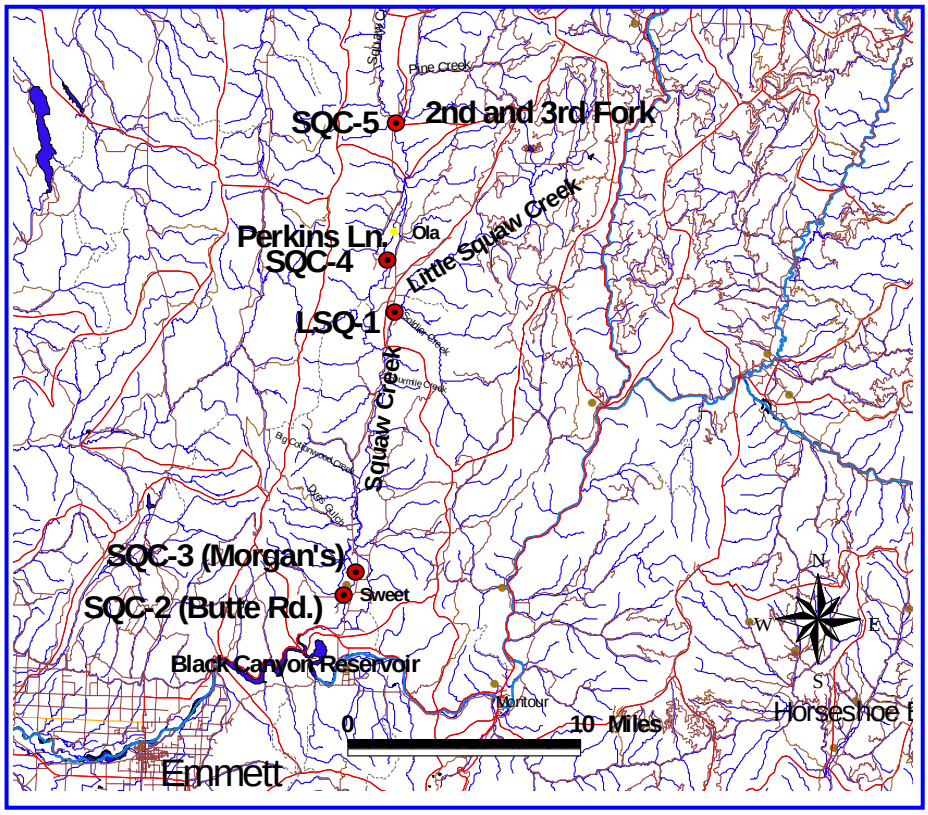


Figure 1. Squaw Creek and Little Squaw Creek monitoring sites.

General Results

Suspended Sediment Concentration (SSC)

Suspended sediment samples were collected at all locations to determine if suspended sediment concentrations (SSC) were at unacceptable levels. The overall SSC concentrations were well below any chronic or acute levels for aquatic species. At no time did any station exceed the good to moderate level of 25-80 mg/L (DFO 2000) which is considered the threshold concentration for quality fish habitat (Table 1 and 2).

Table 1. Suspended sediment and fisheries effects.

Suspended Sediment concentrations (SSC)	Possible Effect on Fisheries
< 25 mg/L	No evidence of harmful effects on fish.
25-80 mg/L	Possible to maintain good to moderate fisheries however yield would be somewhat diminished relative to water with < 25ppm
80-400 mg/L	Unlikely to support good freshwater fisheries.
>400 mg/L	At best only poor fisheries are likely to be found.

Table 2. SSC statistics (mg/L).

Sites	SQC-5	SQC-4	LSQ-1	SQC-3	SQC-2
mean	6.6	6.6	5.8	7.1	9.7
median	5.2	3.6	4.7	3.5	6.2
high	19.2	23.4	11.8	21.7	33.5
low	0.9	1.2	1	1.3	2.5
Standard Dev.	4.8	6.3	3.9	6.6	9.6

Phosphorus

Two types of phosphorus, total and dissolved were evaluated during this study. Total phosphorus (TP) is usually bound to particulate matter or plant matter while dissolved phosphorus (DP) is dissolved in the water column and not associated with particulate matter, making it the most bioavailable form for plant uptake. Dissolved phosphorus can consist of both organic and inorganic phosphorus but it is the dissolved inorganic form that is utilized by plants for growth.

Dissolved phosphorus makes up approximately 50-62% of TP starting in June and this trend is observed primarily in the three lower stations (LSQ-1, SQC-3, and SQC-2). The increase in DP indicates that phosphorus is primarily returning to Squaw Creek as overland flow from irrigation and is not bound to sediment (Figure 2). Irrigation return water from grain crops and pasture land usually contribute a greater percentage of phosphorus in the dissolved form.

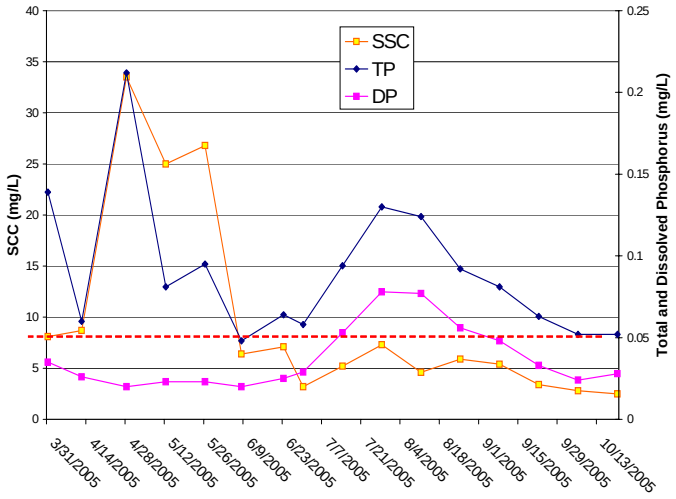


Figure 2. Site SQC-2 TP and DP ratio during peak irrigation.

The Environmental Protection Agency (EPA) recommends that streams discharging into lakes or reservoirs should not exceed 0.05 mg/L of phosphorus (EPA 1987). Since the mainstem of Squaw Creek discharges into Black Canyon Reservoir the 0.05 mg/L TP will be used to evaluate the data (Table 3).

Little Squaw Creek (LSQ-1) which is a tributary to Squaw Creek will be evaluated using a different TP value. Based on the Snake River Hells Canyon Total Maximum Daily Load (SR-HC TMDL) TP values should not exceed 0.070 mg/L from sources entering the Snake River. This 0.070 mg/L TP level requires the Lower Payette River to make a reduction of 34% in TP entering the Snake River. Since LSQ-1 does not discharge directly into Black Canyon Reservoir the higher TP level of 0.070 mg/L will be used for data evaluation. Table 3 lists the statistics for TP data collected during this study.

Table 3. Total Phosphorus statistics (mg/L).

Sites	SQC-5	SQC-4	LSQ-1	SQC-3	SQC-2
Mean	0.042	0.072	0.113	0.088	0.090
Median	0.037	0.068	0.111	0.083	0.081
High	0.073	0.117	0.175	0.221	0.212
Low	0.018	0.03	0.075	0.038	0.048
Standard Dev.	0.017	0.030	0.037	0.045	0.043

Based on the mean TP values from Table 3 reductions would be required within Squaw Creek to meet a 0.05 mg/L target. The reductions increase in a downstream direction as follows: SQC-5 no reductions, SQC-4 30%, SQC-3 44%, and SQC-2 45%. Little Squaw Creek would require a TP reduction of 38% to meet the 0.070 mg/L target.

Figure 3 indicates that there is a significant difference in TP concentration (p = <0.001) between the furthest up-stream site (SQC-5) and the lowest site (SQC-2). The dotted redline indicates the desired TP concentration.

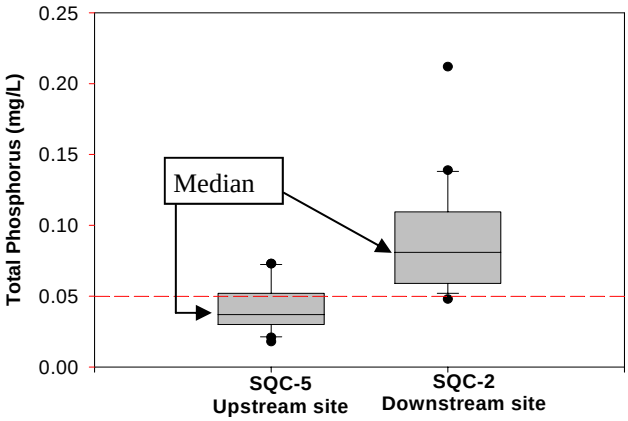


Figure 3. Box plot TP comparison of SQC-5 and SQC-2

The higher TP levels could be a result of lack of dilution within Squaw Creek during the peak irrigation period. Starting near the end of June and the first of July the discharge level in Squaw Creek drops drastically and return irrigation water dominates (Figure 4).

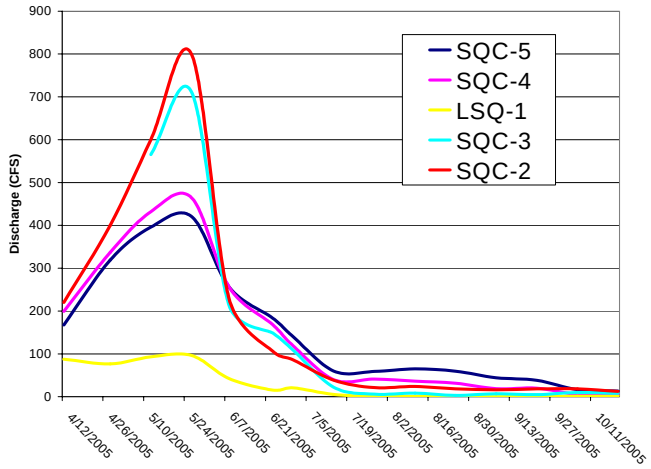


Figure 4. Discharge rates for Squaw and Little Squaw Creek.

This trend can be observed throughout the study area and is illustrated at station SQC-2 in Figure 5.

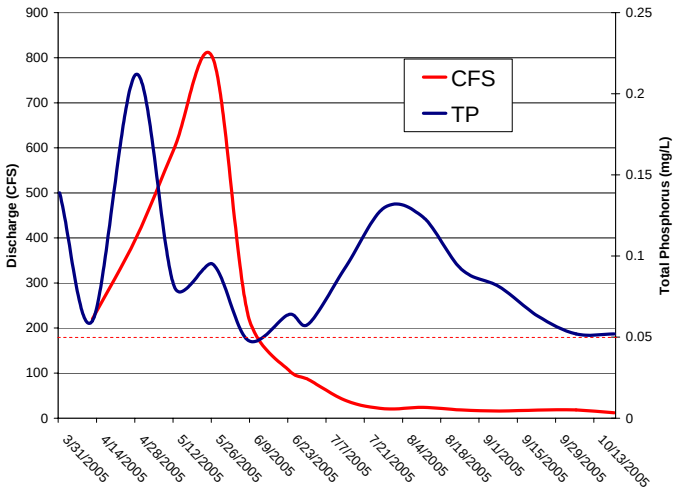


Figure 5. Station SQC-2 discharge and TP comparison.

Bacteria (Escherichia Coli)

ISDA evaluated bacteria levels for the 2005 monitoring season using the state water quality standard for Escherichia Coli (*E-coli).* The state criteria for *E-coli* (primary contact) is made up of a two step process using a trigger value of 406 colony forming units (CFU). The 406 CFU trigger indicates a violation in *E-coli* concentration that requires 5 samples collected over a 30 day period to calculate the monthly geomean for *E-coli*. A geomean concentration over 126 CFU indicates a water quality violation.

There was no geomean monitoring on Squaw Creek. For the individual grab samples collected several exceeded the 406 CFU trigger value (red values Table 4).

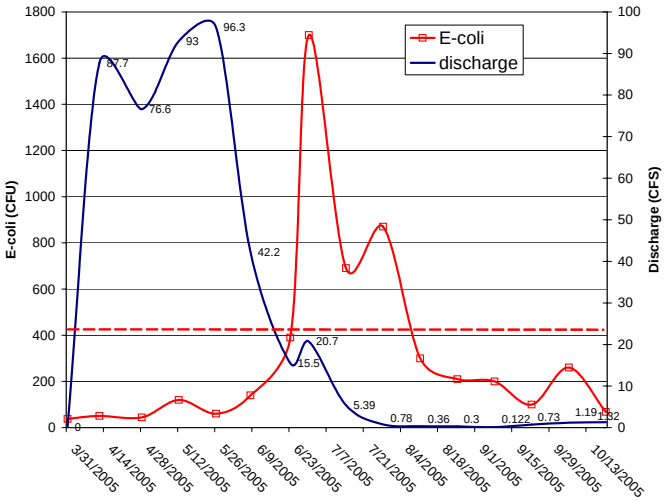
Table 4. Squaw Creek *E-coli* results

Date	SQC-5	SQC-4	LSQ-1	SQC-3	SQC-2
3/31/2005	14	14	38	62	120
4/12/2005	19	19	51	33	24
4/28/2005	44	180	44	310	490
5/12/2005	42	61	120	120	150
5/26/2005	84	75	60	173	192
6/8/2005	83	110	140	340	200
6/23/2005	86	250	390	79	150
6/30/2005	61	280	1700	160	340
7/14/2005	240	390	690	370	370
7/28/2005	150	330	870	180	260
8/11/2005	520	250	300	920	440
8/25/2005	190	260	210	100	250
9/8/2005	140	160	200	370	290
9/22/2005	650	200	100	770	200
10/6/2005	57	93	260	73	53
10/20/2005	22	370	68	210	50

The data in Table 4 indicates there does not appear to be a bacteria concern within the main stem of Squaw Creek. Given the sporadic nature of the bacteria hits it is highly unlikely that geomean results would indicate a bacteria violation.

Little Squaw Creek appears to potentially have a bacteria problem based on the data collected. Over a twenty-eight day period LSQ-1 had three samples that exceeded the 406 CFU guidance (Figure 5). It is possible that if five samples were collected over a 30 day period LSQ-1 may exceed the *e-coli* geomean criteria of 126 CFU.

Figure 5. E-coli results LSQ-1



Conclusions

Although the phosphorus levels in Squaw Creek and Little Squaw Creek are higher than desired, for waters discharging into reservoirs or lakes, the TP levels do not appear to be causing any excessive or unwanted aquatic plant growth. In addition, there appears to be no oxygen demanding activities that could lower the overall dissolved oxygen (DO) levels within the creeks. All of the DO levels measured were considerably above the state water quality criteria of 6.0 mg/L. The higher TP levels occur during the time when normal discharge rates decrease towards base flow and irrigation return water makes up the bulk of water within Squaw Creek. At this time dissolved phosphorus makes up the majority of phosphorus.

It does not appear from the 2005 data that suspended sediment concentrations (SCC) are causing any potential short term acute or long term chronic problems for fisheries within Squaw Creek. In addition, the SCC levels are well below the Snake River Hells Canyon TMDL requirements of less than 80 mg/L for acute events lasting no more than 14 days and less than 50 mg/L as a monthly average.

The data suggests that the main stem of Squaw Creek does not appear to have a bacteria (*E-coli*) concern. Although there were concentrations above the one time primary contact level of 406 CFU the temporal distribution would probably not lend itself to a geomean violation. Little Squaw Creek (LSQ-1) exceeded the one time 406 CFU concentration three times over a 28 day period. This could indicate that if 5 samples were collected over a 30 day period LSQ-1 may not meet the state water quality standard for *e-coli* geomean concentration (126 CFU).

Recommendations

At this time the source and transport of phosphorus within Squaw Creek and Little Squaw Creek is unknown. The data seems to indicate that one of the possible sources is return flows from irrigation water. Given this assumption ISDA would recommend an additional year of monitoring with the addition of several sites to evaluate irrigation return waters for phosphorus concentrations.

References

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