APPENDIX R

Burke Creek Monitoring Project Final Report

Burke Creek Monitoring Project
Final Report

Reporting Period
February 2006 – December 2007

Prepared for:
Sierra Colina, LLC
224 Kingsbury Grade, Suite 203
Stateline, NV 89449

Prepared by:
Nevada Tahoe Conservation District
Stateline, NV
and
Northwest Hydraulic Consultants, Inc.
South Lake Tahoe, CA

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1.0 Background

The Burke Creek Monitoring Project (Project) was conducted to provide baseline water quality data for Burke Creek in the vicinity of Sierra Colina. A monitoring work plan was adopted by Sierra Colina, the Nevada Tahoe Conservation District (NTCD), and Northwest Hydraulic Consultants (nhc) in February 2006 and revised in August of 2006[1]. At the conclusion of the first year of data collection, a Year 1 Report[2] was completed and monitoring was extended for an additional year to increase confidence in the range of baseline water quality data collected. Grab sampling and flow monitoring continued through calendar year 2007 as outlined in the Sierra Colina Property Water Quality Baseline Sampling and Analysis Scope of Work.

The following report includes all data collected for the Project and relevant observations based upon review of the data. For the previous two years, quarterly progress reports were completed as part of the Project, as well as the Year 1 Report. This report represents the most complete set of data collected for the project and the final observations made by NTCD and nhc.

2.0 Methods

Six sites were sampled for water quality: WQ-1, WQ-2, WQ-3, WQ-4, WQ-5, and WQ-6 (Figure 1 and Figure A-1). WQ-1, WQ-3, WQ-4, and WQ-6 encompass approximately 1,525 ft of the main stem of Burke Creek and have perennial flow. WQ-2 is located in an ephemeral tributary to Burke Creek that enters approximately 775 ft upstream of WQ-3 and flows during runoff events and seasonally high groundwater conditions. WQ-5 is a drainage channel for the soccer fields associated with the Kahle Community Center and flows only during significant runoff events.

WQ-1 and WQ-2 are both immediately downstream from residential roads and residential development. WQ-3 is located in an open wet meadow area with relatively dense riparian vegetation just upstream from the Sierra Colina parcel and provides an indication of the quality of water entering the property. WQ-4 is located on the Sierra Colina parcel in a slightly incised section of Burke Creek with some evidence of active bank erosion. WQ-6 is located above Highway 50 near the Sierra Colina property boundary and is the most downstream sample site providing an indication of the quality of water discharging from the Sierra Colina property.

[1] Burke Creek Monitoring Workplan (nhc and NTCD, revised August 28, 2006)
[2] Burke Creek Monitoring Project Final Report – Year 1 (nhc and NTCD, February 27,. 2007)

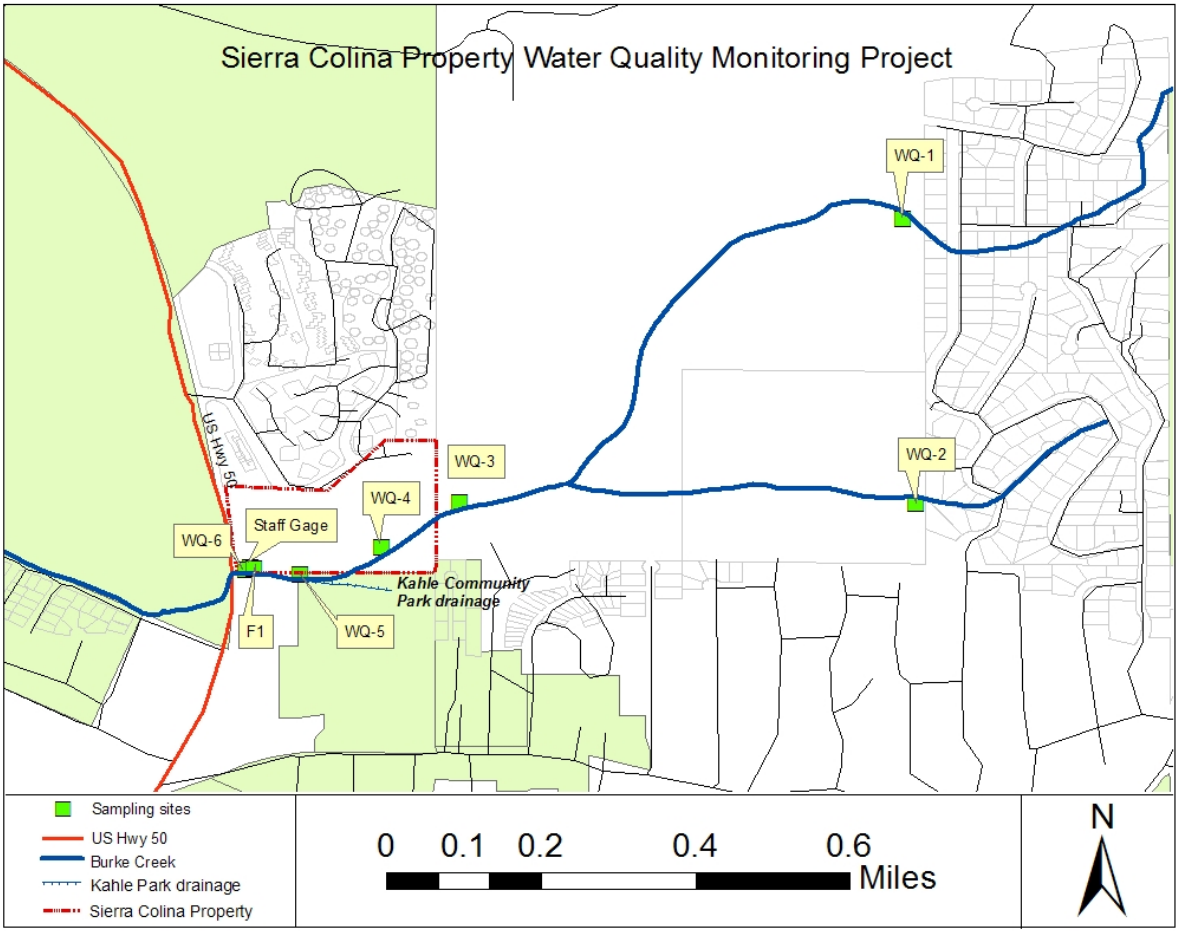

Figure 1. Burke Creek Sampling Locations

Flowing water was sampled at the locations described above and analyzed for the constituents listed in Table 1. In-situ data (Table 1) were also collected at each site. Table 1 lists the abbreviations used in this report for water quality constituents.

Table 1. Abbreviations for Water Quality Constituents

Water Quality Constituent	Symbol	Type of Analysis
Nitrate + Nitrite	NO_3+NO_2	Lab
Total Kjeldahl Nitrogen	TKN	Lab
Ammonia	NH3	Lab
Dissolved Phosphorous	DP	Lab
Total Phosphorous	TP	Lab
Total Suspended Sediment	TSS	Lab
Particle Size Distribution	PSD	Lab
Grease and Oil	G&O	Lab
Dissolved Iron	Fe	Lab
pH	pH	In-situ
Conductivity	Cond	In-situ
Temperature	Temp	In-situ

2.1 Flow

A pressure transducer configuration using a Van Essen Instruments Diver® and Baro Diver® (the latter used to compensate for changes in barometric pressure) was installed upstream of Highway 50 in Burke Creek (Figure 1, "F1") to measure water depth in the creek (i.e. stage). Continuous stage was collected beginning in April 2006 through December 2007. Manual spot measurements of stage were taken periodically and used to correct the continuous stage data recorded by the pressure transducer. Stage was converted to flow using a stage-discharge rating curve developed by manually measuring discharge (Q) of the creek twenty times during the monitoring period using a Swoffer Portable Flowmeter. A "best fit" line (i.e., the rating curve) was developed in Microsoft Excel to relate stage to flow.

2.2 Water Quality

This report discusses water quality data collected between February 27, 2006 (after adoption of the monitoring workplan) and December 31, 2007 (Table 2). Data collected prior to adoption of the monitoring workplan (Table 3) was reviewed for this report and is included in Appendix B. However, the sampling locations and the number of locations sampled were different for the data collected prior to adoption of the monitoring workplan. Where applicable, observations for data collected prior to the adoption of the monitoring workplan are provided.

Table 2. Sampling Event Descriptions

Date	Time	Event Type	Sampler	Sampling Sites
2/27/2006	1716	Rain on Snow	D. Rios	All sites
3/15/2006	1503	Baseflow	D. Rios	All except WQ-5
4/19/2006	1643	Snowmelt	D. Rios	All except WQ-5
5/24/2006	1513	Baseflow	D. Rios	All except WQ-5
6/19/06[2]	1040	Baseflow	D. Rios	All except WQ-5
7/14/2006	1146	Baseflow	D. Rios	All except WQ-2 and WQ-5
9/15/2006	1338	Baseflow	D. Rios	All except WQ-2 and WQ-5
10/5/2006	1330	Rain	D. Rios	All except WQ-2 and WQ-5
10/10/2006	1445	Rain on Snow	D. Rios	All except WQ-2 and WQ-5
11/2/2006	1150	Rain	D. Rios	All except WQ-5
2/9/2007	1022	Rain, Snow	D. Rios	All sites
6/5/2007	0900	Rain	D. Rios	All except WQ-2 and WQ-5
9/18/2007	1212	Baseflow	D. Fellers	All except WQ-2 and WQ-5
9/20/2007	0945	Rain, Snow	D. Fellers	All except WQ-2 and WQ-5
9/22/2007	1020	Rain, Thunderstorm	D. Fellers	All except WQ-2 and WQ-5
10/29/2007	1418	Rain	D. Fellers	All except WQ-2 and WQ-5
10/29/2007	1652	Thunderstorm	D. Fellers	WQ1, WQ6
11/11/2007	0746	Rain, Thunderstorm, Snow	D. Fellers	All except WQ-2 and WQ-5
12/13/2007	1343	Baseflow	D. Fellers	All except WQ-5

Nineteen sets of data were collected during calendar years 2006 and 2007. Sample sets were divided into two categories to simplify the analysis and to evaluate any potential trends in Burke Creek at higher discharges: 1) an "event" includes rain, rain on snow, spring snow melt, and thunderstorm runoff; and, 2) "baseflow" is characterized by a relatively steady creek flow. Twelve event data sets and seven sets of baseflow data were collected (Table 1). Sampling of runoff events was conducted to coincide as nearly as possible with peak flow snowmelt and rainfall runoff flows using the adjacent US Geological Survey (USGS) Edgewood Creek watershed discharge data (available on-line), National Oceanic & Atmospheric Administration regional weather forecast and real-time weather radar, and professional experience.

Table 3. Additional Sampling Event Descriptions (Prior to Monitoring Workplan)

Date	Time	Event Type	Sampler	Sampling Sites
10/24/2005	1800	Baseflow	C. Praul	WQ-3, WQ-6
11/29/2005	0930	Rain	C. Praul	WQ-3, WQ-6
12/18/2005	1400	Rain on Snow	C. Praul	WQ-3, WQ-5b[1], WQ-6
12/31/2005	1333	Rain	D. Rios	WQ-3, WQ-5, WQ-5b, WQ-6
2/2/2006	0931	Rain on Snow	D. Rios	WQ-3, WQ-6

[1]WQ-5b is a discontinued site located in Kahle Park drainage channel

3.0 Results and Observations

3.1 Flow

The discharge hydrograph for Burke Creek between April 2006 and December 2007 is shown in Figure 2. The spring of 2006 exhibited a fairly typical hydrograph in the Tahoe Basin, with peak discharge occurring during spring snowmelt. This peak is followed by decreasing discharge during the dry summer and an increasing discharge in the fall due to the onset of rain. In the spring of 2007, a peak discharge did not occur because precipitation in the winter of 2007 was below normal and a significant snow pack did not accumulate. Based on review of the USGS Edgewood Creek discharge records and SnoTel records, 2006 had above normal precipitation and 2007 was below normal. Because Burke Creek discharge is expected to be proportional to discharge in Edgewood Creek, it is reasonable to assume that Burke Creek discharge was above normal in 2006 and below normal in 2007.

Using a polynomial fit line, the rating curve achieved an R^2 of 0.84 for flows between approximately 0.1 cfs and 2.3 cfs. Flows above 2.3 cfs are estimated using the same equation but confidence in these computed flows is lower because a stage-discharge relationship was not established (Figure 3).

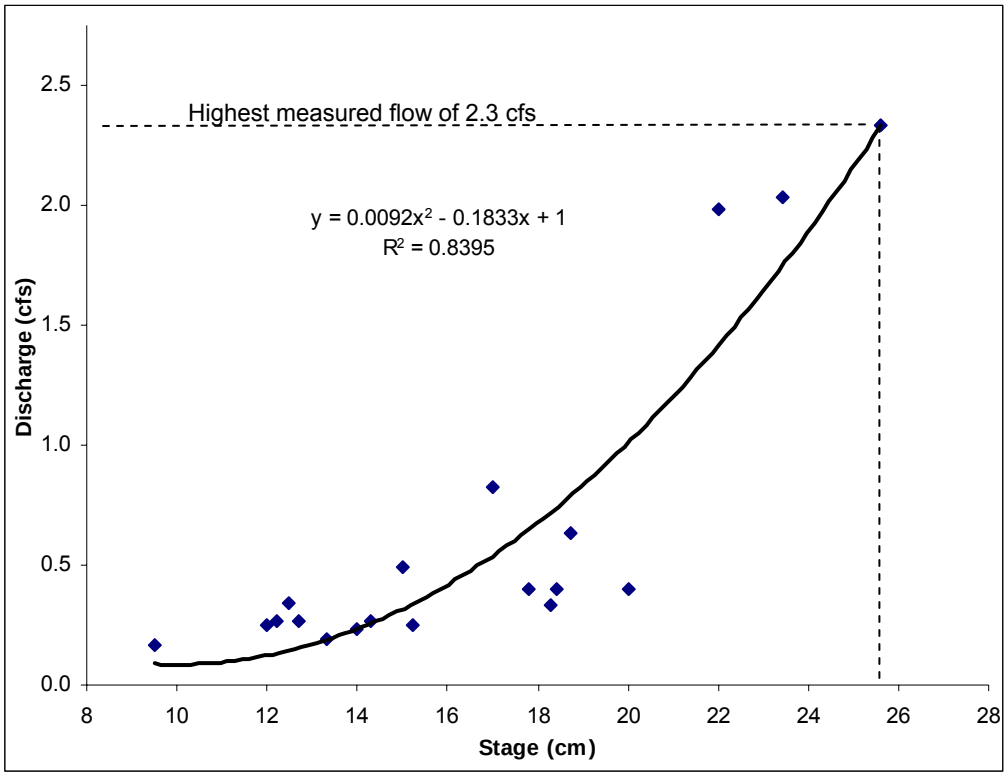

Figure 2. Discharge-stage rating curve for Burke Creek at site F1 (Figure 1)

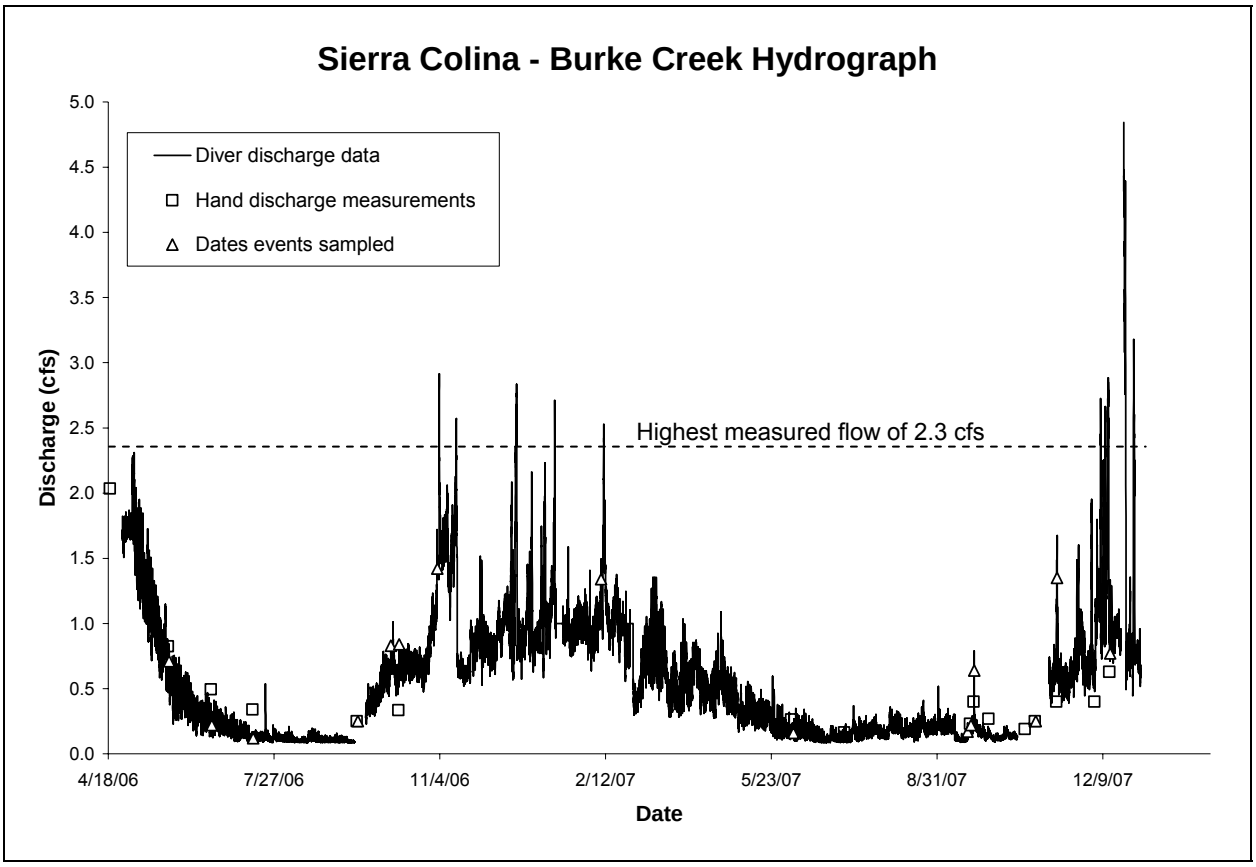

Figure 3. Burke Creek discharge measured at location F1 (Figure 1).

The main channel of Burke Creek (WQ-1, 3, 4, and 6) had continuous flow during the period of this report. Sampling location WQ-2 occasionally had flowing water depending on seasonal groundwater levels or the magnitude of the runoff event. WQ-2 had no flow from July 17, 2006 until December 13, 2007. WQ-5 only flowed twice during this study from significant runoff events.

A significant rain event occurring on December 31st, 2005 produced flood conditions throughout the south shore of the Lake Tahoe Basin (prior to implementation of the monitoring workplan, see Table 3). Evidence of erosion from overbank flooding onto the adjacent Burger King parcel was observed after the event. The peak flow in Edgewood Creek during the December 31st event was roughly 2.5 times the peak discharge in Edgewood during spring snowmelt. Discharge in Burke Creek was not measured for this event, but water quality samples were collected and the event represented the highest peak discharge at which water quality samples were obtained.

3.2 Water Quality

Tables 4 and 5 summarize the data collected for this effort. Of the nineteen sample sets collected, WQ-1, 3, 4, and 6 were sampled and analyzed for all constituents except on 10/29/07 when a thunderstorm occurred and samples were collected from only WQ-1 and WQ-6. Based upon the scope of the monitoring workplan, limited dissolved Iron

(Fe) and oil and grease concentrations were analyzed in samples collected from various locations.

Table 4. Mean concentration and standard deviation ( ) for seven "baseflow" samples

Sample Location	Distance from WQ-1 (m)	NH_4^+ (µg/L)	NO_3/NO_2 (µg/L)	TKN (µg/L)	SRP (µg/L)	TP (µg/L)	Fe (mg/L)	TSS (mg/L)
WQ-1	0	5 (2)	24 (8)	164 (95)	6 (3)	33 (11)		11 (9)
WQ-2	340	7 (2)	4 (1)	251 (53)	15 (5)	49 (25)		6 (6)
WQ-3	1115	4 (2)	13 (7)	222 (91)	7 (6)	36 (5)		15 (10)
WQ-4	1300	7 (5)	9 (7)	316 (174)	6 (3)	47 (19)	1.0	17 (14)
WQ-5	1410							
WQ-6	1525	6 (3)	7 (7)	226 (74)	6 (3)	45 (18)	0.4	14 (10)

Table 5. Mean concentration and standard deviation ( ) for twelve "event" samples

Sample Location	Distance from WQ-1 (m)	NH_4^+ (µg/L)	NO_3/NO_2 (µg/L)	TKN (µg/L)	SRP (µg/L)	TP (µg/L)	Fe (mg/L)	TSS (mg/L)
WQ-1	0	5 (3)	29 (63)	333 (367)	10 (11)	55 (44)	0.5 (0.2)	17 (21)
WQ-2	340	7 (1)	5 (1)	366 (143)	32 (8)	57 (30)		36 (29)
WQ-3	1115	3 (1)	19 (32)	403 (285)	8 (6)	52 (23)	0.4	17 (13)
WQ-4	1300	3 (1)	13 (22)	433 (222)	9 (6)	67 (30)	0.7	18 (13)
WQ-5	1410	29 (1)	45 (20)	2556 (1280)	677 (506)	986 (254)		102 (105)
WQ-6	1525	4 (1)	12 (19)	1036 (1643)	13 (9)	126 (174)	1 (0.4)	28 (34)

3.2.1 General Observations

TRPA's maximum allowable concentrations for surface water constituents are provided at Table 6 (TRPA Code of Ordinances, Chapter 81). The maximum allowable concentrations are used for comparative purposes in the observations made below.

Table 6. TRPA pollutant concentration limits for surface runoff (not to exceed 90th percentile)

Constituent	Maximum Concentration
Dissolved Inorganic Nitrogen as N	0.5 mg/l
Dissolved Phosphorus as P	0.1 mg/l
Dissolved Iron as Fe	0.5 mg/l
Grease and Oil	2.0 mg/l
Suspended Sediment	250 mg/l

- Inorganic nitrogen is the sum of NH_4^+ and NO_3/NO_2 and the average concentrations were well below the 500 µg/l maximum allowable concentration. The greatest concentration of 225 µg/l occurred on 27 Feb 2006 at WQ-1.

- Dissolved Phosphorus (DP) was not measured, but SRP is the measure of bioavailable phosphorus and constitutes the majority of dissolved phosphorus. The average SRP concentration at WQ-5 for runoff events exceeded the TRPA DP threshold due to events on 27 Feb 2006 and 9 Feb 2007 that recorded SRP concentrations of 319 and 1034 µg/l, respectively.

- None of the samples taken in Burke Creek (WQ-1, WQ-2, WQ-3, WQ-4, and WQ-6) were above TRPA's maximum allowable concentrations for discharge to

surface water for species of dissolved nitrogen, dissolved phosphorus, or suspended sediment.

- Dissolved Fe was consistently above the TRPA discharge standard averaging 0.74 mg/l for all events and sites and exceeded the TRPA threshold for dissolved Fe. The Lake Tahoe region typically has high iron concentrations and these concentrations are not extraordinary.

- Grease and oil concentrations were measured at WQ-6. Seven concentrations were measured and all were less than the detection limit except for 5 June 2007 when the concentration was 2.1 mg/l. This concentration exceeds the maximum allowable concentration.

- All TSS (i.e. suspended sediment) concentrations measured in Burke Creek were well below the TRPA threshold of 250 mg/l. The maximum concentration was 176 mg/l measured at WQ-5 on 27 Feb 2006. Average concentrations of TSS for runoff events (36 mg/l) were triple base flow measurements (12 mg/l).

- Average particle size for baseflow samples and event flow samples is 131 and 167 µm, respectively. The fraction of fine sediment in Burke Creek (defined as < 10 µm) averaged 6% of TSS for both baseflow and event flow (Table 7). In general, event flows shifted the particle distribution to larger particle sizes. The greatest fine sediment concentration occurred on February 27, 2006 at WQ-5. This event also had the highest TSS concentration of any sample.

Table 7. Average values for particle size and percent exceedence and standard deviation ( )

	Avg Mean (µm)	Particle Size (µm) Percent Larger			
		1µm	10µm	100µm	1000µm
Baseflow	131 (53)	100 (0)	94 (3)	45 (14)	0 (0)
Eventflow	167 (144)	99 (1)	94 (5)	52 (16)	2 (8)

- In-situ parameters were relatively consistent for baseflow and event flow conditions. Analysis was completed for pH and temperature for all 18 sample dates. pH was significantly lower (paired t-test, p=0.0022) for baseflow conditions averaging 6.6 compared to event flow pH of 7.0. This difference is likely due to buffering from groundwater. Temperature was significantly higher (paired t-test, p=0.0527) for average baseflow (7.6 ^{o}C) compared to average event flow (6.5 ^{o}C). This difference is likely due to event flow being dominated by snow melt. Conductivity data is only presented for the final two sample dates and averaged 159 µS/cm. Prior conductivity values were not accurate due to a calibration error.

4.0 Discussion

Burke Creek was monitored near its mouth during the Spring 2001 and Spring 2002 as part of the USGS stream monitoring network. Inspection of these data shows a similar range of concentrations for constituents monitored in this effort (e.g., TSS, SRP, TP, etc.). Stream discharge also had a range similar to discharges measured in this study.

Figures A2 through A7 are spatial graphs of average baseflow and event flow for each water quality constituent. When flowing (sample size = 2), the drainage from the Kahle Community Park (WQ-5) contributed elevated concentrations of TP and SRP that were at least an order of magnitude greater than TP and SRP concentrations observed in Burke Creek. As a result, the water quality measured at WQ-6 was adversely affected (37% increase in SRP and 90% increase in TP from WQ-4 on average).

Using an alpha of 10% ($\alpha = 0.1$), a t-test analysis reveals only TKN and TP have a statistically significant difference in concentrations for baseflow samples vs. event flow. However, a general trend appears in Figure A-2 through A-7 when progressing downstream from WQ-3 to WQ-6, where most pollutants (except Nitrate + Nitrite) decrease in concentration for baseflow samples and concentrations increase for event samples.

On a spatial basis, average concentrations for all constituents showed a statistically significant difference between WQ-5 and WQ-6 using a paired t-test. There was no statistically significant difference in concentrations between any other adjacent sample locations.

Fine sediment (< 10 µm) is the primary pollutant of concern to the loss of Lake Tahoe clarity. Particle size distribution shows only a small fraction of TSS in Burke Creek is fine sediment. Despite the larger average size of particles in event flow vs. baseflow (Table 7), the difference measured between event flow and baseflow are not spatially or temporally significant (Figures A8-A11).

5.0 Conclusions

This monitoring effort achieved the goal of establishing baseline water quality data for Burke Creek in the vicinity of Sierra Colina for a range of hydrologic conditions and seasons. These data provide anticipated ranges of water quality and discharge in Burke Creek for specific types of runoff events and baseflow conditions.

Baseline data collected has shown that Burke Creek water quality has relatively low concentrations for pollutants of concern for Lake Tahoe clarity (i.e. fine sediment, phosphorous, and nitrogen). This finding is supported by the following observations from the baseline data collected.

- None of the samples taken in Burke Creek (WQ-1, WQ-2, WQ-3, WQ-4, and WQ-6) were above TRPA's maximum allowable concentrations for discharge to surface water for species of dissolved nitrogen or dissolved phosphorus.

- All TSS (i.e. suspended sediment) concentrations measured in Burke Creek (WQ-1, WQ-2, WQ-3, WQ-4, and WQ-6) were below the TRPA threshold of 250 mg/l and average concentrations were well below the TRPA threshold. Average concentrations of TSS for runoff events (36 mg/l) were triple base flow measurements (12 mg/l).

- Average particle size for baseflow samples and event flow samples is 131 and 167 µm, respectively. The fraction of fine sediment in Burke Creek (defined as < 10 µm) averaged 6% of TSS for both baseflow and event flow samples.

- Note that when flowing, the drainage from the Kahle Community Park (WQ-5) contributed elevated concentrations of TP and SRP that are an order of magnitude greater than TP and SRP concentrations observed in Burke Creek.

Baseline data collected for Burke Creek in this effort supports recent stream channel estimates of pollutant loading for Burke Creek, calculated as part of the Lake Tahoe TMDL[3]. The TMDL work estimates Burke Creek pollutant loads to be similar to some of the less disturbed streams in the Tahoe Basin (e.g., Lonely Gulch Creek, McKinney Creek, etc.), and much less than disturbed streams such as the Upper Truckee River, Blackwood Creek, and Ward Creek. For example, the estimated fine sediment load for Lake Tahoe's largest sediment input, the Upper Truckee River, is roughly 2,250 metric tons per year (MT/yr). Conversely, the estimate of fine sediment load from Burke Creek is less than 1 metric ton per year (MT/yr). The trend is similar when analyzing pollutant loading on a unit area basis. Based on the above estimate of pollutant loading, the Upper Truckee River watershed contributes 132 pounds per year per acre (lbs/yr/ac) of fine sediment. Conversely, the Burke Creek watershed contributes 0.07 (lbs/yr/ac) of fine sediment.

Although Burke Creek may not be a large source of pollutants in the context of the Tahoe Basin, restoration of the creek can provide incremental benefits in reducing pollutant loads to Lake Tahoe. In addition to reducing pollutant loads to the lake, improved water quality in Burke Creek will positively affect other restoration objectives, such as improved aquatic habitat.

[3] Lahontan Regional Water Quality Control Board. 2007. Lake Tahoe Total Maximum Daily Load Technical Report, California and Nevada. Draft September 2007.

Appendix A - Figures

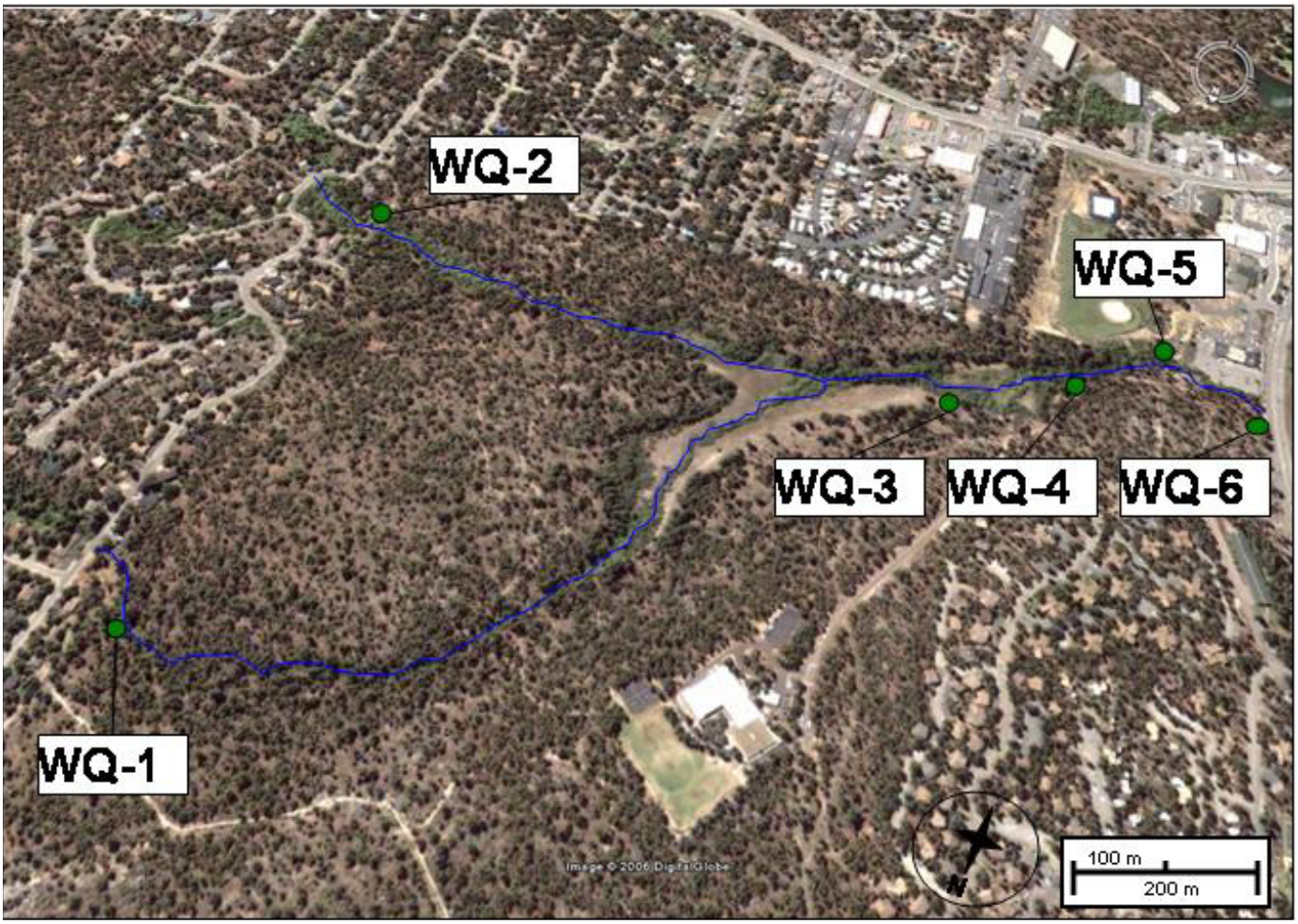

Figure A-1. Oblique Aerial View of Sampling Sites

This perspective differs from Figure 1 by viewing from the north. As shown in Figure A-1, a total of six sites were sampled for water quality: WQ-1, WQ-2, WQ-3, WQ-4, WQ-5, and WQ-6. WQ-1 and WQ-2 are both immediately downstream from residential roads. WQ-1 is downstream from the Lower Kingsbury Erosion Control Project constructed in 2004. The WQ-2 sample site is a tributary to Burke Creek that enters approximately 200 meters upstream of WQ-3. WQ-3 is located just upstream from the Sierra Colina parcel and provides an indication of the quality of water entering the property. WQ-3 is located in an open wet meadow area with a relatively dense stand of riparian vegetation. WQ-4 is located on the Sierra Colina parcel where Burke Creek is slightly incised into its historical floodplain, and has some evidence of active bank erosion. The WQ-5 sample site is an ephemeral drainage from the Kahle Community Park that inflows to Burke Creek at the southern property line of Sierra Colina downstream of WQ-4. WQ-6 is located adjacent to Highway 50 and is the most downstream sample site and provides an indication of the quality of water discharging from the property.

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The following figures show error bars for each average value. To simplify the figures, error bars signifying ± one standard deviation, and are graphed up for "events" and down for "baseflow." This works well for all figures except NH_4.

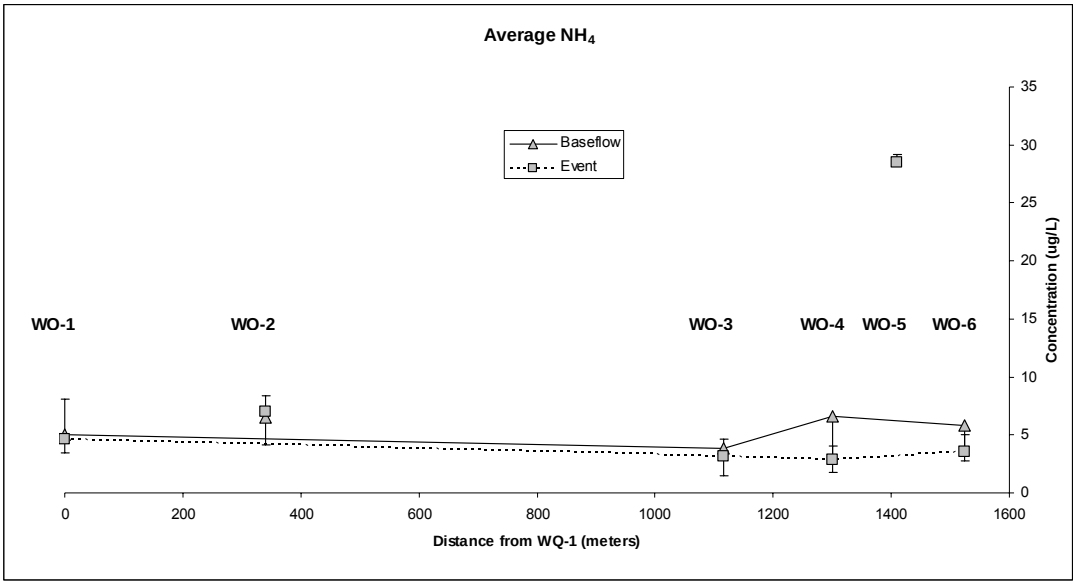

Figure A-2. Spatial Summary of Average NH_4 Concentrations

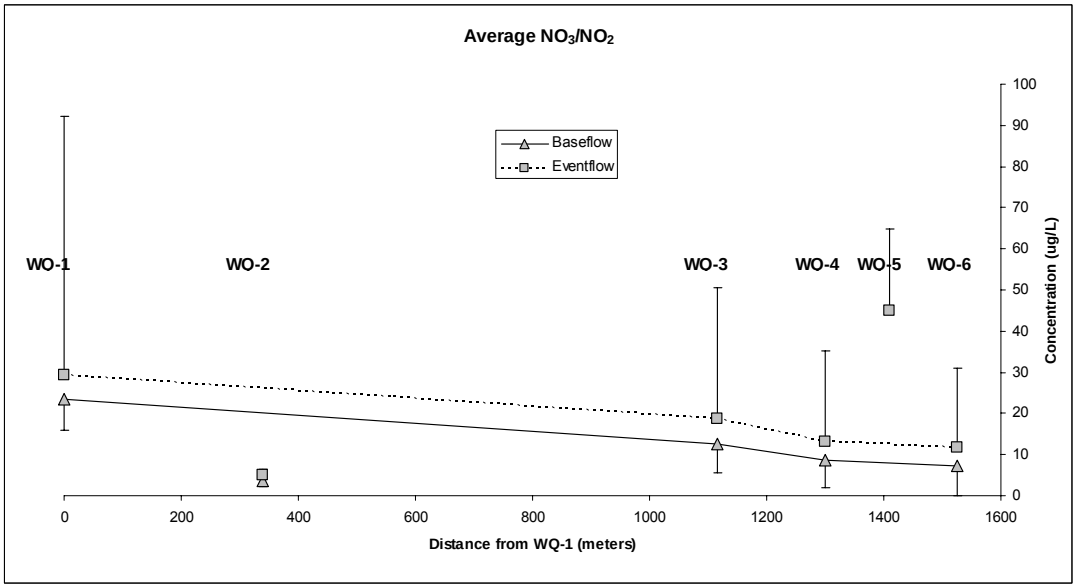

Figure A-3. Spatial Summary of Average NO_3/NO_2 Concentrations

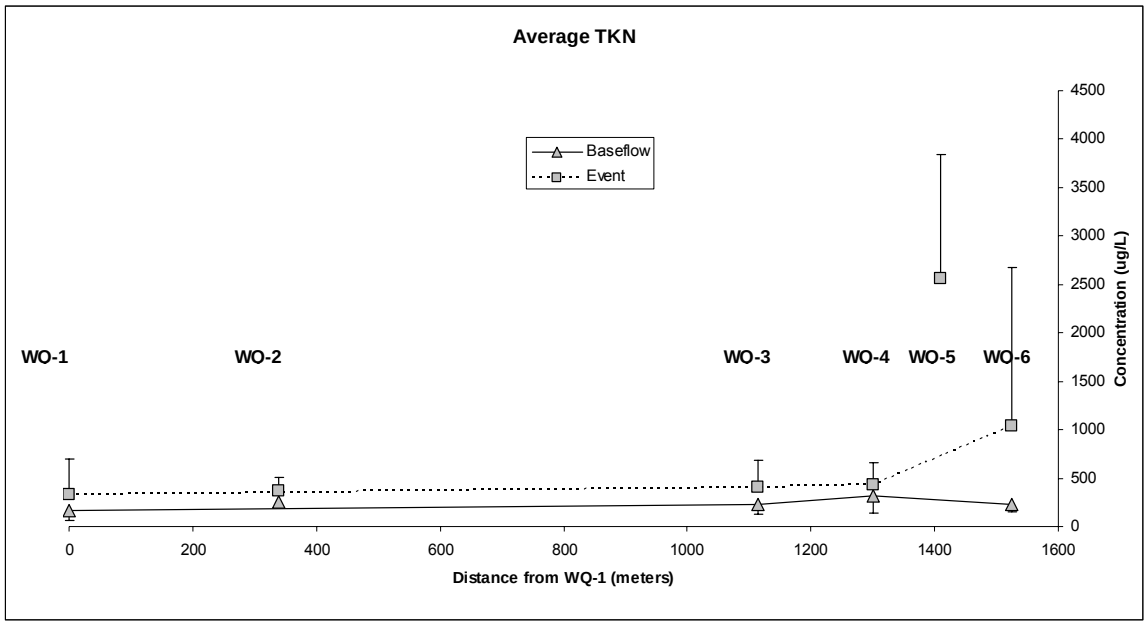

Figure A-4. Spatial Summary of Average TKN Concentrations

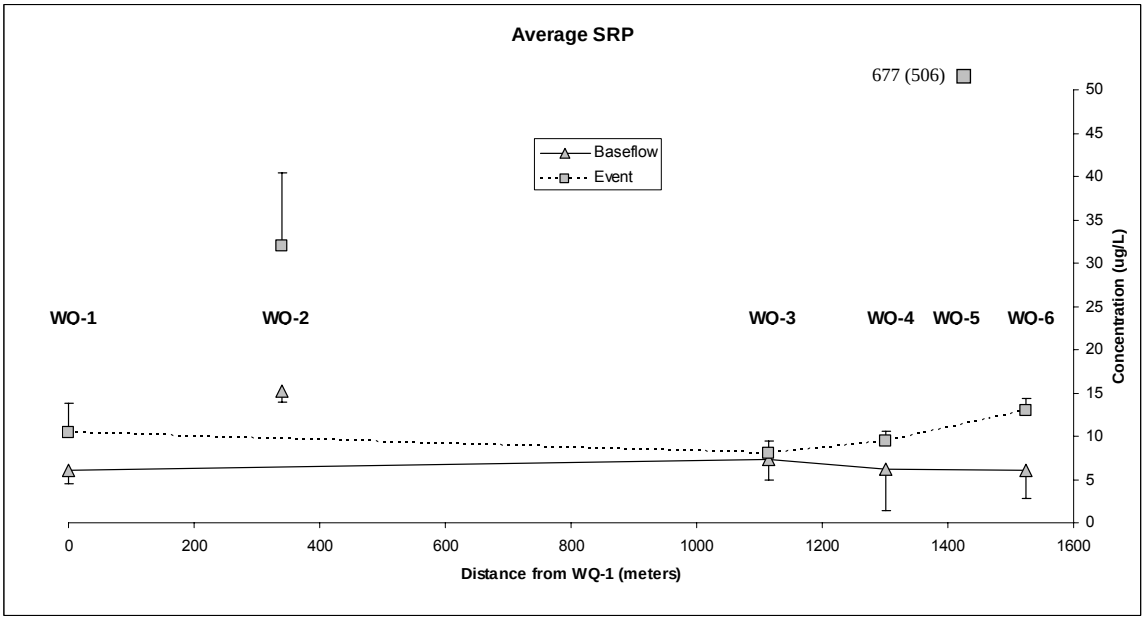

Figure A-5. Spatial Summary of Average SRP Concentrations

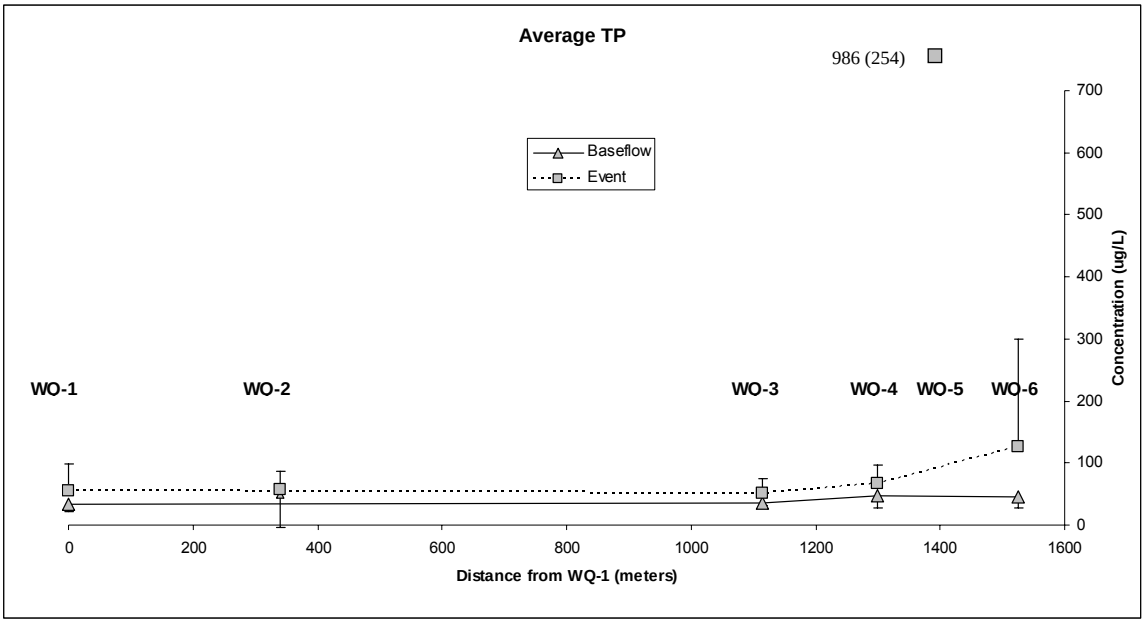

Figure A-6. Spatial Summary of Average TP Concentrations

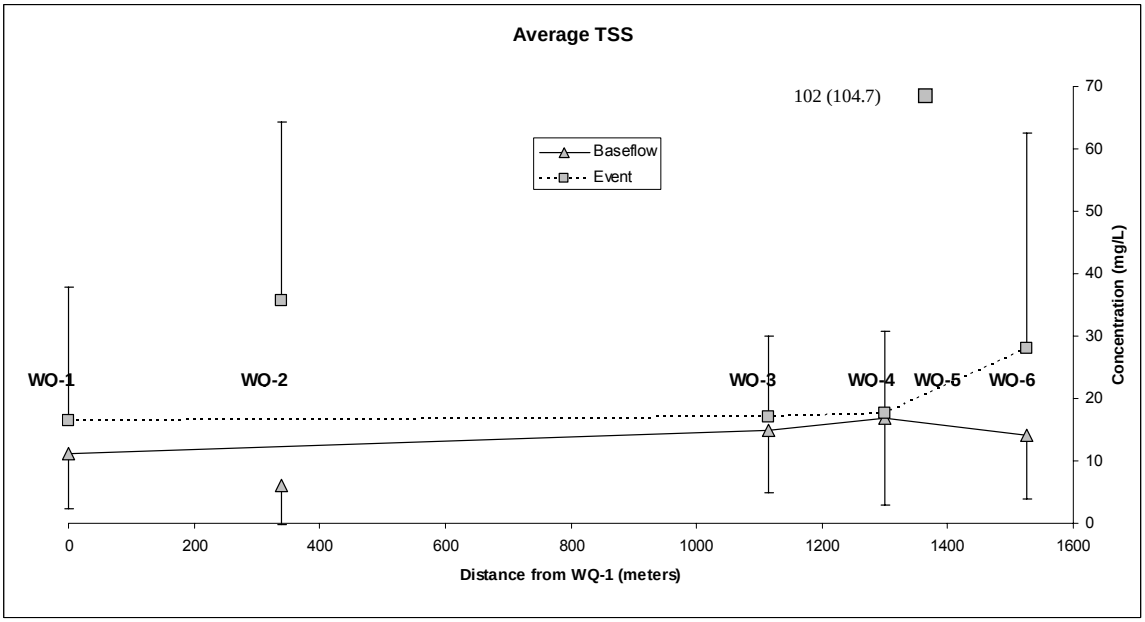

Figure A-7. Spatial Summary of Average TSS Concentrations

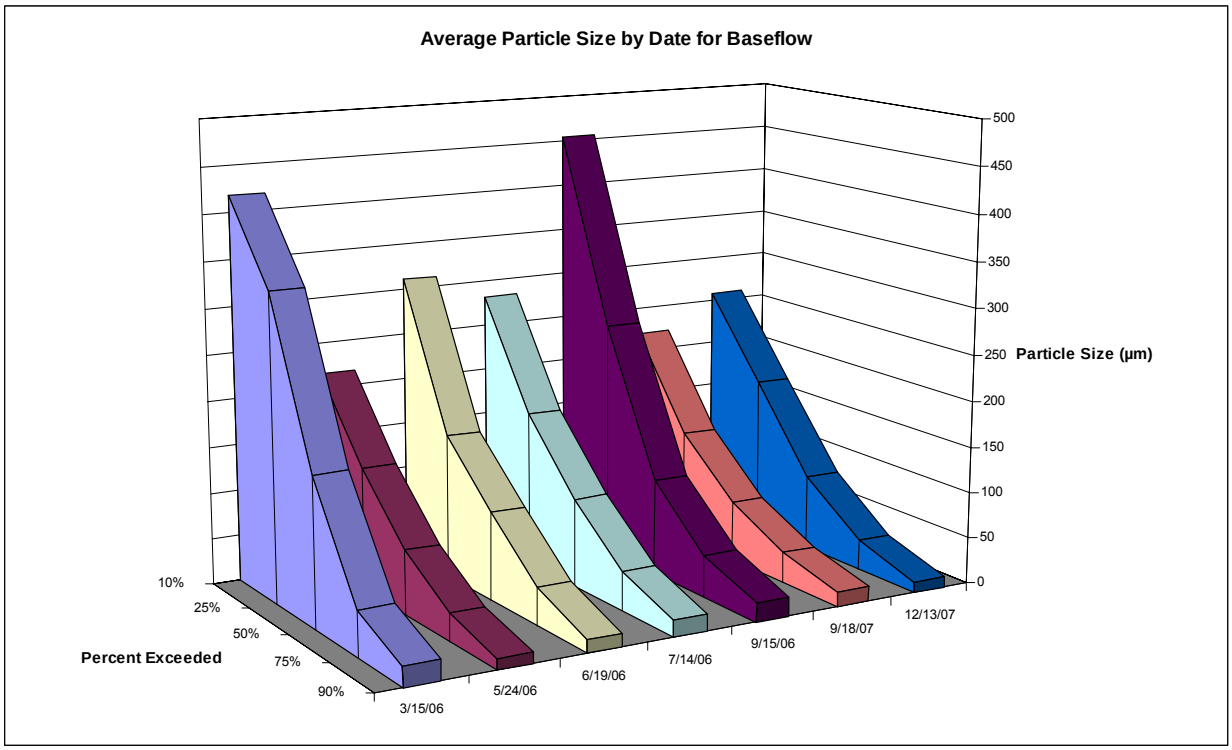

Figure A-8. Discrete particle size exceedence values for all baseflow samples by date.

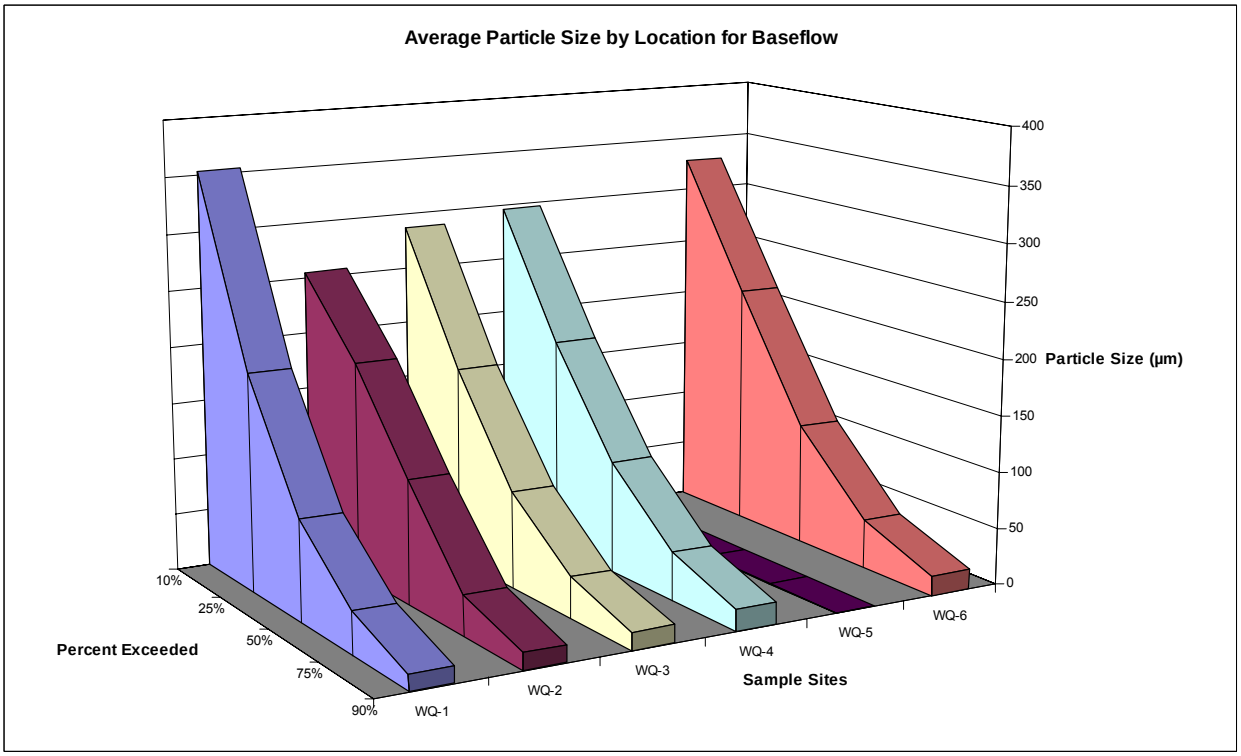

Figure A-9. Discrete particle size exceedence values for all baseflow samples by site.

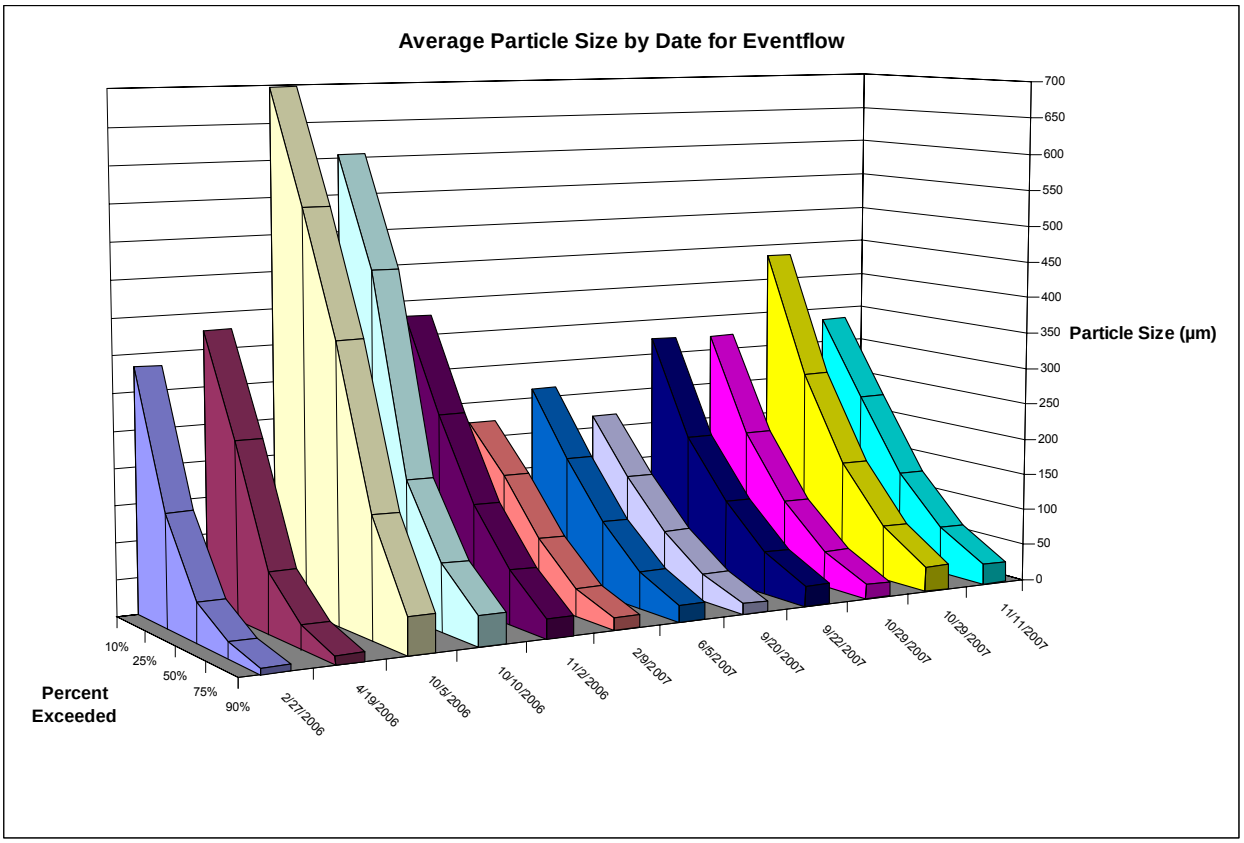

Figure A-10. Discrete particle size exceedence values for all event flow samples by date.

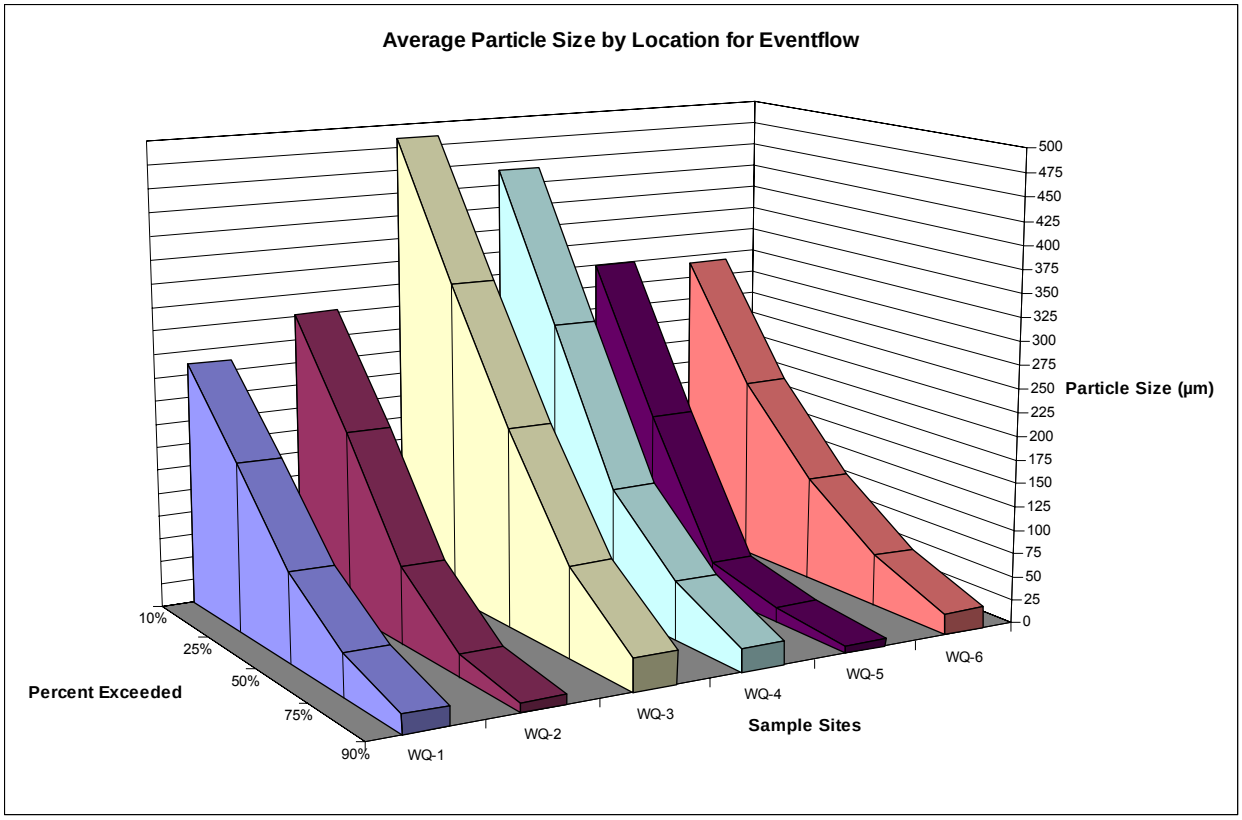

Figure A-11. Discrete particle size exceedence values for all event flow samples by site.

Appendix B – Tabular Summaries of Sample Sets

Table B-1. October 24, 2005, November 29, 2005, and December 18, 2005

Event Date	10/24/2005		11/29/2005		12/18/2005		
Event Type	None		Rain		Rain on Snow		
WQ-6 Flow Rate (cfs)	n/a		n/a		n/a		
	WQ-3	**WQ-6**	**WQ-3**	**WQ-6**	**WQ-3**	**WQ-5b**	**WQ-6**
Nutrient Data							
NH_4^+ (µg/L)	4	4	2	2	3	6	6
NO_3 and NO_2 (µg/L)	1(1)	1	1	1	28	26 (26)	2
TKN (µg/L)	175	139	234	319	711	60	597
SRP (µg/L)	3	5	2	10	2	227	7
TP (µg/L)	29	33	23	43	67	314 (322)	88
Sediment Data							
TSS (mg/L)	6.5	8.5	5	7.2	17.3	13.3	21.5
% TSS Grain Size <1um	0.5	0.2	0.1	0.1	0.5	1.3	0.3
% TSS Grain Size <10um	3.2	0.9	3.2	4.7	5.1	17.4	5.2
% TSS Grain Size <100um	38	25	39	42	55	74	54
% TSS Grain Size >100um	63	75	61	58	45	26	47
Field Parameters							
Temperature (degrees C)	Not Collected		Not Collected		Not Collected		
pH	Not Collected		Not Collected		Not Collected		
Conductivity (µS/cm)	Not Collected		Not Collected		Not Collected		
Sampling Time (hh:mm)	17:45	17:55	9:15	9:36	14:35	14:25	14:10

n/a - not applicable - data collected prior to adoption of Burke Creek Monitoring Workplan
WQ-5b - data collected at discontinued site located in Kahle Park drainage channel

Table B-2. December 31, 2005 and February 2, 2006

Event Date	12/31/2005				2/2/2006			
Event Type	Rain				Rain on Snow			
WQ-6 Flow Rate (cfs)	n/a				n/a			
	WQ-3	**WQ-5**	**WQ-5b**	**WQ-6**	**WQ-3**	**WQ-5**	**WQ-5b**	**WQ-6**
Nutrient Data								
NH_4^+ (µg/L)	24	26 (23)	26	20	2	8	8	2
NO_3 and NO_2 (µg/L)	95	14 (14)	20	71	20	11	21	5
TKN (µg/L)	935	542	687 (659)	1104	251	1107	1235	258
SRP (µg/L)	34	219 (220)	235	32	6	300	341 (338)	15
TP (µg/L)	95	318	354	109 (105)	39	393	435	63 (59)
Sediment Data								
TSS (mg/L)	16.5	32	35.5	34.5	8	14.7	16.5	7.5
% TSS Grain Size <1um	1	2.6	3.4	0.3	0.4	1.9	2.7	0.4
% TSS Grain Size <10um	12.3	26.1	30.5	8	7.9	18.8	36.4	9.1
% TSS Grain Size <100um	72	82	83	70	46	50	94	49
% TSS Grain Size >100um	28	18	17	30	54	51	6	51
Field Parameters								
Temperature (degrees C)	Field Parameter Data Not Collected				Field Parameter Data Not Collected			
pH	Field Parameter Data Not Collected				Field Parameter Data Not Collected			
Conductivity (µS/cm)	Field Parameter Data Not Collected				Field Parameter Data Not Collected			
Sampling Time (hh:mm)	13:46	13:37	13:39	13:33	10:07	10:16	10:21	10:25

n/a - not applicable - data collected prior to adoption of Burke Creek Monitoring Workplan
WQ-5b - data collected at discontinued site located in Kahle Park drainage channel

Table B-3. February 27, 2006 and March 15, 2006

Event Date	2/27/2006						3/15/2006				
Event Type	Rain on Snow						Base flow				
WQ-6 Flow Rate (cfs)	n/a						n/a				
	WQ-1	WQ-2	WQ-3	WQ-4	WQ-5	WQ-6	WQ-1	WQ-2	WQ-3	WQ-4	WQ-6
Nutrient Data											
NH_4^+ (µg/L)	13	6 (7)	2	2	28	3	6	4	9	5	5
NO_3 and NO_2 (µg/L)	212	4	100	71	31	66 (68)	37	2	17	9	8 (7)
TKN (µg/L)	1357	467	915	632	1651	867	143	196	222	212 (222)	204
SRP (µg/L)	38	38	22	20	319	25	6	16	14	3	4 (4)
TP (µg/L)	175	78	85	97	806	153	22	29	29	16	18 (16)
Sediment Data											
TSS (mg/L)	78	16	46	50	176	76	7	2	6	3	4
% TSS Grain Size <1um	0.9	1.3	0.7	0.7	3.9	0.8	0.3	0.0	0.2	0.1	0.0
% TSS Grain Size <10um	10	22.1	8.1	9	33.6	9.8	6.3	0	4.4	4.9	3.7
% TSS Grain Size <100um	65	78	59	63	68	67	55	34	37	42	37
% TSS Grain Size >100um	35	22	41	37	32	33	45	66	63	58	63
Field Parameters											
Temperature (degrees C)	Field Parameter Data Not Collected						4.15	0.2	1.6	1	0.8
pH	Field Parameter Data Not Collected						5.05	5.72	6.38	6.02	6.8
Conductivity (µS/cm)	Field Parameter Data Not Collected						Field Parameter Data Not Collected				
Sampling Time (hh:mm)	16:29	16:36	17:03	17:07	16:57	17:16	13:23	13:52	14:48	14:30	15:03

n/a - not applicable - data collected prior to adoption of Burke Creek Monitoring Workplan

Table B-4. April 19, 2006 and May 24, 2006

Event Date	4/19/2006					5/24/2006				
Event Type	Spring Snowmelt					Base flow				
WQ-6 Flow Rate (cfs)	0.88					0.76				
	WQ-1	**WQ-2**	**WQ-3**	**WQ-4**	**WQ-6**	**WQ-1**	**WQ-2**	**WQ-3**	**WQ-4**	**WQ-6**
Nutrient Data										
NH_4^+ (µg/L)	9	6	7	7 (6)	6	6	8	4	6 (7)	6
NO_3 and NO_2 (µg/L)	52	2	34 (35)	8	6	16	3	9	5	4
TKN (µg/L)	583	278	444	385	333	378	324	326	292	310
SRP (µg/L)	9	17	7	4	5 (5)	10	18	7	7	10
TP (µg/L)	65	58	67 (60)	46	44	53	85	42	50	68
Fe (mg/L)					0.66					
Sediment Data										
TSS (mg/L)	22	12	13	17	20	16	15	13	14	11
% TSS Grain Size <1um	0.5	0.0	0.5	n/a	0.3	0.0	0.7	0.7	0.6	0.4
% TSS Grain Size <10um	6.7	3.8	7.9	n/a	9.8	9.0	8.3	8.8	9.3	7.1
% TSS Grain Size <100um	52	50	52	n/a	66	79	66	64	62	51
% TSS Grain Size >100um	48	51	48	n/a	34	21	34	36	38	49
Field Parameters										
Temperature (degrees C)	5.9	6.8	7.4	8.9	9.3	10.9	12.4	12.6	14	13.9
pH	6.6	6.6	6.6	6.6	6.8	7.12	7.04	7.07	7.12	7.4
Conductivity (µS/cm)	Field Parameter Data Not Collected					Field Parameter Data Not Collected				
Sampling Time (hh:mm)	17:24	17:33	17:07	16:56	16:46	16:00	16:08	15:42	15:33	15:15

n/a - not applicable, insufficient sample for particle size analysis

Table B-5. June 19, 2006 and July 14, 2006

Event Date	6/19/2006					7/14/2006			
Event Type	Base flow					Base flow			
WQ-6 Flow Rate (cfs)	0.50					0.34			
	WQ-1	WQ-2	WQ-3	WQ-4	WQ-6	WQ-1	WQ-3	WQ-4	WQ-6
Nutrient Data									
NH_4^+ (µg/L)	6	9	4	6	9 (10)	4 (4)	3	13	10
NO_3 and NO_2 (µg/L)	19	4	10 (9)	9	9	28	26	23	22 (22)
TKN (µg/L)	127	238	188	302	257	123 (129)	90	338	314
SRP (µg/L)	3	19	2	8	6 (6)	6 (6)	8	10	9
TP (µg/L)	32	48	32	53	49	29	37 (35)	57	62
Fe (mg/L)				1.0					
Sediment Data									
TSS (mg/L)	10	6	12	15	16	14	18	26	26
% TSS Grain Size <1um	0.0	0.8	0.6	0.2	0.6	0.6	0.6	0.3	0.4
% TSS Grain Size <10um	3.6	7.3	11.3	7.7	4.6	7.7	6.0	3.4	3.9
% TSS Grain Size <100um	28	45	78	80	41	61	60	41	46
% TSS Grain Size >100um	72	55	22	20	60	39	40	59	54
Field Parameters									
Temperature (degrees C)	9.5	11.3	9	10.1	9.6	11.1	10.3	11.5	11.2
pH	6.8	6.5	6.7	6.6	6.6	7.1	6.7	6.5	6.2
Conductivity (µS/cm)	Field Parameter Data Not Collected					Field Parameter Data Not Collected			
Sampling Time (hh:mm)	11:15	11:25	10:55	10:48	10:40	12:29	12:01	11:54	11:45

Table B-6. September 15, 2006 and October 5, 2006

Event Date	9/15/2006				10/5/2006				
Event Type	Base flow				Rain				
WQ-6 Flow Rate (cfs)	0.26				0.94				
	WQ-1	WQ-3	WQ-4	WQ-6	WQ-1	WQ-3	WQ-3 FD*	WQ-4	WQ-6
Nutrient Data									
NH_4^+ (µg/L)	5	3	13	7	6	4	3	3 (2)	3
NO_3 and NO_2 (µg/L)	17	4	5	1	1	3	2	2	2
TKN (µg/L)	116 (110)	288	687	226	165	190	250	470	412
SRP (µg/L)	2	2	3	2	2	4	2	11 (10)	20
TP (µg/L)	44	36	76	52	29	45	45	73	75
Fe (mg/L)									
Grease&Oil (mg/L)				<5.0[1]					
Sediment Data									
TSS (mg/L)	27	35	44	30	19	21	7	15	11
% TSS Grain Size <1um	0.8	0.7	0.4	0.5	0.3	0.2	0.4	0.4	0.6
% TSS Grain Size <10um	5.6	5.3	3.8	4.5	4.1	1.5	3.7	3.4	3.3
% TSS Grain Size <100um	47	54	45	55	39	10	38	31	35
% TSS Grain Size >100um	53	46	55	45	61	90	62	70	66
Field Parameters									
Temperature (degrees C)	7.5	7.1	7.4	7.1	7.4	6.9		6.8	6.6
pH	6.9	6.7	6.9	6.9	7.0	6.9		6.9	6.5
Conductivity (µS/cm)	Field Parameter Data Not Collected				Field Parameter Data Not Collected				
Sampling Time (hh:mm)	14:44	14:25	14:20	13:37	14:07	13:45		13:40	13:30

*FD- Field Duplicate

[1]Reporting Limit is high due to insuffient sample amount

Table B-7. October 10, 2006 and November 2, 2006

Event Date	10/10/2006					11/2/2006				
Event Type	Rain on Snow					Rain				
WQ-6 Flow Rate (cfs)	0.34					1.62				
	WQ-1	**WQ-3**	**WQ-3 FD***	**WQ-4**	**WQ-6**	**WQ-1**	**WQ-3**	**WQ-3 FD***	**WQ-4**	**WQ-6**
Nutrient Data										
NH_4^+ (µg/L)	2	3	3	3	4 (3)	3	3	3	4 (5)	4
NO_3 and NO_2 (µg/L)	3	2	2	2	2 (2)	1	2	2	3 (3)	2
TKN (µg/L)	216	365	254	399	707	104	193	220	236	358
SRP (µg/L)	5	7	3	6	5 (5)	4	4	5	5	8 (8)
TP (µg/L)	51	55	4	64	88	34	41 (44)	41	51	49
Fe (mg/L)	0.66				0.88					
Grease and Oil (mg/L)				<5.0[1]						
Sediment Data										
TSS (mg/L)	2	4	5	15	13	6	7	4	10	10
% TSS Grain Size <1um	0.5	0.3	0.1	0.2	0.3	0.3	0.2	0.1	0.3	0
% TSS Grain Size <10um	4.3	3.2	1	1.8	2.6	8.1	7.1	5.7	2.6	3.9
% TSS Grain Size <100um	37	31	12	20	31	65	38	35	24	24
% TSS Grain Size >100um	63	69	88	80	69	35	62	65	76	76
Field Parameters										
Temperature (degrees C)	6.4	5.5		5.6	5.6	7.8	7.2		6.8	6.6
pH	6.93	6.72		6.63	6.4	7.12	7.14		6.93	7.08
Conductivity (µS/cm)	Field Parameter Data Not Collected					Field Parameter Data Not Collected				
Sampling Time (hh:mm)	15:20	15:05		15:00	14:45	12:30	12:11		12:05	11:55

*FD- Field Duplicate

[1]Reporting Limit is high due to insuffient sample amount

Table B-8. February 9, 2007 and June 5, 2007

Event Date	2/9/2007						6/5/2007			
Event Type	Rain, Snow						Rain			
WQ-6 Flow Rate (cfs)	1.23						0.32			
	WQ-1	WQ-2	WQ-3	WQ-4	WQ-5	WQ-6	WQ-1	WQ-3	WQ-4	WQ-6
Nutrient Data										
NH_4^+ (µg/L)	7	8	6	5	29	5 (4)	4	4	3	5 (6)
NO_3 and NO_2 (µg/L)	58	6	44	27	59	21 (21)	13	2	1	2 (2)
TKN (µg/L)	239	265	347	277	3461	370 (375)	204	236	235	561 (565)
SRP (µg/L)	15	26 (26)	13	13	1034	28 (28)	3	2	3	5 (5)
TP (µg/L)	36	36	44	40	1165	68 (68)	27	35	34	66 (69)
Fe (mg/L)							0.34	0.4	0.65	1.7
Grease and Oil (mg/L)										2.1
Sediment Data										
TSS (mg/L)	9	56	17	12	28	17	10	15	14	28
% TSS Grain Size <1um	0.5	0.2	0.4	0.4	0.7	0.5	0.0	0.5	0.0	0.3
% TSS Grain Size <10um	6.9	8.1	4.6	4.6	7.4	5.4	2.9	4.4	7.5	2.9
% TSS Grain Size <100um	59	46	50	47	76	55	52	49	49	44
% TSS Grain Size >100um	41	54	50	53	24	45	48	51	51	56
Field Parameters										
Temperature (degrees C)	5.3	0.5	4.3	3.6	0.5	3.4	8.3	8.4	8.7	8.7
pH	6.7	6.48	6.6	6.39	6.0	6.2	7.1	7.2	7.3	7.7
Conductivity (µS/cm)	Field Parameter Data Not Collected						Field Parameter Data Not Collected			
Sampling Time (hh:mm)	11:15	11:26	10:57	10:48	10:36	10:24	9:25	9:10	9:05	8:57

Table B-9. September 18, 2007 and September 20, 2007

Event Date	9/18/2007				9/20/2007			
Event Type	Base flow				Rain, Snow			
WQ-6 Flow Rate (cfs)	0.24				0.23			
	WQ-1	**WQ-3**	**WQ-4**	**WQ-6**	**WQ-1**	**WQ-3**	**WQ-4**	**WQ-6**
Nutrient Data								
NH_4^+ (µg/L)	2	2	1(1)	2	2	1	2	2
NO_3 and NO_2 (µg/L)	20	12	6	4	13	24	17	8
TKN (µg/L)	123	132	178	134(129)	135	363	334	959
SRP (µg/L)	10(10)	16	8	8(8)	6	10	11	10(10)
TP (µg/L)	23	33	36(38)	34	39	40	53(52)	55
Fe (mg/L)								
Grease and Oil (mg/L)				<1.5				<2.0
Sediment Data								
TSS (mg/L)	3	5	13	8	14	20	17	20
% TSS Grain Size <1um	0.2	0.6	0	0.6	0.9	0.8	1.3	1.1
% TSS Grain Size <10um	6.3	6.4	4.4	6	8.6	6.9	8.7	6.7
% TSS Grain Size <100um	70	75	58	68	63	65	67	52
% TSS Grain Size >100um	30	25	42	32	37	35	33	49
Field Parameters								
Temperature (degrees C)	9.6	9.1	9.6	8.7	7.0	6.1	6.1	6.0
pH	6.84	6.65	6.45	6.42	7.01	6.89	6.81	6.98
Conductivity (µS/cm)	Field Parameter Data Not Collected				Field Parameter Data Not Collected			
Sampling Time (hh:mm)	13:15	13:05	13:00	12:15	11:00	10:45	10:35	9:40

Table B-10. September 22, 2007 and October 29, 2007

Event Date	9/22/2007				10/29/2007					
Event Type	Rain, Thunderstorm				Rain, Thunderstorm					
WQ-6 Flow Rate (cfs)	0.40				0.40					
	WQ-1	WQ-3	WQ-4	WQ-6	WQ-1	WQ-1	WQ-3	WQ-4	WQ-6	WQ-6
Nutrient Data										
NH_4^+ (µg/L)	1	4	3(2)	6	4	3	3	1	1	3(3)
NO_3 and NO_2 (µg/L)	12	8	6	19(18)	3	4	1	1	1	2(3)
TKN (µg/L)	218	906	899	5933	117	615	100	235	159	344
SRP (µg/L)	12	9	5	19	1	24(24)	2(2)	4	3	4
TP (µg/L)	49	101	111	641	32	97	27	33(35)	30	59
Fe (mg/L)									0.64	0.84
Grease and Oil (mg/L)				<2.0					<1.5	
Sediment Data										
TSS (mg/L)	15	28	30	113	2	20	2	3	3	8
% TSS Grain Size <1um	0.2	0.6	1	1.1	1	0.5	0.2	1	1.5	0.7
% TSS Grain Size <10um	1.4	3.2	6.4	5.5	9.4	3	0.6	6.1	10.1	4.2
% TSS Grain Size <100um	38	34	53	57	68	36	33	46	55	30
% TSS Grain Size >100um	62	66	47	43	32	64	67	55	46	70
Field Parameters										
Temperature (degrees C)	7.6	7.5	7.5	7.4	8.4	8.3	8.2	8.0	8.0	7.8
pH	7.65	7.58	7.55	7.72	6.98	7.39	7.41	7.33	7.41	7.40
Conductivity (µS/cm)	Field Parameter Data Not Collected				Field Parameter Data Not Collected					
Sampling Time (hh:mm)	10:35	10:30	10:25	10:20	14:05	16:10	14:30	14:24	14:18	16:52

Table B-11. November 11, 2007 and December 13, 2007

Event Date	11/11/2007				12/13/2007				
Event Type	Rain, Snow				Base flow				
WQ-6 Flow Rate (cfs)	0.35				0.24				
	WQ-1	**WQ-3**	**WQ-4**	**WQ-6**	**WQ-1**	**WQ-2**	**WQ-3**	**WQ-4**	**WQ-6**
Nutrient Data									
NH_4^+ (µg/L)	2	2	3 (3)	3	6	5	2	2	2(2)
NO_3 and NO_2 (µg/L)	3	1	2	3 (3)	28	5	10	3	2(2)
TKN (µg/L)	294	418	613	730	137	244	308	204	135
SRP (µg/L)	5 (5)	7	16	15	5(5)	8	2	4(4)	3
TP (µg/L)	36	44	109	104 (102)	29	34	44(45)	38	34
Fe (mg/L)				0.76					0.36
Grease and Oil (mg/L)				1.6					
Sediment Data									
TSS (mg/L)	8	13	12	11	2	2	16	5	5
% TSS Grain Size <1um	1.2	0.1	0.9	1.0	1.2	0.0	0.9	n/a	0.9
% TSS Grain Size <10um	7.3	0.6	6	7.2	11.1	14.2	6.2	n/a	7.9
% TSS Grain Size <100um	59	19	46	51	63	54	54	n/a	55
% TSS Grain Size >100um	41	81	54	49	37	46	46	n/a	45
Field Parameters									
Temperature (degrees C)	4.6	4.7	4.3	4.3	3.8	3.8	1.6	0.7	0.7
pH	7.6	7.5	7.5	7.6	6.7	6.2	6.6	6.3	6.6
Conductivity (µS/cm)	120	140	160	160	150	290	150	120	140
Sampling Time (hh:mm)	9:40	9:24	9:20	9:14	12:38	12:56	13:23	13:32	13:55

n/a - not applicable, insufficient sample for particle size analysis