

2010 Data Report



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BCWA Sampling Program

A generally continuous collection of surface quality data began in 1990 for the Bear Creek Watershed (Figure 1) and at Bear Creek Reservoir (Figure 2). Data collection includes specific chemical, physical and biological parameters. Data is collected monthly and bi-monthly at Bear Creek Reservoir and along Turkey Creek and Bear Creek, and in the watershed from July to September. The Association meets water quality data sampling and analyses objectives established in the Bear Creek Reservoir Control Regulation # 74 and as contained in an annually updated watershed sampling procedure memorandum (Bear Creek Watershed Association Surface Water Monitoring Program Version 2010.02, BCWA).

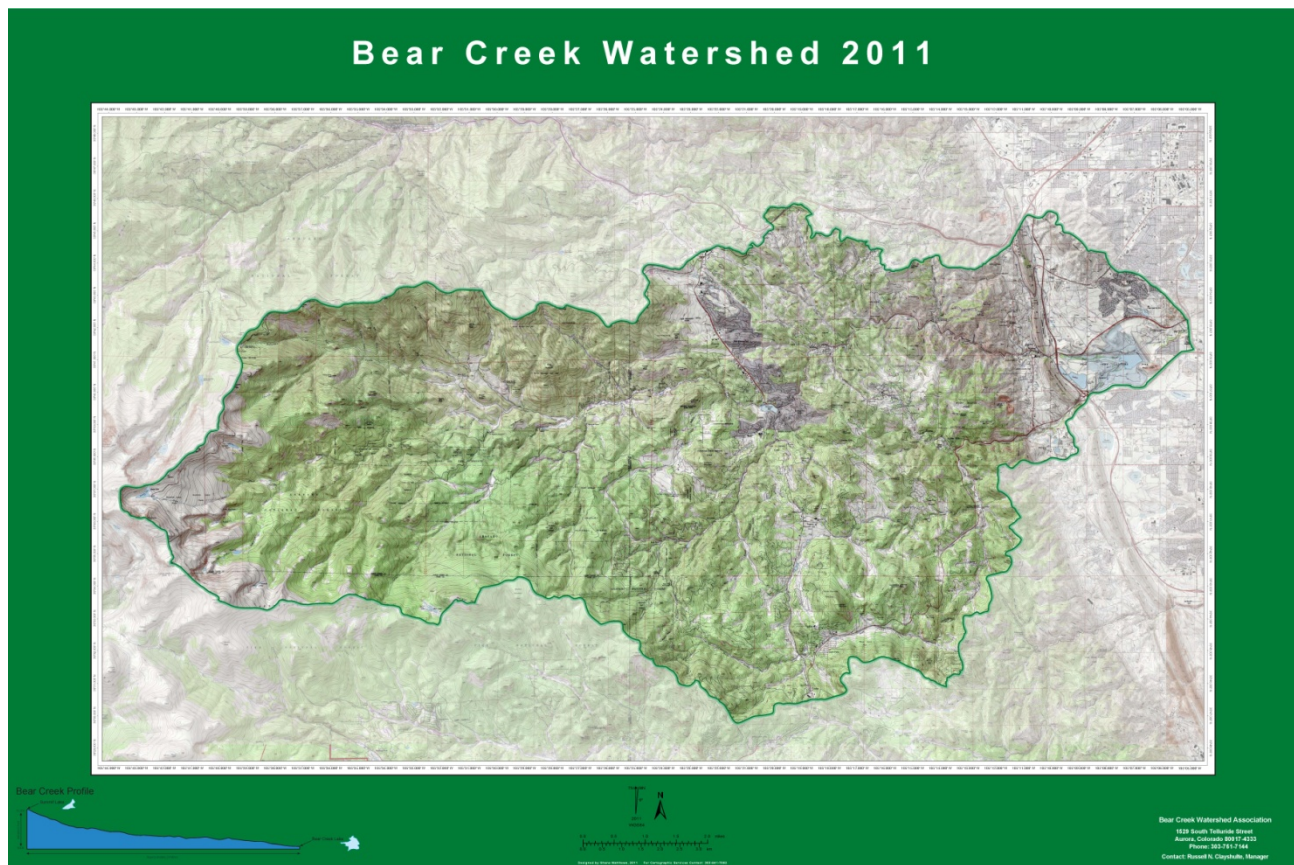


Figure 1 Bear Creek Watershed

BCWA Monitoring Site Characterizations

The Bear Creek Watershed Association maintains four types of monitoring efforts to characterize water and environmental quality within the Bear Creek Watershed:

1. P1- Routine water quality monitoring at Bear Creek Reservoir (multiple vertical stations), Turkey Creek inflow to reservoir, Bear Creek inflow to reservoir, and reservoir discharge into lower Bear Creek. The P1 sites are long-term monitoring sites consistent with the intent of the monitoring program outlined in the Bear Creek Reservoir Control Regulation.
2. P2- Supplemental sampling of restoration or other project specific sites (e.g., Coyote Gulch in cooperation with the City of Lakewood). These types of monitoring efforts are for limited duration and for specific parameters of interest.
3. P3- Watershed surface water monitoring along Bear Creek and Turkey Creek drainages for site-specific

characterizations (e.g., temperature trends, nutrient loading, flow studies). These are interim and long-term monitoring sites for watershed characterizations

4. P4- Supplemental environmental characterizations of Bear Creek watershed including, but not limited to macroinvertebrates, flow analysis, habitat characterizations, fishery evaluations, system productivity, or other environmental factors that potentially affect fisheries or watershed health.

P1 - Bear Creek Reservoir Monitoring Program

The follow monitoring plan sections detail the 2010 reservoir and watershed monitoring programs as approved by the BCWA Board and accepted by the Water Quality Control Division staff (WQCD). This monitoring plan remains consistent with the quality assurance goals of the previously adopted Association QAPP (Bear Creek Watershed Association, 2006). However, this monitoring plan is the working version. The 2010 monitoring program version 2010.01 adapted from the last version of the 2009.02 monitoring plan. The 2009 modifications to the monitoring plan result from changes to Bear Creek Control Regulation #74 and updated standards and classifications in Regulation #38. Changes include:

- Additional temperature probes for new stream segments. Add two new temperature data loggers in Bear Creek Segment 1b above and below the Ward Ditch. Add new logger location on Cub Creek near Brookforest Inn, site 35 and lower Cub Creek, site 50. Include these sites for seasonal chemistry in 2010.
- Maintain existing temperature data logger locations and seasonal monitoring periods.
- Recognize growing season for data collection as July, August and September. Adjust watershed chemistry analyses to focus only on the period of July to September, beginning 2010.
- New monitoring sites added in 2009 for Summit Lake in the Mount Evans Wilderness (segment 8), in upper segment 7 below Summit Lake for the July, August and September months.
- Drop other supplemental chemistry monitoring of “selected tributaries or lakes/reservoirs in watershed”.
- Increase monitoring for Evergreen Lake chemistry to obtain samples at -1 meter and +1 meter in water column, and adjust position of temperature data loggers in water column. Track temperature against new standard and DO compliance in central pool of Evergreen Lake. No ammonia and TIN monitoring for Evergreen Lake.
- Work with the City of Lakewood to more closely monitor dissolved oxygen in water column and adjust the operation of the reservoir aeration system on a weekly basis to maintain DO standards, while minimizing aeration operations. This requires addition vertical probe sampling in the July to September period to monitor DO levels in the water column at site 40.
- Establish sediment and nutrient internal loading studies in Bear Creek Reservoir for 2010.
- Establish photographic points for critical segments and conditions. Document dewatering of Bear Creek Segment 1b below both the Arnett-Harriman and Ward ditches.
- Appendix A contains the 2010 monitoring sites with the BCWA site identifiers, data logger location and chemistry-monitoring sites by new stream segment descriptions.
- Identify reference sites for segments (Appendix A)

- Appendix B in the back of the monitoring plan shows the general location of watershed sampling locations. An atlas of larger scale maps maintained on Association web site (www.bearcreekwatershed.org).

The routine monitoring program (P1) focuses on Turkey Creek drainage and Bear Creek drainage inputs and discharge from Bear Creek Reservoir (Figure 2) into lower Bear Creek with a central pool characterization of the reservoir near the dam (BCWA site 40). In Figure 2, the outlet structure is near BCWA site 41 with Bear Creek inflow near BCWA site 44 and Turkey Creek inflow near BCWA site 43. The reservoir chemistry and biological characterization occurs at BCWA site 40. Vertical probe samples for specific conductance, temperature, dissolved Oxygen, and pH are measured at 1-meter intervals at all reservoir sites. The current monitoring program optimizes data generation to evaluate reservoir inflow loading, tropic state changes within the reservoir, and reservoir outflow; while minimizing monitoring cost. The aeration sites are visible in Figure 2. Monitoring stations within Bear Creek Park are shown in Figure 3. A map of partial sampling sites and wastewater treatment plant locations is shown in Figure 4.

The Association measures flow in Bear Creek and Turkey Creek during sampling events. The Association also estimates discharge flows from Bear Creek reservoir for sampling events. The U.S. Army Corps of Engineers maintains records of flow inputs and discharge for the reservoir system.

The four 2010 P1 routine watershed-monitoring stations, including the reservoir station, are:

1. Mainstem of Turkey Creek prior to discharge into Bear Creek Reservoir, within Bear Creek Park, adjacent to the City of Lakewood Maintenance Yard;
2. Mainstem of Bear Creek prior to discharge into Bear Creek Reservoir, within Bear Creek Park, adjacent to the bridge at the western edge of the park;
3. Tail-water discharge from Bear Creek Reservoir in the concrete channel that starts the lower Bear Creek; and
4. Bear Creek Reservoir, center of main pool and supplemental vertical profile stations 40, 41, 42, 43, and 44



Figure 2 Bear Creek Reservoir with Sampling Stations

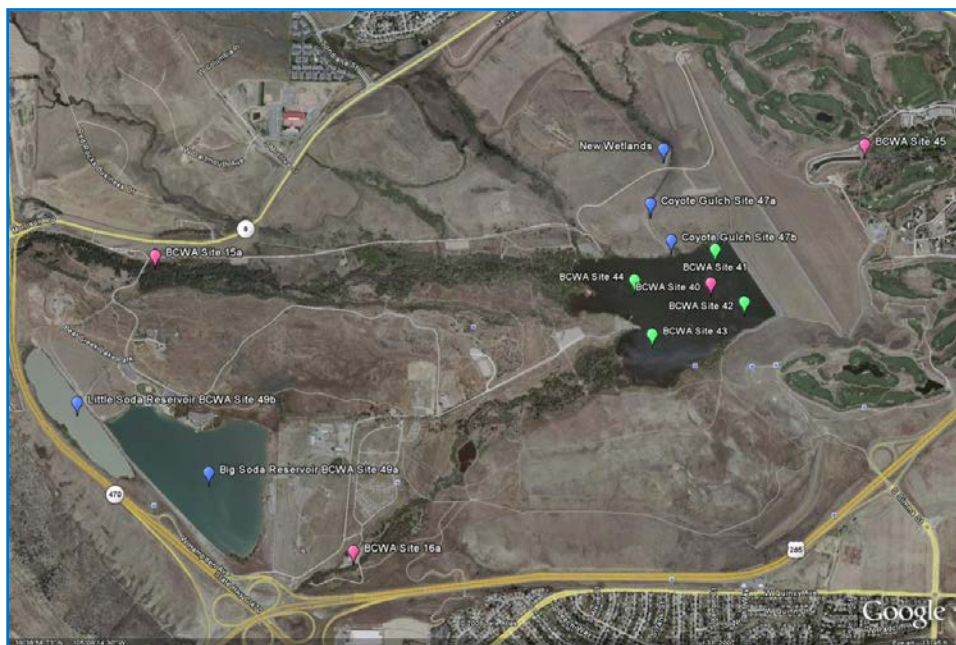


Figure 3 Bear Creek Park with BCWA Sampling Sites

Table 1 lists water quality monitoring parameters for the P1 sampling sites. Table 2 shows methods of analyses and detection limits. Laboratory analyses are performed by GEI Consultants, Inc. / Chadwick Ecological Division. Samples delivered to GEI Consultants, Inc. / Chadwick Ecological Division within 1 hour of final sample collection. The phytoplankton samples are a composite of the top 1-meter of the water column. Reservoir bottom samples taken at about 9 meters depth, which is + 1m above the bottom. Care is taken to not disturb the bottom sediments where the sample is collected. The top samples represent a composite water sample from -0.75m to -1.25m, as collected in a vertical Van Dorn sampler.

Table 1 Routine Monitoring Parameters

Parameter (units)	Bear & Turkey Creek Inflows	Reservoir Sites	Reservoir Outflow
Physical/Field			
Flow/ Discharge (cu m/s)	X		X
Specific Conductance (umhos/cm)	X	X (Profiles at sites 40, 41, 42, 43, and 44)	X
Secchi (meters)		X (sites 40, 41, 42, 43, and 44)	
Dissolved Oxygen (mg/l)	X	X (Profile sites 40, 41, 42, 43, and 44)	X
Temperature (C)	X	X (Profile at sites 40, 41, 42, 43, and 44)	X
Total Suspended Sediments (mg/l)	X	X (site 40; laboratory)	X
pH (standard unit)	X	X (Profile at sites 40, 41, 42, 43, and 44)	X
Biological (Site 40 only)			
Chlorophyll a (ug/l)		X (-1m)	
Phytoplankton (July, August, September only; six sample sets)		X (top 1-meter water column, composite)	
Nutrients (Site 40 only)			
Nitrate + Nitrite (ug/l)	X	X (top, lower)	X
Total Dissolved Phosphorus (ug/l)	X	X (top, lower)	X
Total Phosphorus (ug/l)	X	X (top, lower)	X
Total Nitrogen		X (top, lower)	

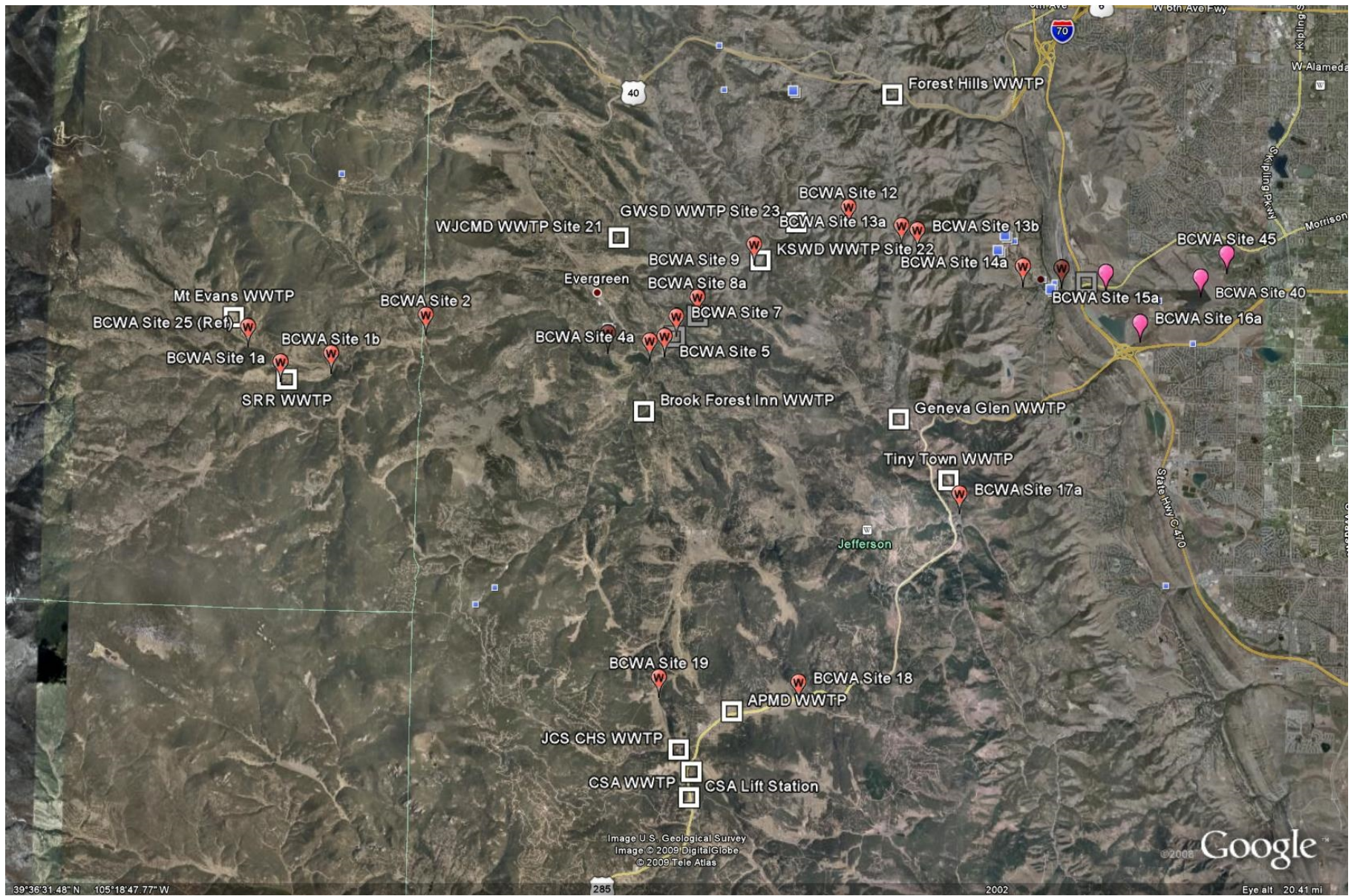


Figure 4 Bear Creek Watershed Sampling locations (Not all labels shown)

Table 2 **Methods and detection limits for laboratory analyses.**

Analyte	Method*	Detection limit
Total Suspended Solids	2540 D	4 mg/L
Total Dissolved Solids	2540 C	4 mg/L
Chlorophyll	10200 H (modified)	0.1 mg/m3
Orthophosphate	4500-P G	2 µg/L
Total Phosphorus	4500-P G	2 µg/L
Nitrate+Nitrite	4500-NO3 I	2 µg/L
Total Nitrogen	4500 TN	2 ug/l

P1 Data Results

The monitoring plan is detailed in the *Bear Creek 2010 Sample Plan Version 2010.02*, which is posted on the Association website monitoring page at www.bearcreekwatershed.org. The monitoring plan is reviewed annually and updated as appropriate. The Water Quality Control Division staff reviews the annual monitoring plan (generally in December) and proposes changes as appropriate. The dual review is consistent with the requirements of the *Bear Creek Control Regulation*. The 2010 data results are contained in the *2010 Bear Creek Master Spreadsheet* posted on the Association website monitoring page. Monthly summary reports are provided to the Association Board and these data files are also posted to the website. Selected data and a summary of the water quality management program is presented in the *2010 BCWA Annual Report WQCC (BCWA, April 2010)*, which also posted with previous Association annual reports.

P3 - Stream Monitoring Program

Purpose

The Association conducts special stream and lake monitoring programs within the Bear Creek Watershed including Bear Creek and Turkey Creek Drainages (North and South Turkey Creek). The monitoring plan is detailed in the *Bear Creek 2010 Sample Plan Version 2010.02*, which is posted on the Association website monitoring page at www.bearcreekwatershed.org. The monitoring year divides into a warm-season period with more intense sampling and a cold-season period, designed to provide minimal winter and spring data. This data report summarizes temperature and water quality monitoring data, sampling results obtained from in-stream locations, and data from five-wastewater treatment plant (WWTP) effluents. The complete 2010 Cold-season and Warm-season water quality data set is an electronic data summary report and spreadsheet.

The program is a cooperative effort between the Association and the five larger wastewater treatment plant dischargers: Evergreen Metropolitan District (EMD), West Jefferson County Metropolitan District (WJCMD), Kittredge Sanitation and Water District (KSWD), Genesee Water and Sanitation District (GWSD), and the Town of Morrison. This warm-season 2010 monitoring program began April-May 2010 with completion in September-October 2010. The in-stream monitoring program provides more detailed water quality information specifically for temperature, pH, dissolved oxygen, specific conductance, total ammonia, nitrate+nitrite, dissolved phosphorus, and total phosphorous, with calculated total inorganic nitrogen in Bear Creek watershed streams.

The Cold-season temperature monitoring program collected data from 15 in-stream watershed locations, including the eight identified Colorado Division of Wildlife (CDOW) fish survey sites, and the five “larger” wastewater plant dischargers to Bear Creek. During the cold-season no chemical or biological monitoring or sampling was performed at any of the watershed locations.

The 2010 Warm-season sampling and monitoring program collected data from 34 locations (including the five wastewater treatment plants-WWTP) within the Watershed. The Program included the eight identified Colorado Division of Wildlife (CDOW) fish survey sites.

Monitoring for pH, dissolved oxygen, temperature and specific conductance was performed monthly at 34 Watershed locations, including the five WWTPs. Sampling for Total Ammonia, Nitrate+Nitrite, (calculated

Total Organic Nitrogen), Dissolved Phosphorus and Total Phosphorous was performed coincidentally with monthly monitoring. Twenty of the 34 locations sampled (including WWTPs), were coincident with temperature dataloggers. Chemical and biological samples analyzed by GEI Consultants/Chadwick Ecological Consultants, Inc. in Littleton, Colorado. WWTP effluent data tables summarize monthly process control sheets and results of permit- and non-permit required effluent analyses collected by dischargers.

Flow data summarizes the two flow gages located on Bear Creek. These locations include above Evergreen Lake and above Morrison. Manual flow measurements performed at watershed locations through the program period. Weather data from the reporting station located at the EMD WWTP collected, analyzed and summarized. Table 3 lists sampling and monitoring sites utilized in 2010 program.

Table 3 BCWA Monitoring Sites

Site ID	Site Location by Stream Segment	2010 May-October		2010-11 Off-season	Reference
		Data Logger	Chemistry	Data Logger	Site
Segment 1a					
Site 1a	Above Lost and Found (Singin' River Ranch) complex	x	x		R
Site 1b	Below West Bryant Singin' River Ranch-Williams Property		x (Alternative)		
Site 2	Above Evergreen Lake at Clear Creek County line	x			
Site 3a	Above Evergreen Lake at CDOW Site	x	x	x	
Segment 1b					
Site 15a	Bear Creek Segment 1b at the USGS gaging station within Bear Creek Park	x	x	x	R
Site 27a	Above Morrison WWTP effluent discharge (Below Ward Ditch)	x(new)		x	
Site 27b	Above Morrison WWTP effluent discharge (above Ward Ditch)	x (new)			
Site 24	Morrison WWTP Eff	x			
Segment 1d					
Site 4a	Evergreen Lake Surface, profile station	x			R (PROFILE)
Site 4b	Evergreen Lake Profile Station, one meter down	x	x		
Site 4c	Evergreen Lake Profile Station, two meters down	x			
Site 4d	Evergreen Lake Profile Station, three meters down	x			
Site 4e	Evergreen Lake Profile Station, four meters down	x	x		
Segment 1e					
Site 5	Above EMD WWTP, at CDOW downtown site	x	x	x	R
Site 7	Below EMD WWTP effluent	x			
Site 8a	Bear Creek Cabins at CDOW Site	x	x	x	
Site 9	O'Fallon Park, west end at CDOW Site	x	x	x	
Site 12	Lair o' the Bear Park, at CDOW site	x	x	x	
Site 13a	Below Idledale, Shady Lane at CDOW site			x	
Site 14a	Morrison Park west end of town, at CDOW Site	x	x	x	R
Site 20	EMD WWTP Eff	x			
Site 21	WJCMD WWTP Eff	x			
Site 22	KSWD WWTP Eff	x			
Site 23	GWSD WWTP Eff	x			
Segment 2					
Site 45	Lower Bear Creek, below reservoir concrete trace/ weir (Plunge pool)	x	X		R
Segment 3					
Site 25	Vance Creek (Mt. Evans Wilderness drainage)	x	X		R
Segment 4a					
Site 47a	Upper Coyote Gulch		x		
Site 47b	Lower Coyote Gulch, discharge into reservoir		x		R
Segment 5					
Site 26	Cub Creek, Upstream of Hwy 73 bridge, south of EMD WTP	x			
Site 50	Cub Creek, Upstream of Cub Creek Park	x	x		R
Site 35	Cub Creek, Upstream @ Brookforest Inn	x	x		R

Site ID	Site Location by Stream Segment	2010 May-October		2010-11 Off-season	Reference
		Data Logger	Chemistry	Data Logger	Site
Site 39	Genesee Reservoir	X (profile)			
Segment 6a					
Site 16a	Turkey Creek within Bear Creek Park at old USGS gage	x	x	x	R
Site 18	South Turkey Creek Aspen Park Metropolitan District	x	x		
Segment 6b					
Site 17b	Confluence of North and South Turkey Creeks, above on NTC	x			
Site 19	North Turkey Creek Flying J Ranch Bridge	x	x		R
Segments 7 and 8					
Site 37	Summit Lake outfall, Mainstem from Lake at first ripples (Segment 7)		x		R
Site 36	Summit Lake outfall (Mount Evans Wilderness) (Segment 8)		x		R
Site 38	Bear Creek at Bear Tracks, Bridge (Segment 7)		x		

Monthly measurements performed in the morning and began at approximately 08:00 in Evergreen Lake. Measurements recorded with an YSI Professional hand-held meter. The meter utilizes a multi-probe sensor, capable of measuring pH, Temperature, Dissolved Oxygen and Specific Conductance simultaneously. Measurements are logged, retained in the on-board computer, and then manually downloaded. Typically, the logged data manually downloaded by viewing each file and transcribing data onto monthly Logsheets. The data was entered into a spreadsheet. Prior to the program, the meter was calibrated by certified technicians. Prior to each monitoring event, the meter was calibrated for each parameter, using a purchased calibration solution for specific conductance and purchased pH buffers (two-point calibration, 7.00 and 10.01). All calibrations were documented on a Calibration Logsheets.

Fresh batteries installed in the meter at the start of the program and batteries replaced when the observed battery charge reached 50%. Flow measurements were performed coincidentally with monthly sampling and monitoring. A Global Water flow probe Model FP101 was used and values obtained were combined with stream width and depth measurements to calculate estimated streamflow.

Monthly sampling for Total Ammonia, Nitrate+Nitrite and Total Phosphorous was performed concurrently with monthly monitoring at 20 locations. The monthly sampling and monitoring was also coordinated with permit sampling performed by the WWTPs discharging into Bear Creek. The reason for this coordinated effort was to attempt to provide a water quality “snapshot” of Bear Creek at that point in time.

WWTP effluent Total Ammonia, Nitrate, Nitrite and Total Phosphorous samples are analyzed by treatment plant laboratories: EMD, WJCMD and KSWD plant effluents were analyzed by EMD personnel, as typically done for CPDES permit reporting. EMD personnel utilize the EPA-approved Method 4500-NH3 D. ammonia selective electrode, *Standard Methods for the Analysis of Water and Wastewater, 21st Edition* for Total Ammonia analysis, EPA-approved HACH Method 8190 (equivalent to Method 4500-P B, 5 & P E Total Phosphorous, *Standard Methods for the Analysis of Water and Wastewater, 20th Edition*) for Total Phosphorous and HACH Method 8039, cadmium reduction method for Nitrate analysis. Total Phosphorous and Nitrate analyses were performed with the HACH 2010 spectrophotometer. Similarly, GWSD WWTP personnel analyzed plant effluent per approved methods: For Total Ammonia, Method 417 E., *Standard Methods for the Analysis of Water and Wastewater, 16th Edition*; Total Phosphorous, HACH Method 8048, Nitrate HACH Method 8039 and Nitrate HACH Method 8153. Total Phosphorous, Nitrate and Nitrite analyses were performed with the HACH 2010 spectrophotometer. The Town of Morrison utilizes an outside analytical laboratory for effluent testing of Total Ammonia and Total Phosphorous.

Stream Monitoring and Sampling Data

Monthly stream monitoring and sampling data tabulated into datasets. Data was retrieved from the YSI memory shortly after each monitoring event. Data are transcribed onto logsheets and subsequently entered onto Excel spreadsheets. Each monitoring group (watershed stream Sites and WWTP effluents) has an

individual folder, with one spreadsheet and multiple worksheets of data. Minimum, maximum, average and standard deviation analyses were performed on this (and mostly all) data.

Programmable temperature dataloggers measure and record watershed stream and WWTP effluent temperatures every thirty minutes. The loggers used in the Program are Onset Computer Corporation brand, HOBO H8 and model Water Temp Pro v2 (U22) programmable dataloggers. Prior to the start of the monitoring program, all model dataloggers were returned to Onset for a NIST (National Institute of Standards and Technology) one-point certification and a 'tune-up'. The one-point certification was performed against calibration standards at 20°C. The 'tune-up' consists of a new battery and quality control testing, assuring the dataloggers meet manufacturer's operating specifications. This process occurs every spring, prior to the start of the special stream monitoring program. The Association maintains a fact sheet with temperature monitoring protocols, as included in the Association annual report.

The dataloggers were programmed for measurements every thirty minutes at an office computer equipped with the Onset software. At this frequency, the memory capacity is approximately 165 days for the H8 series logger and 905 days for the U22 (Water Temp Pro) series logger. The Association employs newer models with delayed-start capabilities. Logsheets were utilized to record the exact time of deployment and retrieval of all units, so that erroneous measurements (measurements recorded out of water) could be omitted during the data evaluation process.

The U22 series loggers were utilized in all watershed stream locations. These loggers were downloaded to a shuttle device. Occasionally, the download process occurred precisely at the measurement instance and a measurement was lost. There are no watertight cases required for the U22 model loggers. The date and deployment time for all loggers is noted on a logsheet. After downloading the last logger in the Watershed, the laptop and shuttles are transported to the desktop computer with the Onset software at the EMD Administration office. The logger data is transferred from the laptop and from the shuttles to the desktop. The shuttles are connected to the computer via a download cable, and data on the shuttles are individually downloaded into separate program files.

30-minute datalogger temperature measurements were exported from the Onset Computer software into Excel spreadsheets. Each download of temperature data is treated as a file in the Onset software. Once the Onset file formats had been exported and saved as separate Excel files, the Excel spreadsheets for each location were combined into one Excel spreadsheet with multiple worksheets. Therefore, each Excel file contains multiple worksheets, one for each separate download of data, and a summary worksheet. The master dataset spreadsheet contains separate worksheets for each Site in the watershed, displaying all temperature datalogger values and statistical analysis, as well as sampling and monitoring data and statistics.

The date and time recorded on the Launch/Retrieval Logsheets were used to eliminate erroneous temperature measurements prior to data analysis. The majority of these erroneous measurements were eliminated by utilizing the shuttle devices to field-download data. Occasionally, the field download process occurred exactly at the time of a measurement, and an erroneous value was recorded or missed. These were also removed from the raw data prior to analysis. Once in a spreadsheet format, the data was evaluated against the underlying standard Weekly Average Temperature (WAT) criteria, against the underlying standard Daily Maximum Temperature (DM) criteria and against the Maximum Weekly Average Temperature (MWAT) criteria. Percentages of compliance were calculated. Weekly Average Temperatures were determined by calculating the mean temperature of seven consecutive days of data beginning with either April or May or the first day of data collection. Any lack of data collection resulting in a data gap of one day or more, required that the seven-day period begin anew. Maximum Weekly Average Temperatures were determined by evaluating the calculated Weekly Average Temperatures. Daily Maximum values were obtained by calculating the average temperature of a two-hour period beginning with the first temperature recorded, and determining the maximum value from each day. Again, any lack of data collection resulting in a data gap more than two hours, required that the two-hour calculation period begin anew. In most cases, there were four measurements in a two-hour period.

Since there are five, “larger” wastewater treatment facilities that discharge into Bear Creek (four into Segment 1e and one into Segment 1b), an effort was undertaken to analyze effluent parameters that would be consequential to the receiving waters. Table 4 lists the parameters of concern (Effluent Flow, Temperature, Dissolved Oxygen, pH, Total Ammonia, Nitrate, Nitrite (GWSD only), and Total Phosphorous) that were collected and analyzed. Only data that typically comprises daily Process Control and permit-mandated monitoring was reviewed. In prior years, the same data was collected and combined with monitoring and measurements taken in Bear Creek. This combined data was introduced to separate temperature, dissolved oxygen models to document existing effects, and predict possible outcomes of specific scenarios.

Table 4 Wastewater Treatment Plants and Parameters

WWTP	Parameters
EMD	Flow, pH, Temperature (Temp), Dissolved Oxygen (DO); Total Ammonia (NH ₃), Nitrate (NO ₃), Nitrite (NO ₂), Total Phosphorous (TP); Total Inorganic Nitrogen (TIN), Temp Datalogger (logger)
WJCMD	Flow, pH, Temp, DO, NH ₃ , NO ₃ , NO ₂ , TIN, TP, logger
KSWD	Flow, pH, Temp, DO, NH ₃ , NO ₃ , NO ₂ , TIN, TP, logger
GWSD	Flow, pH, Temp, DO, NH ₃ , NO ₃ , NO ₂ , TIN, TP, logger
Morrison	Flow, pH, Temp, DO, NH ₃ , TP, logger

The sampling and monitoring portion of the program was coordinated with the permit required effluent sampling. This occurred on Thursdays during the program.

Weather (local)

A National Weather Service Cooperative Reporting Station Number 052790 is maintained at the EMD WWTP. Daily high and low air temperatures and precipitation are recorded and transmitted monthly to the National Weather Service. Weather data was tabulated and correlated with Bear Creek stream flows (obtained at the USGS gage above Evergreen Lake) for the Program. Weather data collected during the program period was compared to the available historical weather records, obtained at the NWS High Plains Climate Center.

Gaging Station Stream Flows

A USGS stream gage (USGS 06710385) maintains a location above Evergreen Lake, near the CDOW fish survey site. The gage location is adjacent to the Denver Mountain Parks golf course and restaurant (Keys on the Green) parking lot. The second gaging station is located below the temperature datalogger location ID MORR10, above the town of Morrison, just west of the Highway 8 Bridge over Bear Creek. This station (BCMORCO 06710500) is maintained by the US Army Corps of Engineers and the Colorado Division of Water Resources. Weekly stream flow graphs were printed from both stations and filed for record. Monthly average daily flows from both gages exported to a spreadsheet for comparison with historical data.

There were 26 years of historical record available for the gage above Evergreen Lake (October 1984 through September 2010). For the gage located in Morrison, there were 91 years of historical USGS record available. Although flow records began at this location in 1899, the most complete data record exists from 1919 through 2007. For the USGS gage within Bear Creek Lake Park, there were 23 years of record. Historic records obtained from the USGS National Water Information system website.

Association Data Record

Data Management

Large quantities of varied data were collected during the Program: Monthly stream monitoring and sampling, laboratory results, thirty-minute temperature measurements from dataloggers, wastewater treatment plant effluent process control and permit monitoring data (from five treatment plants), weather statistics and stream flows comprise raw data. All data are stored on an office computer, using Microsoft Office XP Professional software. The majority of the data resides in and analyses occurred in Excel spreadsheet format. Data nightly backed up to a server.

Depositories

The Association data is located at two different locations. Watershed data collected with the assistance of EMD staff is maintained on computer systems at the EMD offices. All raw watershed data electronically forwarded from EMD staff to the Manager for data summary and analyses. RNC Consulting LLC maintains all monitoring data for all Association monitoring programs. Data is kept on a computer with daily back-up to an external hard drive. Additionally, a back-up set of data is kept on data discs.

2010 Association Data

P1 monitoring program

The P1 monitoring program is contained in a spreadsheet titled *Bear Creek Reservoir 2010 Master Spreadsheet*. The spreadsheet contains all data analyses. Copies of the spreadsheet distributed to Association membership, WQCD staff and interested parties in February 2010 after approval from the Association Board (Bear Creek Association February 2010).

P3 Monitoring Program

The P3 monitoring program is contained in a spreadsheet titled *Bear Creek Watershed Data Summary 2010*. This spreadsheet is too large to post on the Association Website and is only available from disc or Thumb-drive. The file contains the complete watershed field data, including QA/QC temperature data and field chemistry; along with Association data processing.

Special Data Reports of Historic Data

A specialized Temperature spreadsheet contains all temperature data from 1997-2009 for Bear Creek Reservoir and the Bear Creek and Turkey Creek monitoring sites (Bear Creek Association March 2010). Other summary spreadsheets include: A spreadsheet of available total inorganic nitrogen (TIN) data for P1 sites (2000-2009) and selected watershed sites in 2007; A summary spreadsheet of all high altitude data; and a summary spreadsheet of Bear Creek Reservoir aeration operations.

2010 Association Excel Spreadsheets and Technical Memorandums Posted to Website

1. Bear Creek Reservoir 2010 Master Spreadsheet (February 2011)
2. 2010 Watershed Data Report summary
3. Bear Creek Watershed Association Surface Water Monitoring Program Version 2010.02
4. 2010 macroinvertebrate spreadsheet (raw data WQCD)
5. Macroinvertebrate spreadsheet summary (all years)
6. 2010 Fishery Master and 2010 DOW Raw Fishery Data
7. 2010 flow Study Technical Memorandum
8. Coyote Gulch master spreadsheet and 2010 Summary report Technical Memorandum
9. Site master spreadsheet
10. Site Master Maps Series (Google Earth Maps)
11. 2010 Recreational Uses Technical Memorandum
12. 2010 Aeration Study Technical Memorandum
13. BCWA 2010 Kerr/Swede Summary Technical Memorandum
14. BCWA 2010 Bear Creek Reservoir Sediment Study Technical Memorandum
15. BCWA High Elevation Field Data Summary
16. High Quality Evergreen Lake data Summary

Electronic Transfers WQCD/ Depositories

1. Spreadsheet watershed QA/QC spreadsheet data only (WQCD - 4); depositories (2)
2. Spreadsheet watershed QA/QC spreadsheet with summary information and standard analyses (WQCD - 2); depositories (2)
3. Temperature record (WQCD - 2); depositories (2);
4. WQCC annual report, 2010 Data Report; (WQCD - 2), depositories (2)

P2 – 2010 Supplemental Sampling Of Restoration Projects

Coyote Gulch

The Association samples Coyote Gulch at two-sites on a monthly basis (Figure 4). This paired sample design is characterizing the nutrient reduction (Total phosphorus and Nitrate-nitrogen) from an erosion restoration project. The Association also gathers field parameter data for temperature, pH, dissolved oxygen, and specific conductance. The Association monitors flow to make loading estimates. This restoration project is a potential Association trading project, which will be based on a 5-year post-construction data set. The Association produces a summary report in January of each year for the previous year's data (Technical Memorandum 2010.03 –Coyote Gulch 2010 Data Summary, BCWA). Table 5 shows summary loading data for pre-construction compared with post-construction restoration. The project has reduced the base-load of total phosphorus reaching Bear Creek Reservoir (Figure 5).

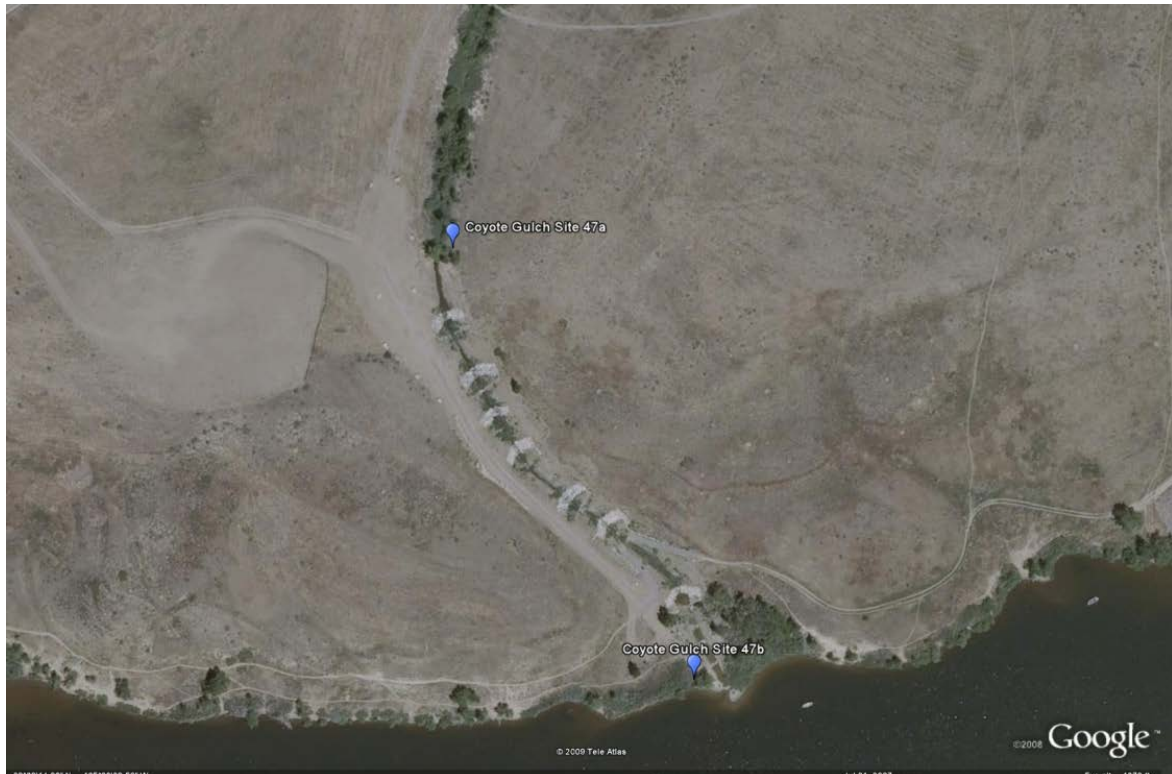


Figure 5 Coyote Gulch Sampling Points and Restoration Drop Structures

Table 5 Average and total pounds pre month at monitoring sites as base load

Average Loading Pounds Per Year					
		Reservoir		Above Project	
		Nitrate	T Phos	Nitrate	T Phos
Pre-construction	2006-2007	200.7	20.0		
Post-Construction	2007-2008	128.7	4.4	160.9	5.2
	2009*	142.0	6.7	185.9	8.9
	2010*	203.7	8.1	216.7	8.5
Loading Pounds After Stable					
		Reservoir		Above Project	
		Nitrate	T. Phos	Nitrate	T Phos
Total Pounds		5,948	409	6,875	456
Average		180	12	208	14
Median		102	5	148	6
2009*/2010* average loadings per year excludes April storm loadings					

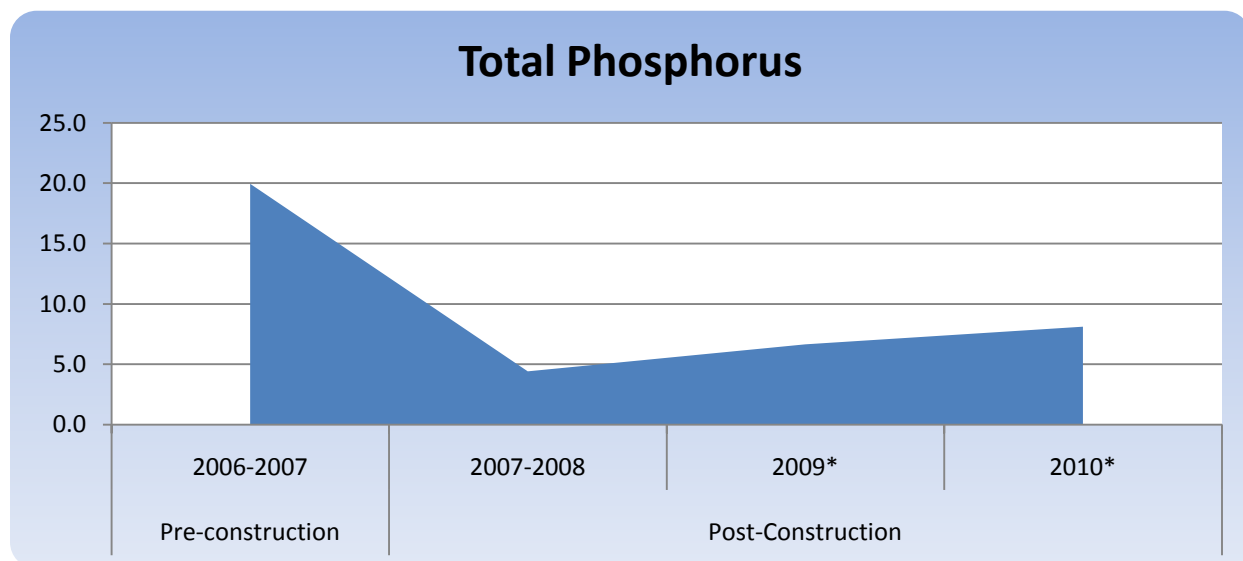


Figure 6 Average Annual Pounds of Total Phosphorus Reaching Reservoir

P4 – 2010 Supporting Watershed Study Efforts

Special Flow Study

A portable velocity meter spot checked estimated flows at CDOW fish survey sites (Table 6). The flow measurements match closely with the USGS measured flows at Keys on the Green and Morrison. The flow drop from Morrison Park to Bear Creek Park is due to diversion at the Harriman Ditch.

Table 6 2010 Bear Creek Watershed Stream Flow Data

Site ID	Site Location by Stream Segment	Flow cfs		
		7/8/2010	8/5/2010	9/2/2010
Segment 1a				
Site 1a	Above Lost and Found (Singin' River Ranch) complex	39.3	51.4	23.2
Site 3a	Above Evergreen Lake at CDOW Site	49.5	66.4	14.6
Segment 1e				
Site 5	Above EMD WWTP, at CDOW downtown site	62.2	59.4	25.7
Site 8a	Bear Creek Cabins at CDOW Site	63	77.6	24.3
Site 9	O'Fallon Park, west end at CDOW Site	52.4	77.5	27.1
Site 12	Lair o' the Bear Park, at CDOW site	63	76.1	28.3
Site 13a	Below Idledale, Shady Lane at CDOW site	74.1	76.9	38.4
Site 14a	Morrison Park west end of town, at CDOW Site	67.4	75.6	21.9
Segment 3				
Site 25	Vance Creek (Mt. Evans Wilderness drainage)	9.5	10.4	7.9
Segment 5				
Site 35	Cub Creek, Upstream @ Brookforest Inn	6	1.13	0.43
Site 50	Cub Creek, Upstream of Cub Creek Park	6.3	1.61	0.88
Segment 6a				
Site 18	South Turkey Creek Aspen Park Metropolitan District	0.41	0.1	0.01
Segment 6b				
Site 19	North Turkey Creek Flying J Ranch Bridge	1.9	1.2	0.52
Segments 7 and 8				
Site 37	Bear Creek, Mainstem from Lake 1/4 mile downstream (Segment 7)	3.1	17.9	3.87
Site 36	Summit Lake outfall (Mount Evans Wilderness) (Segment 8)	3	7.1	1.02
Site 38	Bear Creek at Bear Tracks, Bridge (Segment 7)	17.6		11.9

Macroinvertebrate Assessment

The macroinvertebrate integrity of Bear Creek is under assessment. Macroinvertebrate samples collected at the 9 CDOW fish survey sites along Bear Creek: Morrison (west end), Idledale, Lair o' the Bear Park, O' Fallon Park, Bear Creek Cabins, Main Street Evergreen (across from the Little Bear), above Evergreen Lake upstream of the USGS gaging station, at the Singing River Ranch, and Cub Creek. Table 7 summarizes Macroinvertebrate data. The cooperative macroinvertebrate sampling was done by the Association on September 20, 2010 at the DOW fish survey locations with analyze done by the WQCD. Sample collection done by the state timed-kick net methodology protocol. Annual macroinvertebrate samples collected in the fall at fish survey sites with a target of a five-year data set. The processed species indexes will help establish expected conditions. The Association has a raw data file available on the web site.

Table 7 2010 Macroinvertebrate Summary

Bear Creek Watershed 9/20/2010				
WQCD Station ID	Location	Total Taxa	2010 MMI_	O/E_p>half
122	above Morrison Park	27	80.5	1.018338
122a	at Lair of the Bear Park	24	62.2	1.019086
122b	at O'Fallon Park	25	57.7	1.189392
122C	at Baker Bridge (Idledale)	27	69.8	1.018617
5760A	at Cub Creek Park	18	55.5	0.750599
5762	below Evergreen	23	39.1	1.190047
5763	at Little Bear	28	56.6	1.19009
5764	at Key of the Green GC	18	36.1	0.850864
5764	at Key of the Green GC	15	37.4	0.680691
5768A	at Singing River Ranch	27	71.2	1.396792

CDOW Fish Survey Bear Creek

CDOW conducted their annual fish survey at eight locations September 2010 (Table 7). The survey included six historic sites and two additional sites. The added fishery survey sites were upstream of Evergreen Lake near Keys-on-the Green restaurant, and in the upper portion of the watershed at the Singing River Ranch.

There are complete fishery data surveys from five fish monitoring stations prior to 2005 (1991, 1994, 1999, 2002, 2003, 2004, and 2005). In 2005 and into future survey years there are seven to eight fish monitoring stations and CDOW will strive to monitor all fish survey sites each year to produce, at a minimum, a five-year complete record from 2005-2010. There are partial survey year records (2-4 fish monitoring sites) for 1988, 1989, 1990, 1987, 2000, and 2001). While these partial data years provide valuable information, caution must be used to extrapolate this data over the "Stream Reach". However, this data characterizes fishery behavior at specific locations in the "Stream Reach".

Table 8 2010 DOW Fishery Data

Station	Standardized Average Width (ft)	Species	2010			
			No./Acre	lb/Acre	No./Acre >12cm	lb/Acre >12cm
Williams Property Singing R. Ranch-	23	Brown	210	53	149	54
		Rainbow	0	0	150	94
		Stock RBT	150	94	----	----
		TOTAL	360	53	299	148
Dedisse Park	33	Brown	536	43	332	42
		Rainbow	71	17	75	32
		Stock RBT	----	----	----	----

Station	Standardized Average Width (ft)	Species	2010			
			No./Acre	lb/Acre	No./Acre >12cm	lb/Acre >12cm
		TOTAL	607	60	407	74
Downtown Evergreen	34	Brown	376	62	188	62
		Rainbow	42	9	33	9
		Stock RBT	----	----	----	----
			** One pass minimum population estimate			
		TOTAL	418	71	221	71
Bear Creek Cabins	32	Brown	941	102	462	101
		Rainbow	520	48	248	48
		Stock RBT	----	----	----	----
		TOTAL	1461	150	710	149
O'Fallon Park	31	Brown	1550	160	1058	152
		Rainbow	50	13	50	13
		Stock RBT	----	----	----	----
		TOTAL	1600	173	1108	165
Lair O' the Bear	29	Brown	1328	170	781	164
		Rainbow	124	22	95	21
		Stock RBT	----	----	----	----
		TOTAL	1452	192	876	185
Idledale	25	Brown	1224	156	768	152
		Rainbow	61	7	38	8
		Stock RBT	----	----	----	----
		TOTAL	1285	163	806	160
Morrison	30	Brown	752	86	398	84
		Rainbow	92	14	73	14
		Stock RBT	----	----	----	----
		TOTAL	844	100	471	98

Kerr/Swede Gulch Summary Data

Swede Gulch is listed on the 303(d) list as a low priority for E. coli. There is a discrepancy in the naming of the Swede/Kerr Gulch system. The United States Geological Survey maps used by the Division suggest that the mainstem is Swede Gulch. The Colorado Department of Transportation has maintained for decades an informational sign at the mouth of the gulch listing the gulch as Kerr Gulch. The locals also have identified the mainstem as Kerr Gulch with Swede Gulch as an upstream tributary. As such, the mainstem is Kerr/Swede Gulch with the western gulch upstream of the upper confluence as Kerr Gulch and the eastern tributary as Swede Gulch (Figure 5). The Division and Association agree this area maybe a good candidate to understand the impact of septic systems to the water quality in tributaries.

The Division and Association agree there is a water quality problem that requires further investigation. The Association commits to a 5-years monitoring program to evaluate E. coli on Kerr/Swede Gulch (confluence with Bear Creek, below confluence of Swede Gulch and just upstream of confluence on Kerr Gulch) and lower Swede Gulch. The Association will monitor E. coli at 4-sites (Figure 7) from January (provided winter flows) through December over a 5-year period. The Association will also collect data for temperature, pH, specific conductance and Dissolved Oxygen using the field probe. The Association will GPS selected sites and begin special monitoring program in May 2010. The Association anticipates using the wastewater treatment plant laboratories for the E. coli analyses. Periodically, the Association will collect duplicates for analyze at an outside laboratory.

Table 9 summarizes the 2010 data collected for Kerr/Swede Gulch study. Figure 8 shows the plotted E. coli results with Table 10 showing the 2010 E. coli geometric means. There is no exceedance of the E. coli standard within the system during 2010. Table 11 and Figure 9 show estimated flows within the drainage

system. Flow measurements were converted into monthly flow estimates as acre-feet per month (Table 12 and Figure 10). Table 13 and Figure 11 show predicted loading estimates for total phosphorus, dissolved phosphorus, ammonia and nitrate-nitrogen. The Association will attempt to document the potential nutrient loading contributions from septic systems within the drainage system.

Segment 5 Bear Creek

Swede, Kerr, Sawmill, Troublesome, and Cold Springs Gulches, and mainstem of Cub Creek from the source to the confluence with Bear Creek.

Segment 5 Water Quality Standards

- Temperature =TVS(CS-II) °C; April-October =18.2 (MWAT)/23.8 (DM) °C; November-March =9.0 (MWAT)/13.0 (DM) °C
- D.O.=6.0 mg/l; D.O.(sp)=7.0 mg/l
- pH=6.5-9.0
- E. Coli=126/100ml (Measured as a geometric mean of data)

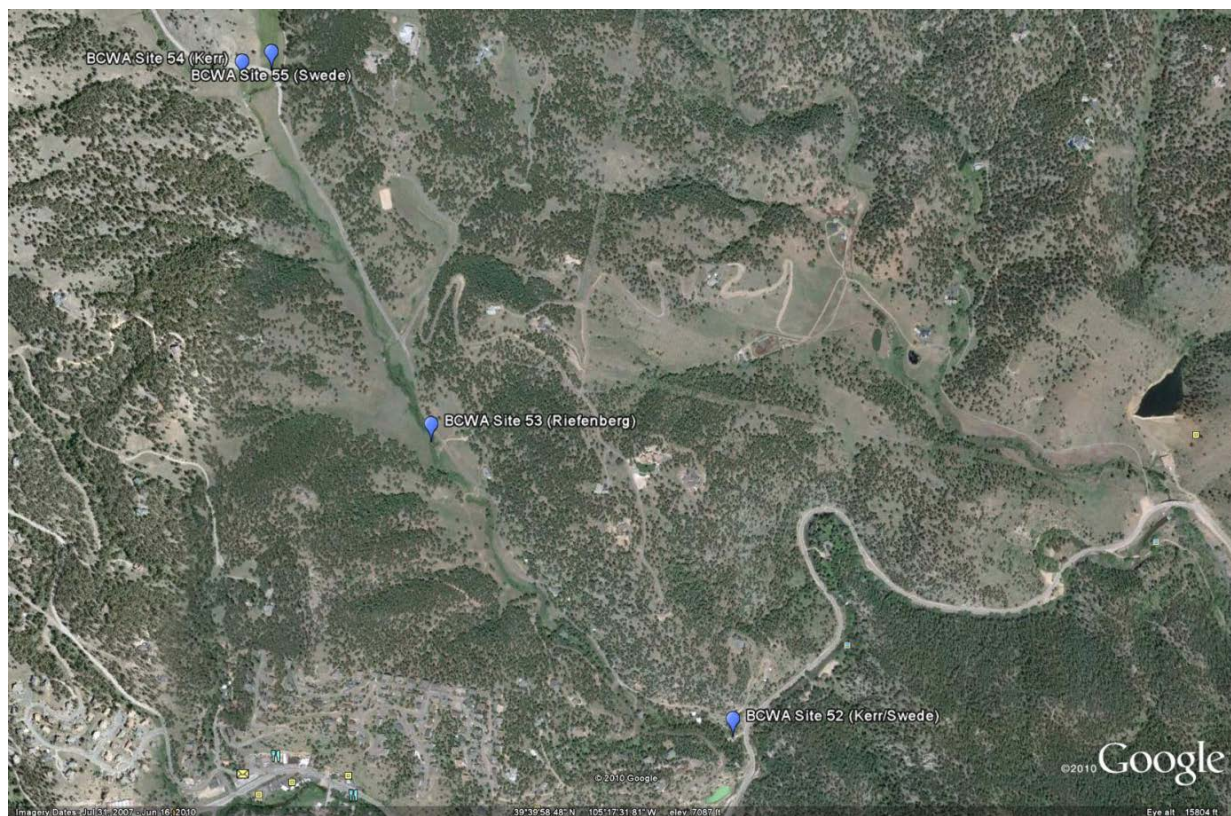


Figure 7 Kerr/Swede Gulch Sample Locations

Table 9 Kerr/Swede Gulch Sampling

BCWA Site	Time	Temp (C)	pH	SC (ms/cm)	DO (mg/l)	Rel NO3 (mg/l)	E. Coli (Cells/100ml)
5/25/2010							
Site 52 - Confluence	12:46	12.5	8.35	0.82	8.57	1.31	10
Site 53 - Riefenberg	13:01	14.6	8.31	0.82	8.12	1.01	6
Site 54 - Kerr	13:15	14.9	8.24	0.8	7.74	0.96	5
Site 55 - Swede	13:10	15.2	8.09	0.88	7.64	0.94	12
6/22/2010							
Site 52 - Confluence	13:20	17.9	8.38	0.83	7.48	2.13	40

BCWA Site	Time	Temp (C)	pH	SC (ms/cm)	DO (mg/l)	Rel NO3 (mg/l)	E. Coli (Cells/100ml)
Site 53 - Riefenberg	13:35	19	8.3	0.83	7.23	2.15	40
Site 54 - Kerr	13:50	19.1	8.24	0.81	6.63	2.07	76/90
Site 55 - Swede	13:45	21.2	8.22	0.86	6.79	2.13	38
7/20/2010							
Site 52 - Confluence	13:33	15.5	7.51	0.848	8.09		80/128
Site 53 - Riefenberg	13:22	16.2	7.64	0.848	7.73		48/160
Site 54 - Kerr	13:10	16.8	7.9	0.829	7.32		128/280
Site 55 - Swede	13:16	19.2	7.56	0.905	7.08		40/64
8/24/2010							
Site 52 - Confluence	11:14	12.7	8.57	0.84	10.29		52
Site 53 - Riefenberg	10:57	12.7	8.41	0.84	10.02		236
Site 54 - Kerr	10:43	12.5	8.34	0.81	9.52		32
Site 55 - Swede	10:37	13.5	8.26	0.86	9.69		36
9/28/2010							
Site 52 - Confluence	13:27	12	7.77	0.84	8.34		16
Site 53 - Riefenberg	13:44	14.3	7.94	0.8	7.48		16
Site 54 - Kerr	14:01	14.5	8.1	0.83	7.46		20
Site 55 - Swede	13:55	17.1	8.09	0.92	6.79		12
10/26/2010							
Site 52 - Confluence	9:15	2.4	7.98	0.85	10.27		2
Site 53 - Riefenberg	9:26	2.1	8.05	0.84	9.85		4
Site 54 - Kerr	9:36	1.8	8.24	0.84	9.81		2
Site 55 - Swede	9:40	1.7	8	0.85	9.8		4
11/16/2010							
Site 52 - Confluence	9:27	1.5	7.66	0.835	9.86		1
Site 53 - Riefenberg	9:40	2.2	7.9	0.819	9.64		1
Site 54 - Kerr	10:52	2.9	7.84	0.839	8.79		3
Site 55 - Swede	10:58	2.3	8.05	0.786	9.36		1
12/8/2010							
Site 52 - Confluence	1:49	0.9	8.3	0.848	11.31		2
Site 53 - Riefenberg	2:05	0.7	7.91	0.779	10.55		2
Site 54 - Kerr	2:20	0	7.91	0.781	10.84		11
Site 55 - Swede	2:16	0.3	7.92	0.822	10.28		6

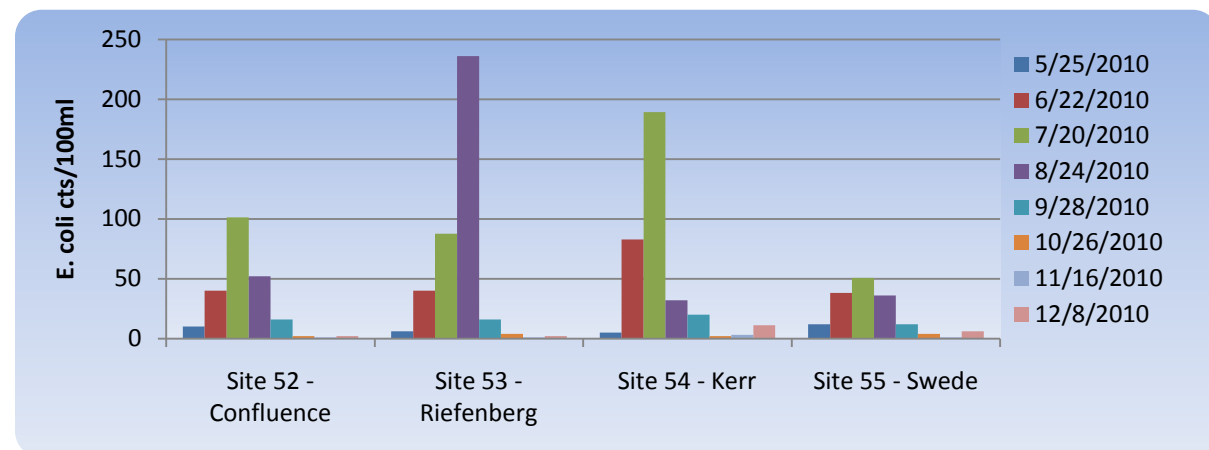


Figure 8 2010 E. coli Counts by Month

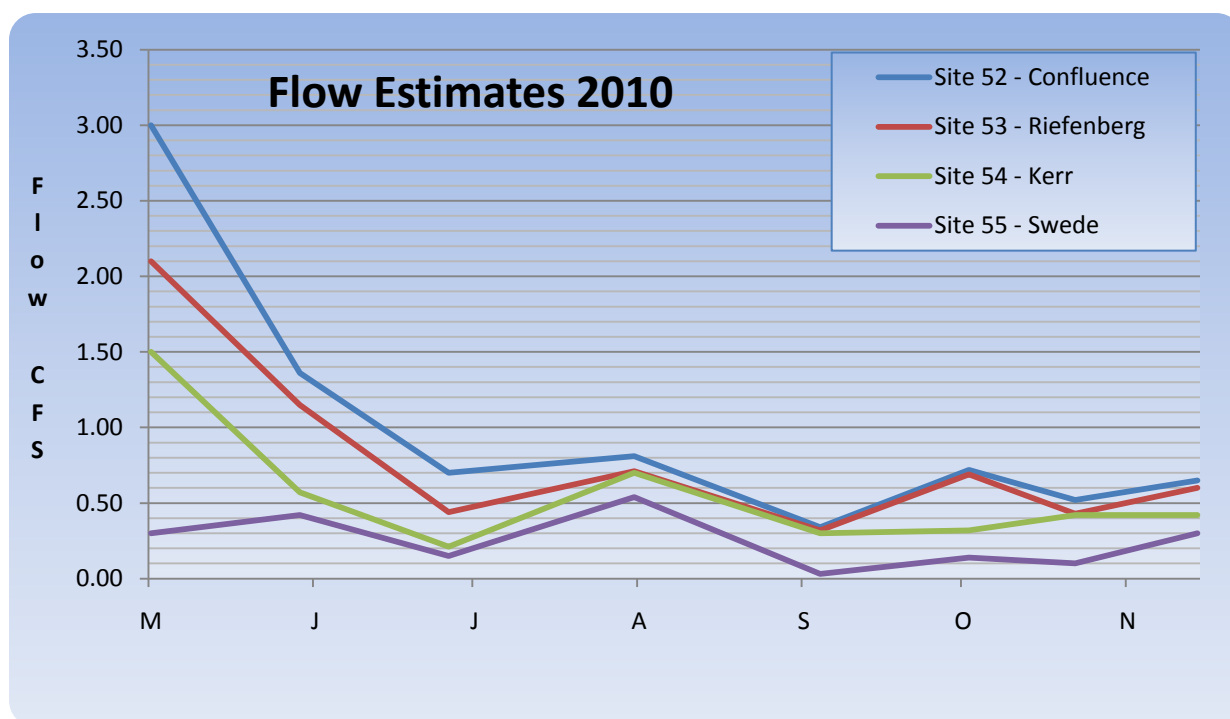
Table 10 E. Coli 2010 Geometric Mean Summary

BCWA Site	2010
	Geometric Mean
Site 52 - Confluence	13
Site 53 - Riefenberg	16
Site 54 - Kerr	24
Site 55 - Swede	13
Total	16

Note -There is no exceedance of the E. coli standard with the system

Table 11 Kerr/Swede Gulch Flow Estimates (CFS)

Site	25-May	22-Jun	20-Jul	24-Aug	28-Sep	26-Oct	15-Nov	8-Dec
Site 52 - Confluence	3.00	1.36	0.70	0.81	0.34	0.72	0.52	0.65
Site 53 - Riefenberg	2.10	1.15	0.44	0.71	0.32	0.69	0.43	0.60
Site 54 - Kerr	1.50	0.57	0.21	0.70	0.30	0.32	0.42	0.42
Site 55 - Swede	0.30	0.42	0.15	0.54	0.03	0.14	0.10	0.30

**Figure 9 2010 Flow Estimates by Site****Table 12 2010 Monthly Flow Estimates (Acre-Feet/ Month)**

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Site 52 - Confluence	184	81	43	50	20	44	31	40	494
Site 53 - Riefenberg	129	68	27	44	19	42	26	37	392
Site 54 - Kerr	92	34	13	43	18	20	25	26	270
Site 55 - Swede	18	25	9	33	2	9	6	18	121

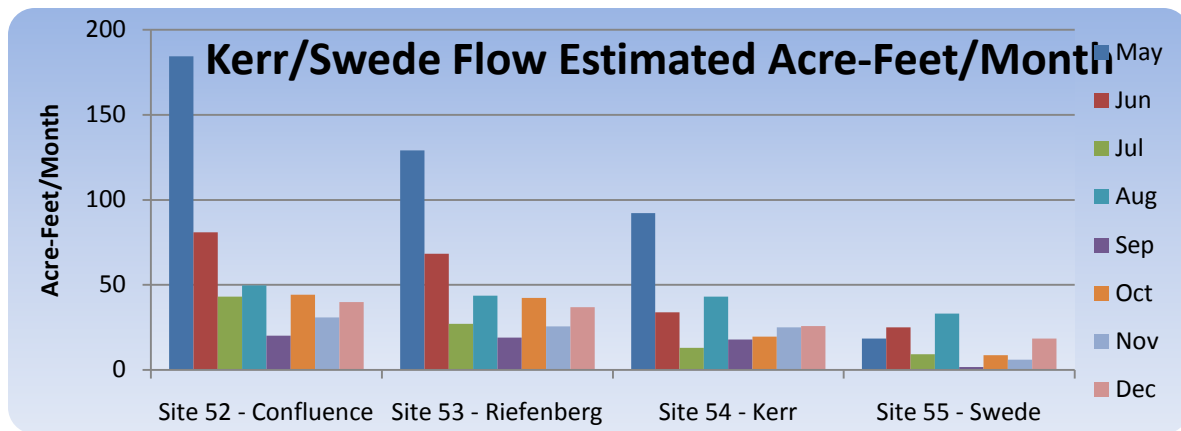


Figure 10 2010 Monthly Flow Estimates by Site

Table 13 November Chemistry Data Results with November Load Estimates

Site	15-Nov-10			
	Nitrate/Nitrite (ug/l)	Ammonia (ug/l)	Total Phosphorus (ug/l)	Total Dissolved Phosphorus (ug/l)
Site 52 - Confluence	197	43	43	4
Site 53 - Riefenberg	94	32	6	9
Site 54 - Kerr	225	42	22	3
Site 55 - Swede	61	37	37	10
Pounds Per November				
Site 52 - Confluence	16.59	3.62	3.62	0.34
Site 53 - Riefenberg	6.55	2.23	0.42	0.63
Site 54 - Kerr	15.31	2.86	1.50	0.20
Site 55 - Swede	0.99	0.60	0.60	0.16

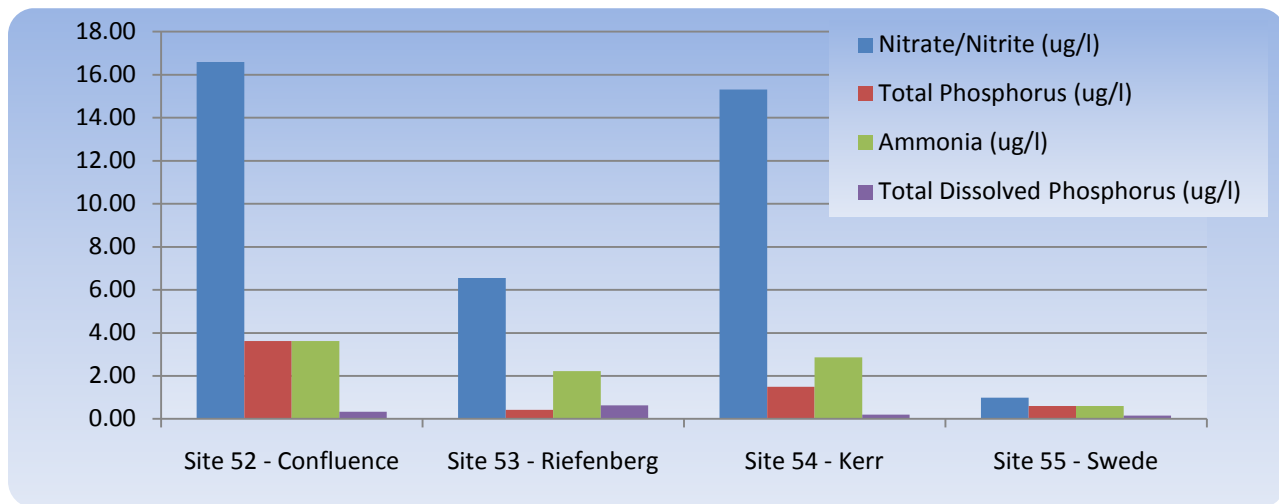


Figure 11 November 2010 Nutrient Loading in Kerr/Swede System

2010 Bear Creek Park Recreational Uses

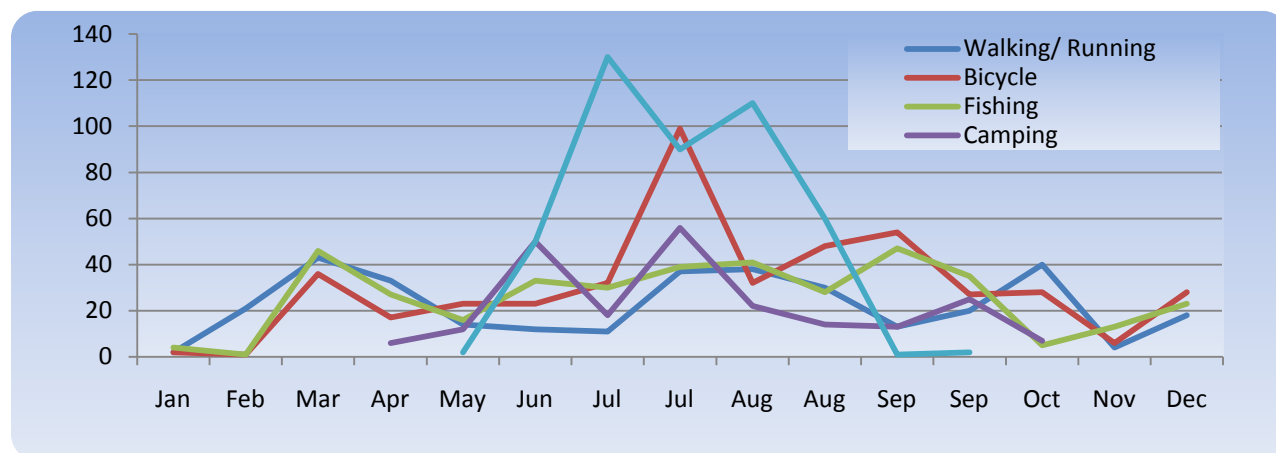
The Association collects limited data on recreational uses within Bear Creek Park during the monitoring events. Tables 14 and 15 predict recreational use estimates based on a 4-hour count. Figures 12 and 13 show major recreational uses predicted for typical week-days. Recreational uses in the Park increase dramatically on week-ends.

Table 14 Recreation Uses Based on Sample day Counts

Recreational Uses	Week-day - 1/2 Day estimates															Median
	Jan	Feb	Mar	Apr	May	Jun	Jul	Jul	Aug	Aug	Sep	Sep	Oct	Nov	Dec	
Archery			0	1	0	2	1	6	0	2	4	7	1	0	0	1
Walking/ Running	2	21	43	33	14	12	11	37	38	30	13	20	40	4	18	20
dogs	2	0	3	11	0	1	2	12	5	3	6	1	11	0	3	3
Bicycle	2	1	36	17	23	23	32	99	32	48	54	27	28	6	28	28
Horseback Riding			1	1	2	3	8	3	6	4	2	5				3
Stable Horses				15	16	28	14	23	28	27	24	17				23
Fishing	4	1	46	27	16	33	30	39	41	28	47	35	5	13	23	28
Boats BCR						1	2	4	5	6	3					4
Camping				6	12	50	18	56	22	14	13	25	7			16
Beach					2	50	130	90	110	60	1	2				55
Canoe/Sailboard (Soda)						1	4	3	5	1	2	1			1	2
Ski School training						1	3	5	3	2	1					3

Table 15 Recreation Uses estimated per Week-Day during Sampling Period

Recreational Uses	Week-day - Daily Use Estimates												Median
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Archery				2	0	4	6	2	6	2			2
Walking/ Running	4	42	86	66	28	24	75	68	43	80	8	36	43
dogs	4	0	6	22	0	2	17	8	9	22		6	6
Bicycle	4	2	72	34	46	46	131	80	102	56	12	56	51
Horseback Riding			3	12	13	20	14	20	20				14
Stable Horses				15	16	28	14	23	28				20
Fishing	8	2	92	54	32	66	80	69	75	10	26	46	50
Boats BCR						2	3	6	8				5
Camping				7	13	55	20	62	24	15			20
Beach					3	75	195	135	165				135
Canoe/Sailboard (Soda)						2	8	6	3			2	3
Ski School training						2	8	5	3				4

**Figure 12 Major recreational uses by Month**

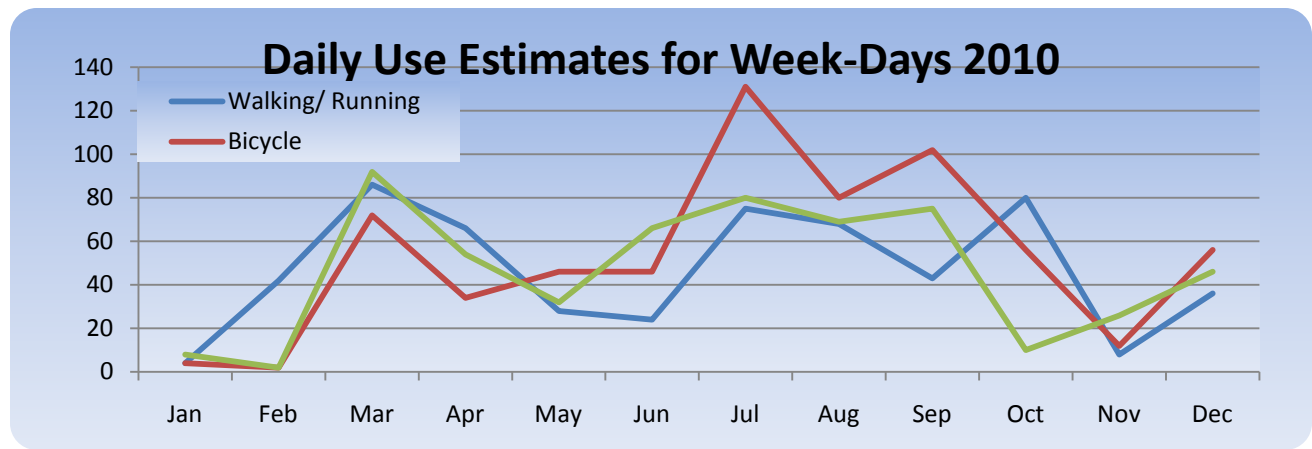


Figure 13 Daily Use Recreational Estimates for week-days in 2010

Bear Creek Reservoir Sediment Study

Sediment Survey Questions

1. What is the distribution of phosphorus in bottom sediments and is this phosphorus load evenly distributed across the reservoir bottom?
2. Do aeration operations affect to release of total phosphorus from bottom sediments?
3. Is the internal loading of phosphorus showing trends over time, temporal?
4. Is there a reliable method to determine if internally phosphorus loading is decreasing over time?
5. What is the potential annul contribution of phosphorus into the water column and when does this nutrient transfer occur?
6. Is the high organic build-up in the reservoir inlets affecting the amount of available phosphorus for transfer into the water column?
7. How does water-column phosphorus chemistry relate to sediment chemistry?

Sediment Survey Design



Figure 14 Sediment Sample Locations

Field sampled on August 26, 2010. Bottom samples obtained with a petite Ponar sampler. Two dredge drops were made at each site resulting in 1.5 to 3 liters of bottom mud. GPS coordinates were taken at each site. The locations in above figure are estimates. Two samples were bagged from the composite mud sample at the site One bag of sample was used for analyses and the second sample retained for future reference. The contents of the sample were placed in a pie tin. Samples were dried at 105 degrees C in an oven for 24 to 48 hours.

Total Organic Matter

An about 5 gram sample of the dried sediment was weighed, ashed in a muffle furnace at 550 degrees C for 1 hour and reweighed. The total organic matter (TOC) is volatilized and the percent difference is calculated to determine the estimated percentage of TOC.

Grain Size Distribution

A mechanical sieve “sandshaker” was used to determine the percentage distribution of selected grain sizes in the dried bottom sediments. The dried sediment was re-loosened into a sandy silt material. All bottom sediment material was less than U.S. Standard sieve 10 (0.08 inches) in diameter. As such all reservoir sediment ranges from coarse sand to clay size. The Sieve distribution used is shown in the following Table.

Grain-Size Term	ASTM No.	Mesh Opening (in)	Sieve Designation
Very Coarse and Coarse Sand	25	0.026	26 OPN
Medium Sand	60	0.009	9 OPN
Fine Sand	120	0.0046	46 OPN
Very Fine Sand	200	0.0029	29 OPN
Silt and Clay	<200		

Total Phosphorus Extraction Procedure - Distilled Water

1. Weigh 4 g of wet mud into 125 ml bottle with lid.
2. Add 20 mL of distilled water and shake manually over a one hour period.
3. Centrifuge at 3,500 rpm for 15 minutes.
4. Filter the solution through a 0.7 µm membrane filter.
5. Use 5 ml for analysis; retain remainder for dilution, if appropriate.

Analysis -Determine total phosphorus as water extractable P in wet mud using HACH method 8190 PhosVer 3 with acid persulfate digestion Test “N Tube method measured with a Hach DR2010 spectrophotometer at 890 nm.

Sediment Results

Data results are summarized in Figures 14, 15 and 16.

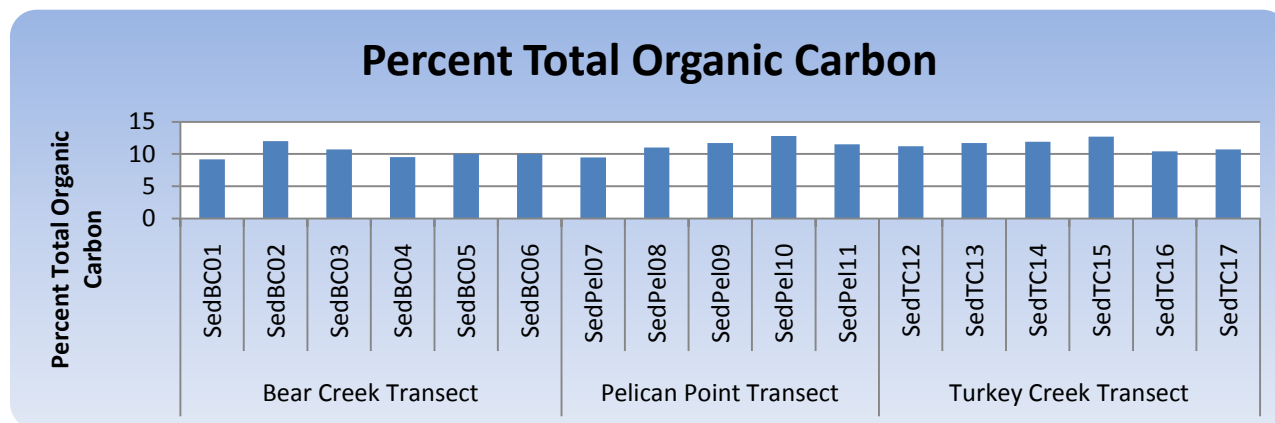


Figure 15 Sediment Total Organic Carbon

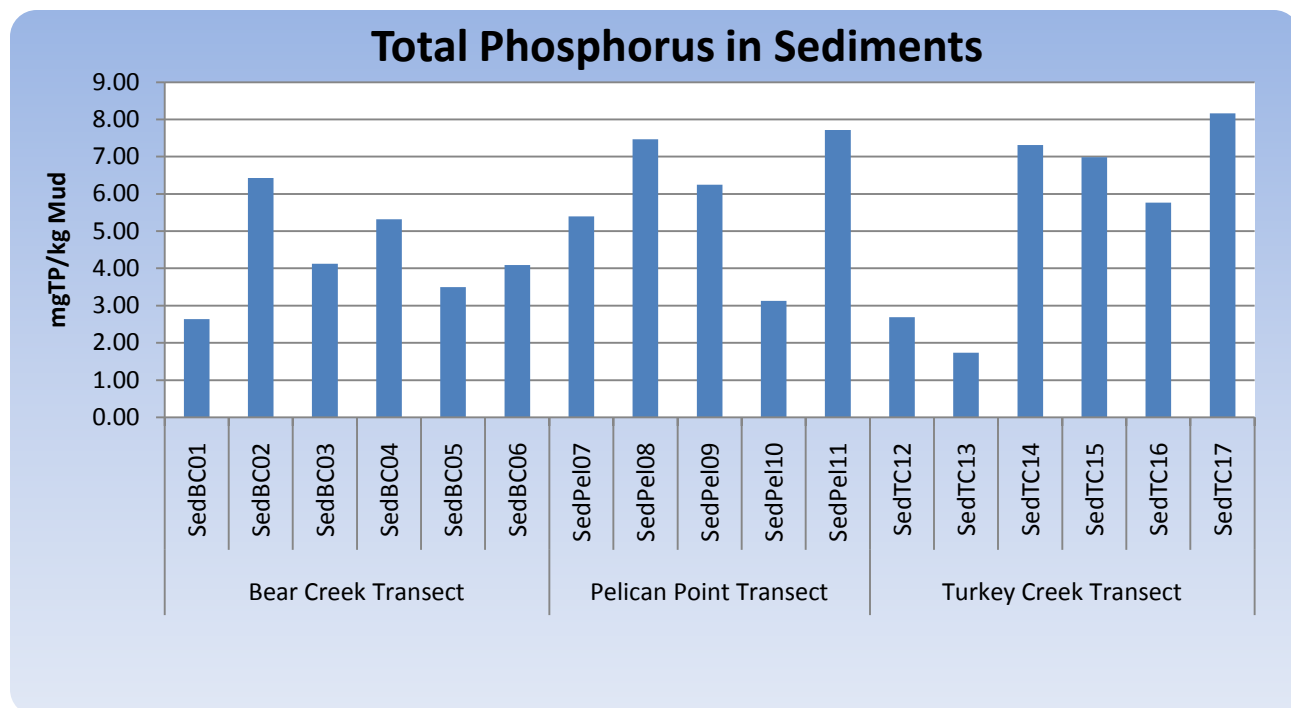


Figure 16 Sediment Total Phosphorus

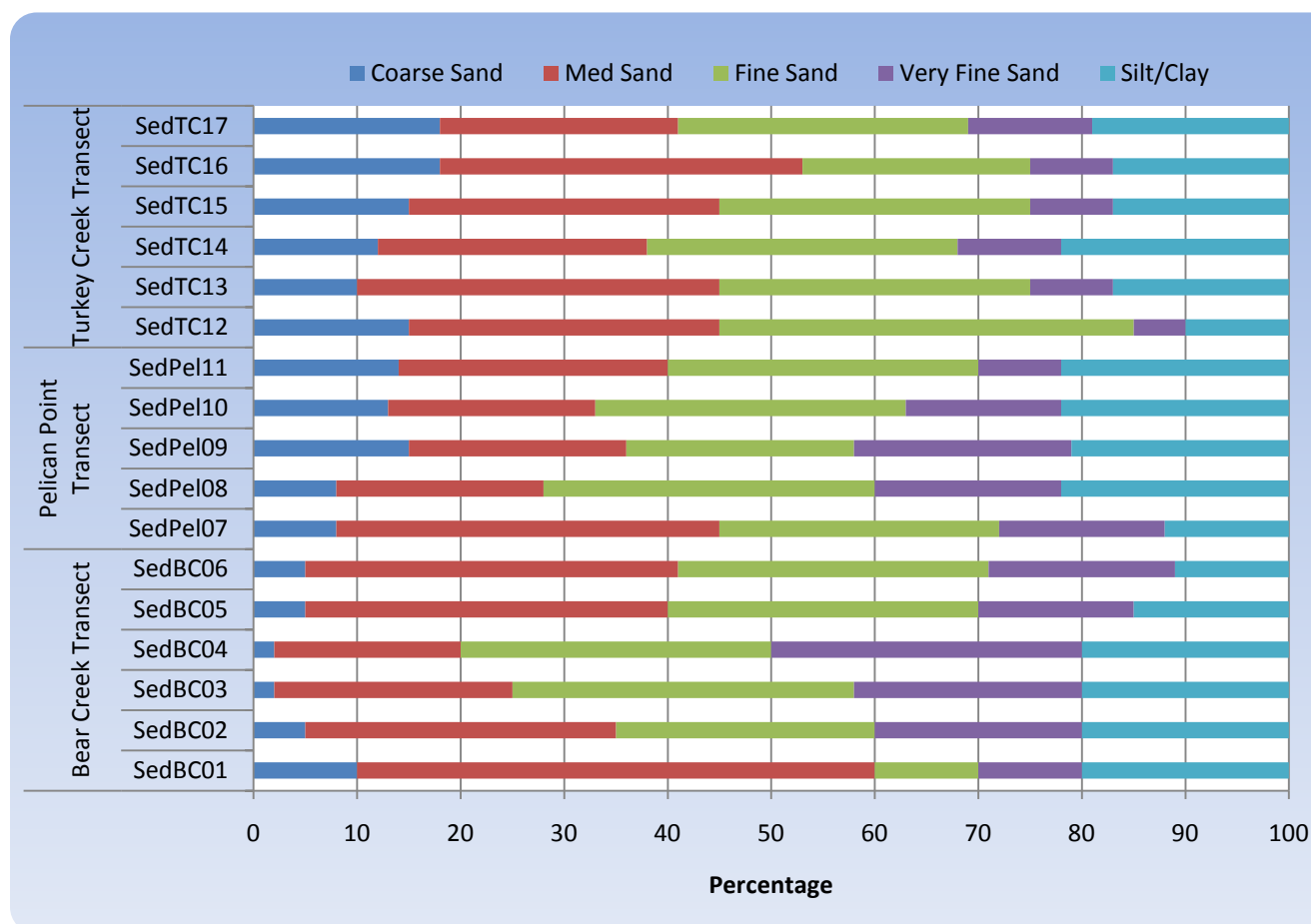


Figure 17 Sediment Grain Size Distribution

2010 Bear Creek Reservoir Aeration Log

The Association operates the Bear Creek Reservoir aeration system to minimize the aerator operations and maximize dissolved oxygen concentrations within the water column (Figure 17).

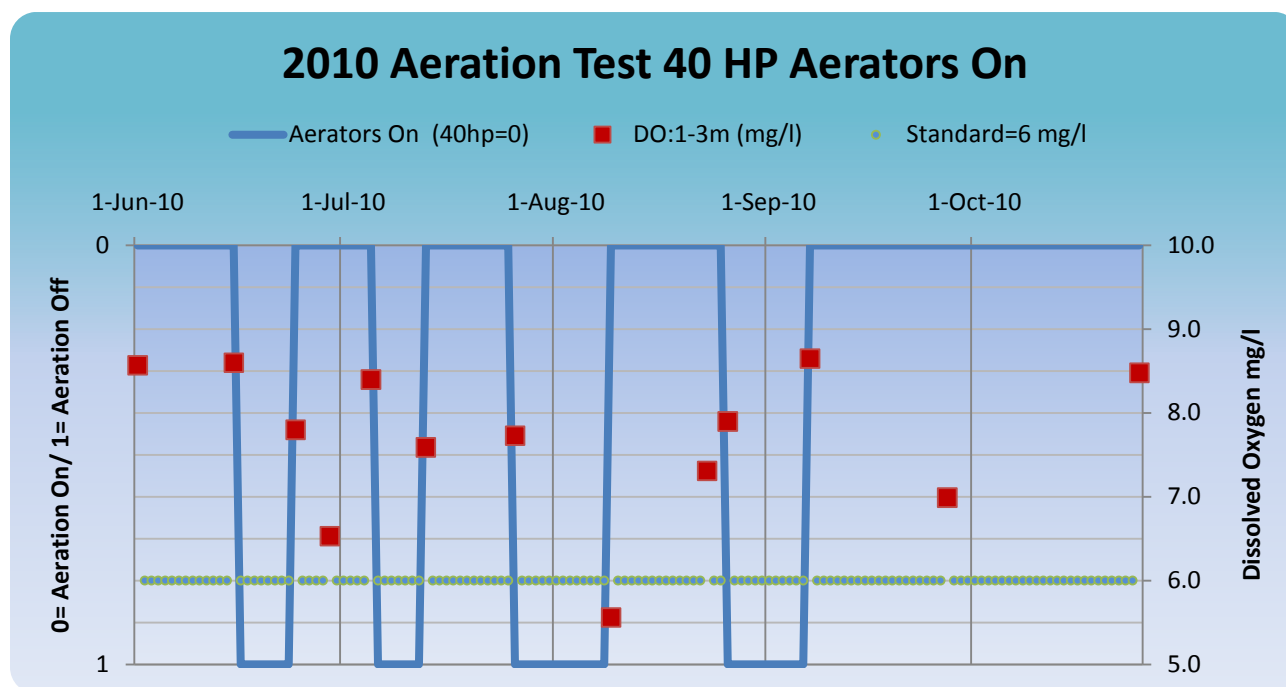


Figure 18 Aeration Operation and Dissolved Oxygen Levels

P3-Summary Bear Creek Watershed 2010 Monitoring Data

Overview

Sampling and Monitoring Program Notes

Data organization reflects the Colorado Water Quality Control Division's segmentation and water quality standards to waterbodies in the Bear Creek Watershed per Regulation 38. Sampling and monitoring data is presented for the calendar year, compared to applicable water quality standards. Site numbers identify exact locations, but are grouped into respective segments, with segment summary tables at the beginning of a segment group. All data collected is presented in table form, with summary analyses.

Temperature dataloggers that were in stream segments since January 1, 2010 were replaced with other loggers that had already returned from the manufacture after being recalibrated and recertified in early February ready to begin collecting data at 30-min intervals. The additional loggers were sent to the manufacturer for annual recalibration and recertification. The loggers were returned to sites and programmed to begin data collection at 30-minute intervals on the days that they were placed at the sites. All loggers were removed and data downloaded after September 30. WWTP loggers and selected stream loggers were repositioned at their sites and data collection resumed.

Stream and lake sampling and monitoring data, including pH, Temperature, Dissolved Oxygen, Specific Conductance, Ammonia, Nitrate+Nitrite, Total Inorganic Nitrogen (calculated), Total Nitrogen, Dissolved Phosphorus, and Total Phosphorous was collected from July through September, at 18 sites. Stream and lake temperature dataloggers were used at 29 Sites, including the Evergreen Lake profile station and the Genesee reservoir profile station, excluding the five WWTPs. Eight selected Sites collected datalogger temperatures from January 1 through September 30. The twenty-one remaining sites collected temperature data from April through September and May through October. Manual flows were measured at 19 sites in the watershed during the July to September timeframe.

Temperature Compliance

The Cold- and Warm-season timeframe was redefined by the adoption Regulation 38, which assigned calendar dates by Segment for cold-season and warm season regarding water quality standards for temperature. For this reporting format, the Cold-season program is defined as approximately November to March, depending on specific stream segments. Regarding temperature dataloggers, Cold-season locations included sites in all segments excluding segment 1d, segment 5, and segment 10, situated from above Evergreen Lake to below the outfall of Bear Creek Lake in the Bear Creek Watershed. Segment 1a (Sites 1a, 2, 3a), Segment 1b (Site 15a), Segment 1e (Sites 5, 8a, 9, 12, 13a, 14a), Segment 2 (Site 45), Segment 3 (Site 25), Segment 6a (Site 16a), and Segment 16b (Site 19) comprise the Cold-season locations for temperature dataloggers. It is worth mentioning that many of these sites only recorded data during the shoulder season the month before the warm season began. The program began in early November 2009 and ended in December of 2010. The data presented in this report reflects the temperature measurements collected from January 1 through December 31, 2010. (This change represents the revision of reporting data collected in a calendar year broken into cold and warm seasons).

The Warm-season program locations included twenty-six sites in Bear Creek Segments 1a, 1b, 1d, 1e, 2, 3, 5 and 10 (including four total at the Evergreen Lake profile station and four total at the Genesee Reservoir profile station) and three sites in Turkey Creek Segments 6a and 6b, for a total of twenty-nine sites. Additionally, the five major wastewater treatment plants discharging into Segment 1e (EMD, WJCMD, KSWD, GWSD) and 1b (Morrison) were monitored. The 2010 Warm-season program for temperature data collection began on April 1 and May 1 and concluded on September 30 and October 31 depending on the segment.

Temperature compliance, as compared to water quality standards, is presented by segment, roughly progressing from the upper reaches of the watershed to lower. Some sites only have temperature data collection during the Warm-season, while other sites have dataloggers almost throughout the year.

316,744 individual temperature data points were obtained from the twenty-nine datalogger sites within the watershed. The evaluating criteria used to determine potential impairment of stream temperature is detailed in the tables below, specific to segment. There were 785 weekly averages calculated for the program period. 68,605 two-hour blocks were averaged and 5705 Daily Maximum values were calculated. 79,334 individual temperature data points were obtained from the five dataloggers located in the WWTP effluents that discharge into Bear Creek Segments 1e and 1b. Recognizing that there are no permit temperature limits, a data summary consisting of number of measurements and calculations, Weekly Average and Daily Average temperatures are presented.

Table 16 Bear Creek Watershed 2010 Temperature Compliance by Segment

	Cold-season		Warm Season	
Segment 3	9°C WAT	13°C DM	17°C WAT	21.2°C DM
# Exceedances	0	7	0	0
% Compliance	100%	77.42%	100%	100%
Segment 1a	9°C WAT	13°C DM	17°C WAT	21.2°C DM
# Exceedances	1	5	1	3
% Compliance	95.83%	97.24%	98.08%	99.20%
Segment 1d	WAT	DM	18.2°C WAT (CLL)	23.8°C DM (CLL)
# Exceedances	NA	NA	5	0
% Compliance	NA	NA	95.45%	100%
Segment 1e	9°C WAT	13°C DM	19.3°C WAT	23.8°C DM
# Exceedances	0	0	3	1
% Compliance	100%	100%	98.90%	99.95%
Segment 1b	9°C WAT	13°C DM	19.3°C WAT	23.8°C DM
# Exceedances	0	0	1	0
% Compliance	100%	100%	99.28%	100%

	Cold-season		Warm Season	
Segment 5	9°C WAT	13°C DM	18.2°C WAT	23.8°C DM
# Exceedances	N/A	N/A	0	0
% Compliance	N/A	N/A	100%	100%
Segment 6a	9°C WAT	13°C DM	18.2°C WAT	23.8°C DM
# Exceedances	0	0	0	0
% Compliance	100%	100%	100%	100%
Segment 6b	9°C WAT	13°C DM	17°C WAT	21.2°C DM
# Exceedances	0	3	0	6
% Compliance	100%	90.32%	100%	95.28%
Segment 10	9°C WAT	13°C DM	17°C WAT	21.2°C DM
# Exceedances	N/A	N/A	36	25
% Compliance	N/A	N/A	59.10%	89.46%

NA-Indicates no logger data obtained.

Table 17 Number of Temperature Measurements

2010 Total Number of Measurements (Off- and Growing seasons)				
	# 30-min. Temps.	# Calculated WAT	# 2-Hr. Avgs. For DM calculation	# Calculated DM
Segment 3	7344	21	1834	153
Segment 1a	26286	547	76	6565
Segment 1d	37820	110	9450	785
Segment 1e	86859	245	21696	1803
Segment 1b	35891	102	8968	745
Segment 5	21911	62	5474	454
Segment 6a	59797	52	4417	369
Segment 6b	7614	22	1902	158
Segment 10	30192	88	7544	628
Watershed totals	316744	785	68605	5705

Segment 8 (Site 36) and Segment 7 (Sites 37 and 38)

- No temperature dataloggers and therefore do not have sufficient data to determine compliance with water quality standards for temperature.

Segment 3 (Site 25)

- All cold and warm season temperatures complied with the standards except for the cold season DM which complied 77.42% of the time.

Segment 1a (Sites 1a, 2, 3a)

- 95.83% of the recorded temperature values complied with the 9°C Weekly Average Temperature (WAT) standard Oct 1 through May 31.
- 97.24% of the recorded temperature values complied with the 13°C Daily Maximum (DM) Temperature standard for Oct 1 through May 31.
- 98.08% of the recorded temperature values complied with the 17.0°C Weekly Average Temperature (WAT) standard June 1 through September 30.
- 99.20% of the recorded temperature values complied with the 21.2°C Daily Maximum (DM) temperature standard for June 1 through September 30.

Segment 1d (Sites 4b, 4c and 4d)

- 95.45% of the recorded temperature values complied with the 18.2°C Weekly Average Temperature (WAT) standards for CLL designation.
- 100% of the recorded temperature values complied with the 23.8°C Daily Maximum (DM) Temperature standards for CLL designation.

Segment 1e (Sites 5, 7, 8a, 9, 12, 13a and 14a)

- All cold season temperatures complied with the standards.
- 98.90% of the recorded temperature values complied with the 19.3°C Weekly Average Temperature (WAT) standard Apr 1 through Oct 31.
- 99.95% of the recorded temperature values complied with the 23.8°C Daily Maximum (DM) Temperature standard for Apr 1 through Oct 31.

Segment 1b (Sites 15a and 27b)

- All cold season temperatures complied with the temperature standards.
- 99.28% of the temperatures complied with the 19.3°C Weekly Average Temperature(WAT) for the warm season, and 100% of the temperatures complied for the 23.8°C Daily Maximum (DM) temperature standard for the warm season.

Segment 5 (Sites 26, 35 and 50)

- All cold and warm season temperatures complied with the standards.

Segment 6a (Sites 16a and 18)

- All cold and warm season temperatures complied with the standards.

Segment 6b (Site 19; Site 17a logger missing)

- 90.32% of the temperatures complied with the cold season DM standard.
- 95.28% of the temperatures complied with the warm season DM standard.
- All other temperatures complied with all other standards.

Segment 10 (Sites 39a, 39b, 39c, and 39d)

- 59.10% of the temperatures complied with the warm season WAT standard.
- 89.46% of the temperatures complied with the warm season DM standard.

Wastewater treatment plant effluents

Although none of the five wastewater treatment plants that discharge into Bear Creek have temperature limits, datalogger measurements have been analyzed and summarized below using the representative segment standard that the wastewater treatment facility discharges into.

Table 18 WWTP Number of Temperature Measurements

	# 30-min. measurements	# Calculated DAT	# Calculated WAT
EMD WWTP	15905	330	45
WJCMD WWTP	15564	323	44
KSWD WWTP	15901	330	46
GWSD WWTP	16074	334	46
Morrison WWTP	15890	330	46
Totals (Jan 1-Dec. 31)	79334	1647	227

Table 19 WWTP Logger summary 2010

	Cold-season		Growing Season	
Segment 1e	9°C WAT	13°C DM	17°C WAT	21.2°C DM
# Exceedances	33	83	3	0
% Compliance	45.90%	82.11%	97.50%	100%
Segment 1b	9°C WAT	13°C DM	17°C WAT	21.2°C DM
# Exceedances	8	14	15	0
% Compliance	50%	87.93%	50%	100%

Water Quality Compliance

Water quality compliance was determined by sampling and monitoring selected sites during the Growing season timeframe. pH, Dissolved Oxygen, Ammonia and Nitrate measurements were compared to water quality standards to determine compliance. During the August 8, 2010 sampling and monitoring session on Evergreen Lake a dissolved oxygen exceedance was calculated taking the average dissolved oxygen of the top 2-meters. This resulted in a 93.33% compliance for dissolved oxygen as it pertains to the stream and lake standards.

Table 20 Bear Creek Watershed 2010 Water Quality Compliance by Segment

	Stream Std. pH (6.5-9 SU)	Stream Std. DO (6.0 mg/L 2-meter avg.)	Stream Std. NH3-N ug/L (TVS)	Stream Std. NO3-N (10,000ug/L)*
Segment 8				
# Exceedances	0	0	0	0
# Measurements	3	3	3	3
% Compliance	100%	100%	100%	100%
Segment 7				
# Exceedances	0	0	0	0
# Measurements	5	5	4	5
% Compliance	100%	100%	100%	100%
Segment 3				
# Exceedances	0	0	0	0
# Measurements	3	3	3	3
% Compliance	100%	100%	100%	100%
Segment 1a				
# Exceedances	0	0	0	0
# Measurements	6	6	6	6
% Compliance	100%	100%	100%	100%
Segment 1d				
# Exceedances	0	1	0	0
# Measurements	15	12	6	6
% Compliance	100%	93.33%	100%	100%
Segment 1e				
# Exceedances	0	0	0	0
# Measurements	18	18	18	18
% Compliance	100%	100%	100%	100%
Segment 1b	No Sites in Segment 1b were sampled or monitored			
Segment 5				
# Exceedances	0	0	0	0
# Measurements	6	6	6	6
% Compliance	100%	100%	100%	100%
Segment 6a				
# Exceedances	0	0	0	0
# Measurements	3	3	3	3
% Compliance	100%	100%	100%	100%
Segment 6b				
# Exceedances	0	0	0	0
# Measurements	3	3	3	3
% Compliance	100%	100%	100%	100%
Segment 10				
# Exceedances	0	0	0	0
# Measurements	3	3	2	2
% Compliance	100%	100%	100%	100%

*- Samples were analyzed for NO3+NO2-N but compared to the Nitrate water quality standard of 10 mg/L.

Segment 8 (Site 36)

- 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 7 (Sites 37 and 38)

- **Site 37:** 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.
- **Site 38:** 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 3 (Site 25)

- 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 1a (Sites 1a and 3a)

- **(Sites 1a and 3a)** 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 1d (Sites 4a, 4b, 4c, 4d and 4e)

- 100% of the measured pH values and 93.33% of the calculated DO values from the profile station complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 1e (Sites 5, 7, 8a, 9, 12, 13a and 14a)

- **All Sites:** 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 1b (Sites 15a and 27b)

- Neither Site was sampled nor monitored.

Segment 5 (Site 35)

- 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 6a (Site 18)

- 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS).

Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 6b (Site 19)

- 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Segment 10 (Site 39a, 39b, 39c, 39d)

- 100% of the measured pH and DO values complied with the adopted water quality stream standards. Results for Ammonia-N are expected to comply with adopted water quality stream standards (TVS). Samples analyzed for Nitrate+Nitrite-N resulted in 100% compliance with the adopted water quality stream standards for Nitrate.

Summary

Temperature Compliance

Segments 3, 1a, 1d, 1e, 1b, 10, 5 and Turkey Creek Segments 6a and 6b showed little impairment during both the Cold- and Warm Seasons. Comparisons with adopted temperature standards resulted in 94.15% compliance for the WAT and 99.25% compliance for the DM calculated for the Warm Season throughout the Watershed, utilizing the 85th%-tile qualifier. Comparisons with adopted temperature standards resulted in 99.6% compliance for the calculated WAT and 99.15% compliance for the calculated DM for the Cold-season in the monitored locations of the Watershed, utilizing the 85th%-tile qualifier. A comprehensive temperature data collection effort spanning January through December, summarized in 316,744 30-minute measurements at twenty-nine in-stream/lake Sites throughout the Watershed, provided the data for analyses.

The evaluation of the entirety of temperature datalogger measurements recorded during the calendar year at twenty-nine Sites in the Watershed from Mt. Evans Wilderness to just below Bear Creek Lake in Morrison and Turkey Creek do not indicate that a problem exists, either man-induced or natural, when compared to water quality standards. Compliance exceedance issues occurred in segments 1a (cold and warm season), 1b (warm season), 1d (warm season), 1e (warm season), 6b (warm season), and segment 10 (warm season).

Wastewater plant discharges into Bear Creek did not cause temperature impairment. A comprehensive temperature data collection effort from January through December, summarized in 79,334 30-minute measurements in five wastewater treatment plant effluents that discharge into Bear Creek Segment 1e and 1b, showed no evidence of thermal pollution. Although only one of the five WWTPs that discharge into Segments 1e and 1b have temperature limits, the results data collected and presented do not indicate evidence of impairment due to temperature.

Water Quality Compliance

Segments 3, 1a, 1d, 1e, 1b, 5 and Turkey Creek Segments 6a and 6b showed little water quality impairment. A total of three monthly sampling and monitoring events occurred from July through September at twenty-three Sites throughout the watershed. 65 measurements of pH and 62 measurements of DO were performed at these Sites. 100% compliance for pH and 98.39% compliance for Dissolved Oxygen were achieved. 52 samples were analyzed for Total Ammonia and 53 samples were analyzed for Nitrate+Nitrite. Sampling results show 100% compliance with Total Ammonia TVS and 100% compliance with Nitrate water quality standards. (Stream samples were analyzed for Nitrate+Nitrite, but compared to Nitrate water quality standards.) There are no stream standards for Total Phosphorous; however 53 samples were analyzed for Total Phosphorous.

Wastewater plant discharges into Bear Creek result in no evidence of water quality impairment. 99.73% of the wastewater plant effluent pH and 99.67% of effluent Ammonia values met permit limits, while 100% Total Phosphorous met permit effluent limits. Three of the five wastewater treatment

plants met discharge limits stated in their Colorado Discharge Pollutant Elimination System (CDPES) permit for pH, Total Phosphorous and Total Ammonia during 2010 and showed no evidence of thermal pollution. There were permit violations reported for two parameters from 2 of the wastewater treatment plants in 2010. Genesee Wastewater treatment plant had 5 pH exceedances all within a one week period and West Jefferson County Metro Wastewater treatment plant had one exceedance for Ammonia. Wastewater treatment plant effluents had no detrimental effect on the water quality of Segment 1e and 1b. There were no observed impairment issues or temperature issues in the Watershed due to wastewater plant effluents during the Program.

Bear Creek stream flows were lower than historic averages from May through September. Bear Creek stream flows tracked during May through September, on daily average at the gage above Evergreen Lake, were somewhat to significantly lower than the historic daily average in May through September. The stream gage above Morrison followed the Evergreen gage values. The stream flows remained well below to slightly below monthly historic averages. Only 4 days in June and 1 day in July and 6 days in August exceeded historic average flows. A surprising factor in the 2010 Program was the lack of impact that snow pack run-off had on stream flows.

Weather and climate in the May through September timeframe were approximately average to below average as compared to historic averages. Measurably less precipitation was noticed verses historic averages in May, June and July, but increased slightly in August, and was drastically reduced in September. Due to the monthly average maximum temperatures being relatively equal to the historic averages the low precipitation amounts in May, June, July, and September may have been a contributing factor in some of the Daily Maximum and MWAT exceedances that we noticed this warm season.

The Average Monthly Mean temperatures were approximately equal to historical data for May through September. The Average Monthly Maximum temperatures were approximately equal to historical averages for May through September. However, the Average Daily Minimum temperatures were slightly higher or equal to historical averages in all months. The Average Monthly Maximum temperatures were the highest in June and September, which coincided with the lower precipitation levels in these months. The Average Monthly temperatures were unremarkable. It is worth noting that even during and after significant precipitation events, higher stream flows were not noticed.

Weather records and stream gage readings closest to Segment 1a indicate that significantly higher Average Daily Minimum temperatures and significantly lower stream flows were most likely the major contributing factors to the WAT and DM exceedances throughout the warm season.

Watershed Monitoring

WWTP Effluent Temperature and Water Quality

The Process Control and permit sampling and monitoring summaries in the tables below are annual summaries, from January through December. Datalogger temperature measurements of plant effluent were obtained at the identical frequency of the in-stream dataloggers (30-minute intervals) during a study period of January 1 through December 31, broken into a cold and warm season per the listing requirements. The tables are listed in a downstream direction, as the effluents enter Bear Creek, from the EMD WWTP to the Morrison WWTP. Test results for Ammonia, Nitrate, Nitrite and Phosphorous are provided by the wastewater treatment plant laboratories for EMD, WJCMD, KSWD and GWSD and are represented in ug/L. TIN was determined as the sum of Ammonia, Nitrate and Nitrite. Averaged pH values are for statistical analyses only. The town of Morrison utilizes a contract laboratory for analyses.

Table 21 Evergreen Metropolitan District (Site 20)

EMD WWTP Effluent Summary 2010									
2010 Process Control and Permit Sampling and Monitoring									
Parameter	pH, SU	Temp, °C	D. O., mg/L	Total NH3-N, ug/L	NO3-N, ug/L	NO2-N, ug/L	TIN, ug/L	Total P, ug/L	Flow, MGD
Min	6.53	5.60	3.16	13.50	60	10	730	10	0.35
Max	7.42	19.90	7.50	11000	5990	110	6930	1290	1.06
Avg	6.80	12.21	4.81	1541.63	1980	40	3980	180	0.53
Std. Dev.	0.13	4.62	0.92	2176.30	1.68	30	1610	190	0.12
Measurements	265	235	244	54	12	13	12	55	365
Exceedances	0			0				0	
Effluent Datalogger Temperature Summary: Cold Season/Warm Season 2010									
All Temperatures in °C			30-Min Temp. COLD/WARM		Daily Avg. Temp. COLD/WARM		Weekly Avg. Temp. COLD/WARM		
Min			4.90		5.28		5.43		
Max			14.55		14.36		14.03		
Avg			8.71		8.73		8.88		
Std. Dev.			2.86		2.86		2.90		
Measurements			5659		117		15		

[Datalogger ID: EMD5 GPS Coordinates: 39.6376°N, 105.3150°W; Sampling/monitoring site is the EMD WWTP effluent. The datalogger in the UV channel just upstream of the outfall. Effluent flows directly from the UV building to Bear Creek.] Notes: Discharge permit limits for Total Ammonia (NH3-N), in ug/L are as follows: Jan.-10,100, Feb.-6500, Mar.-6400, Apr.-5300, May-5800 June-8200 July-8000 Aug.-6400 Sept.-5200; Oct.-4200; Nov.-5900; Dec.-4700; pH 6.5-9.0

Table 22 West Jefferson County Metropolitan District (Site 21)

WJCMD WWTP Effluent Summary 2010									
2010 Process Control and Permit Sampling and Monitoring									
Parameter	pH, SU	Temp, °C	D. O., mg/L	Total NH3-N, ug/L	NO3-N, ug/L	NO2-N, ug/L	TIN, ug/L	Total P, ug/L	Flow, MGD
Min	6.59	8.40	2.85	20	0	10	160	50	0.04
Max	7.33	19.30	4.70	22500	1530	1490	20210	720	0.77
Avg	6.84	13.19	3.44	5760	330	420	342	180	0.49
Std. Dev.	0.14	3.56	0.34	8120	530	550	5520	150	0.09
Measurements	262	239	239	72	12	8	12	52	365
Exceedances	0			1				0	
Effluent Datalogger Temperature Summary Cold/Warm Seasons 2010									
All Temperatures in °C			30-Min Temp. COLD/WARM		Daily Avg. Temp. COLD/WARM		Weekly Avg. Temp. COLD/WARM		
Min			-5.30		7.00		7.35		
Max			19.40		14.98		14.67		
Avg			10.36		10.37		10.52		
Std. Dev.			2.93		2.56		2.60		
Measurements			5317		110		14		

[Datalogger ID: WJ6 GPS Coordinates: 39.6621°N, 105.3351°W; Sampling/monitoring site is the WJCMD WWTP effluent. The datalogger was located in the end of the abandoned chlorine contact chamber. (Disinfection currently occurs by UV radiation.) The effluent flows into a ditch and joins Troublesome Gulch just outside the plant boundary. Troublesome Gulch flows to Kittredge and combines with Bear Creek at the west end of Kittredge.] Notes: Discharge permit limits for Total Ammonia (NH3-N), in ug/L are as follows: Jan.-13,300, Feb.-9,000, Mar.-13,000, Apr.-8,000, May-10,000 June-12,600 July-13,000 Aug.-10,700 Sept.-8,400; Oct.-6,500; Nov.-8,500; Dec.-6,300; pH 6.5-9.0

Table 23 Kittredge Sanitation and Water District (Site 22)

KSWD WWTP Effluent Summary 2010									
2010 Process Control and Permit Sampling and Monitoring									
Parameter	pH, SU	Temp, °C	D. O., mg/L	Total NH ₃ -N, ug/L	NO ₃ -N, ug/L	NO ₂ -N, ug/L	TIN, ug/L	Total P, ug/L	Flow, MGD
Min	6.63	4.00	0.35	160	300	240	4190	170	0.03
Max	7.29	20.80	10.11	6590	11600	1000	11840	890	0.12
Avg	6.86	11.66	3.47	1260	5770	450	7600	310	0.06
Std. Dev.	0.10	5.03	2.28	1320	2940	270	2290	150	0.01
Measurements	243	218	222	45	13	7	12	24	365
Exceedances	0			0				0	
Effluent Datalogger Temperature Summary Cold/Warm Seasons 2010									
All Temperatures in °C		30-Min Temp. COLD/WARM		Daily Avg.Temp. COLD/WARM		Weekly Avg. Temp. COLD /WARM			
Min		0.70		6.38		2.18		8.01	
Max		10.30		19.34		10.00		19.02	
Avg		4.48		14.35		4.49		14.34	
Std. Dev.		1.97		2.93		1.94		2.90	
Measurements		5655		10246		117		213	
						16		30	

[Datalogger ID: KSWD8 GPS Coordinates: 39.6585°N, 105.2868°W; Sampling/monitoring site is the KSWD WWTP effluent. The datalogger was located near the flow-measuring flume, just upstream of the outfall. Effluent flows from the datalogger location under Highway 74 to the outfall in Bear Creek.] Notes: Discharge permit limits for Total Ammonia (NH₃-N), in ug/L are as follows: Jan.-10,100, Feb.-4,500, Mar.-5,300, Apr. 3,600, May-5,500 June-5,200 July-7,700 Aug.-5,500 Sept.-3,300; Oct.-2,600; Nov.-5,900; Dec.-4,700; pH 6.5-9.0

Table 24 Genesee Water and Sanitation District (Site 23)

GWSD WWTP Effluent Summary 2010									
2010 Process Control and Permit Sampling and Monitoring									
Parameter	pH, SU	Temp, °C	D. O., mg/L	Total NH ₃ -N, ug/L	NO ₃ -N, ug/L	NO ₂ -N, ug/L	TIN, ug/L	Total P, ug/L	Flow, MGD
Min	6.50	8.00	6.90	0	40	60	170	170	0.01
Max	9.29	20.00	10.50	7570	9400	2670	11470	17600	0.42
Avg	7.02	13.79	8.04	640	4820	310	5390	730	0.25
Std. Dev.	0.32	3.45	0.66	1400	2930	660	3170	2360	0.05
Measurements	362	362	361	52	48	14	50	52	365
Exceedances	5			0				0	
Effluent Datalogger Temperature Summary COLD/WARM Seasons 2010									
All Temperatures in °C		30-Min Temp. COLD/WARM		Daily Avg.Temp. COLD/WARM		Weekly Avg. Temp. COLD/WARM			
Min		9.42		9.56		9.60		9.72	
Max		20.19		21.58		16.37		20.72	
Avg		12.26		15.71		12.27		15.70	
Std. Dev.		2.09		3.42		2.08		3.42	
Measurements		5829		10245		121		213	
						16		30	

[Datalogger ID: GWSD9A GPS Coordinates: 39.6732°N, 105.2712°W; Sampling/monitoring site is the GWSD WWTP effluent. The datalogger was located in a wet well, just upstream of the outfall at the plant. Effluent flows from the datalogger location into a drainage, down to and under Highway 74 at the west end of Lair o' the Bear Park, and into Bear Creek.] Notes: Discharge permit limits for Total Ammonia (NH₃-N), in ug/L are as follows: Jan.-13,300, Feb.-8,000, Mar.-8,500, Apr.-7,200, May-8,300 June-12,600 July-13,000 Aug.-10,700 Sept.-8,400; Oct.-6,500; Nov.-8,500; Dec.-6,300; pH 6.5-9.0

Table 25 Town of Morrison (Site 24)

Morrison WWTP Effluent Summary 2010							
2010Process Control and Permit Sampling and Monitoring							
Parameter	pH, SU	Temp, °C	Total NH3-N, ug/L		Total P, ug/L	Flow, MGD	
Min	6.50	6.90	30		250	0.04	
Max	8.20	25.50	4200		1280	0.20	
Avg	7.22	15.66	330		570	0.08	
Std. Dev.	0.38	5.04	610		180	0.02	
Measurements	365	365	51		51	365	
Exceedances	0		0		0		
Effluent Datalogger Temperature Summary COLD/WARM Seasons 2010							
All Temperatures in °C		30-Min Temp. COLD/WARM		Daily Avg.Temp. COLD/WARM		Weekly Avg. Temp. COLD/WARM	
Min		6.20	10.22	6.25	10.45	6.82	10.79
Max		15.20	23.33	14.94	22.99	14.67	22.79
Avg		9.60	18.16	9.62	18.16	9.61	18.25
Std. Dev.		2.47	3.65	2.47	3.65	2.50	3.61
Measurements		5646	10244	117	213	16	30

[Datalogger ID: MORR12 GPS Coordinates: 39.6541°N, 105.1796°W; Sampling/monitoring site is the GWSD WWTP effluent. The datalogger was located in a wet well, just upstream of the outfall at the plant. Effluent flows from the datalogger location into a drainage, down to and under Highway 74 at the west end of Lair o' the Bear Park, and into Bear Creek.] Notes: Discharge permit limits for Total Ammonia (NH₃-N), in ug/L are as follows: Jan.-10,000, Feb.-8,600, Mar.-10,000, Apr.-10,000, May-8,600 June-20,000 July-30,000 Aug.-28,000 Sept.-28,000; Oct.-16,000; Nov.-14,000; Dec.-10,000; pH 6.5-9.0

Other Small Treatment Facilities

Table 26 Tiny Town Effluent Summary

TINY TOWN WWTP Effluent Summary 2010			
2010 Process Control and Permit Sampling and Monitoring			
Parameter	pH, SU	Total P, ug/L	Flow, MGD
Min	7.71	630	0.00057
Max	7.88	1540	0.00155
Avg	7.78	990	0.00093475
Std. Dev.	0.07	380	0.000400891
Measurements	4	4	4
Exceedances	0	2	

Table 27 Brook Forest Inn Effluent Summary

BROOK FOREST INN WWTP Effluent Summary 2010				
2010 Process Control and Permit Sampling and Monitoring				
Parameter	pH, SU	Temp, °C	Total P, ug/L	Flow, MGD
Min	6.8	12.6	20	0.00
Max	7.45	17.4	790	0.01
Avg	7.02	14.7	350	0.00
Std. Dev.	0.22	1.84	290	0.00
Measurements	5	5	5	5
Exceedances	0	0		

Table 28 Bear Creek Cabins Effluent Summary

BEAR CREEK CABINS WWTP Effluent Summary 2010					
2010 Process Control and Permit Sampling and Monitoring					
Parameter	pH, SU	Temp, °C	Total NH3-N, ug/L	Total P, ug/L	Flow, MGD
Min	6.8	12.6	30	20	0.00
Max	7.45	17.4	14000	790	0.01
Avg	7.02	14.7	2862	350	0.00
Std. Dev.	0.22	1.84	5570	290	0.00
Measurements	5	5	5	5	5
Exceedances	0			0	

Bear Creek Stream Segments

Sampling and monitoring was performed by Evergreen Metropolitan District personnel and watershed associates. Laboratory analyses were performed by a contract facility. A summary table for each Segment is presented before individual Site tables in that Segment. When there is only one Site per Segment, the summary table is omitted. Sites where only Warm Season temperature data exists have Cold-season portions of the table blacked out.

The following applies to all Segment Data tables: Existing stream standards: Table Value Standard (TVS) for Total Ammonia (NH3-N), chronic; 10 mg/L (10,000 ug/L) Nitrate (NO3-N), chronic; pH 6.5-9.0 SU; DO 6.0 mg/L; TIN was determined as the sum of Ammonia and Nitrate+Nitrite. Threshold to Evaluate Potential Temperature Impairment: WAT (Weekly Average Temperature), DM (Daily Maximum Temperature), Segment-specific; 2-HR Avg. Temperature data are calculations used to evaluate against DM.

Segments 7 and 8 (Mt Evans Wilderness)**Table 29 Summit Lake Site 36 (In Summit Lake near outlet) Segment 8**

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010									
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L	TN, ug/L
Min	7.6	7.9	6.99	0.02	15	3	18	6	232
Max	8.43	10.1	8.29	0.021	41	41	82	17	237
Avg	8.07	8.73	7.58	0.02	28.67	16.33	45.00	12.33	235.33
Std. Dev.	0.35	0.97	0.54	0.00	10.66	17.46	27.07	4.64	2.36
Measurements	3	3	3	3	3	3	3	3	3

[Monitoring station GPS Coordinates: 39.5979 °N, 105.6411 °W; Sampling /monitoring site is in Summit Lake, near outlet.]

Table 30 Summit Lake Site 37 Segment 7

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010									
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L	TN, ug/L
Min	7.54	6.6	7.54	0.02	5	24	29	6	211
Max	8.04	9.4	8.59	0.02	34	73	89	10	341
Avg	7.78	7.97	7.92	0.02	18.33	46.00	64.33	8.00	261.0
Std. Dev.	0.20	1.14	0.47	0.00	11.95	20.31	25.63	1.63	57.15
Measurements	3	3	3	3	3	3	3	3	3

[Monitoring station GPS Coordinates: 39.5955 °N, 105.6334 °W; Sampling /monitoring site is in Bear Creek, downstream of outlet from Summit Lake.]

Table 31 Summit Lake Site 38 (Bear Creek at Bear Tracks) Segment 7

2 Monthly Sampling/Monitoring Event July7, and Sept. 1, 2010									
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L	TN, ug/L
Min	6.1	9	8.72	0.04	5	57	57	2	160
Max	7.62	10.38	9.55	0.04	5	108	113	7	169
Avg	6.86	9.69	9.14	0.04	5.00	82.50	85.00	4.50	164.0
Std. Dev.	0.76	0.69	0.41	0.00	0.00	25.50	28.00	2.50	4.50
Measurements	2	2	2	2	1	2	2	2	2

[Monitoring station GPS Coordinates: 39.6159 °N, 105.5377 °W; Sampling /monitoring site is in Bear Creek, at bear tracks, in Mt. Evans Wilderness.]

Segment 1a (Above Evergreen Lake)

Table 32 Segment 1a Summary

Segment 1a Sampling/Monitoring Summary 2010								
Monthly Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.59	7.7	8.59	0.039	6	23	34	3
Max	8.18	13.1	11.41	0.068	18	74	92	26
Avg	7.87	10.32	10.00	0.05	11.50	46.67	58.17	12.17
Std. Dev.	0.21	1.73	0.98	0.01	4.86	17.68	20.14	7.15
Measurements	6	6	6	6	6	6	6	6
Segment 1a Datalogger Temperature Summary 2010								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASONS		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 Stream DM (21.2°C)
Min	-0.28	3.72	-0.21	-0.28	-0.24	8.41	3.76	6.66
Max	14.07	22.20	9.37	13.59	13.59	17.14	22.06	22.06
Avg	3.29	12.54	3.05	3.29	4.78	12.58	12.54	14.99
Measurements	8718	17568	24	2176	181	52	4389	366
# 9°C WAT exceeded			1					
% Compliance WAT			95.83%					
# 13°C DM exceeded					5			
% Compliance DM					97.24%			
# 17°C WAT exceeded						1		
% Compliance WAT						98.08%		
# 21.2°C DM exceeded								3
% Compliance DM								99.20%

Table 33 Lost & Found (Singin' River Ranch-Site 1a)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010								
Monthly Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.59	7.70	8.97	0.04	6	38	47	3
Max	7.99	10.10	11.41	0.04	18	74	92	15
Avg	7.73	8.90	10.27	0.04	11	58.33	69.33	8.67
Std. Dev.	0.18	0.98	1.00	0.00	5.10	15.06	18.37	4.92
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. Cold/Warm Season		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 Stream DM (21.2°C)
Min	-0.06	3.72	3.16	-0.04	1.45	8.41	3.76	6.66
Max	11.69	18.03	6.58	11.55	11.55	14.27	17.88	17.88
Avg	5.05	11.04	4.76	5.04	7.71	11.10	11.04	13.04
Std. Dev.	2.86	2.53	1.36	2.83	2.58	1.80	2.51	2.22
Measurements	1488	5856	4	371	31	17	1463	122
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 17°C WAT exceeded						0		
% Compliance WAT						100%		
# 21.2°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: L&F GPS Coordinates: 39.6234 °N, 105.4451 °W; Sampling /monitoring site is in Bear Creek, above Lost & Found (old Singin' River Ranch)]

Table 34 Above Evergreen Lake, at Clear Creek County line (Site 2)

Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 Stream DM (21.2°C)
Min	0.36	4.79	5.17	0.46	3.77	10.09	4.86	7.81
Max	13.71	21.34	8.51	13.39	13.39	16.40	21.16	21.16
Avg	7.00	12.95	6.70	6.99	10.05	12.95	12.95	12.95
Std. Dev.	3.02	2.87	1.32	2.99	2.43	1.87	2.85	2.31
Measurements	1488	5856	4	371	31	18	1463	122
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					1			
% Compliance DM					96.77%			
# 17°C WAT exceeded						0		
% Compliance WAT						100%		
# 21.2°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: ALKCC GPS Coordinates: 39.6368 °N, 105.3972 °W; Datalogger site in Bear Creek near the Clear Creek County line, on Upper Bear Creek Road.]

Table 35 Above Evergreen Lake, at CDOW site (Site 3a)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.86	10.7	8.59	0.05	7	23	34	10
Max	8.18	13.1	10.74	0.07	18	50	68	26
Avg.	8.01	11.73	9.74	0.06	12	35.00	47.00	15.67
Std. Dev.	0.13	1.01	0.88	0.01	4.55	11.22	14.99	7.32
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASONS		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 Stream DM (21.2°C)
Min	-0.28	5.39	-0.21	-0.28	-0.24	10.79	5.51	8.13
Max	14.07	22.20	9.37	13.59	13.59	17.14	22.06	22.06
Avg	1.88	13.64	1.72	1.87	2.64	13.70	13.64	16.22
Std. Dev.	3.71	2.97	3.27	3.70	4.75	1.99	2.94	2.51
Measurements	5742	5856	16	1434	119	17	1463	122
# 9°C WAT exceeded			1					
% Compliance WAT			93.75%					
# 13°C DM exceeded					4			
% Compliance DM					96.64%			
# 17°C WAT exceeded						1		
% Compliance WAT						94.12%		
# 21.2°C DM exceeded								3
% Compliance DM								97.54%

[Monitoring station/Datalogger ID: ALKDOW GPS Coordinates: 39.6331 °N, 105.3372 °W; Sampling /monitoring site in Bear Creek above Evergreen Lake, at the CDOW fish survey site.]

Segment 1d (Evergreen Lake)

Sites 4a-4e comprises a profile monitoring station in Evergreen Lake. During the study period, sampling and monitoring were performed monthly at the individual Site locations at this profile station. This data is presented below. Also during the study period, temperature data collected with dataloggers at the individual Site locations were analyzed and compared to state water quality standards.

Table 36 Evergreen Lake, at surface, near dam (Site 4a)

3 Monthly Sampling/3 Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.79	N/A*	6.29	0.06	N/A**	N/A**	N/A**	N/A**
Max	8.18	N/A*	8.7	0.07	N/A**	N/A**	N/A**	N/A**
Avg	8.05	N/A*	7.55	0.07	N/A**	N/A**	N/A**	N/A**
Std. Dev.	0.18	N/A*	0.99	0.00	N/A**	N/A**	N/A**	N/A**
Measurements	3	N/A*	3	3	N/A**	N/A**	N/A**	N/A**
Datalogger Temperature Summary 2010								
All Temperatures in °C	30-Min Temp. WARM SEASON	Jan 1-Mar 31 Stream Std. WAT (9°C)	Jan 1-Mar 31 2-Hr Avg. Temp.	Jan 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Dec. 31 Stream Std. WAT (19.3°C)	Apr 1-Dec 31 2-HR Avg. Temp.	Apr 1-Dec 31 Stream DM (23.8°C)	
Min	4.53				7.37	6.16	6.85	
Max	22.01				20.02	21.70	21.70	

Avg	14.99				15.02	14.99	15.94
Measurements	7564				22	1890	157
# 18.2°C WAT exceeded					3		
% Compliance WAT					86.36%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: EMD2A GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, on the surface, near the EMD WTP intake.] N/A* indicates temp. readings not taken. N/A** Indicates no sampling at this location.

Table 37 Evergreen Lake, 1.5m below surface, near dam (Site 4b)

3 Monthly Sampling/3 Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.66	15.5	6.02	0.06	15	7	22	10
Max	8.25	16.2	9.12	0.07	31	38	69	19
Avg	7.95	15.83	7.60	0.07	22.67	17.33	40.00	13.00
Std. Dev.	0.24	0.29	1.27	0.00	6.55	14.61	20.70	4.24
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Summary 2010								
All Temperatures in °C	30-Min Temp. WARM SEASON	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)	
Min	6.10				7.31	6.16	6.86	
Max	21.53				19.69	21.36	21.36	
Avg	14.71				14.73	14.71	15.67	
Measurements	7564				22	1890	157	
# 18.2°C WAT exceeded					2			
% Compliance WAT					90.91%			
# 23.8°C DM exceeded							0	
% Compliance DM							100%	

[Monitoring station/Datalogger ID: EMD2B GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 1.5m below surface, near the EMD WTP intake.]

Table 38 Evergreen Lake, 2.5m below surface, near dam (Site 4c)

0 Monthly Sampling/3 Monitoring Events July1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.54	15	4.5	0.06	NA**	NA**	NA**	NA**
Max	8.08	15.7	8.34	0.07	NA**	NA**	NA**	NA**
Avg	7.80	15.37	6.23	0.07	NA**	NA**	NA**	NA**
Std. Dev.	0.22	0.29	1.59	0.00	NA**	NA**	NA**	NA**
Measurements	3	3	3	3	NA**	NA**	NA**	NA**
Datalogger Temperature Summary 2010								
All Temperatures in °C	30-Min Temp. WARM SEASON	Jan 1-Mar 31 Stream Std. WAT (9°C)	Jan 1-Mar 31 2-Hr Avg. Temp.	Jan 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Dec. 31 Stream Std. WAT (19.3°C)	Apr 1-Dec 31 2-HR Avg. Temp.	Apr 1-Dec 31 Stream DM (23.8°C)	

Min	6.00				7.29	6.11	6.91
Max	20.63				18.18	20.18	20.18
Avg	13.96				13.97	13.96	14.76
Measurements	7564				22	1890	157
# 18.2°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: EMD2C GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 2.5m below the surface, near the EMD WTP intake.]

Table 39 Evergreen Lake, 3.5m below surface, near dam (Site 4d)

0 Monthly Sampling/3 Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.15	14.3	2.15	0.07	NA**	NA**	NA**	NA**
Max	7.87	15.2	7.47	0.07	NA**	NA**	NA**	NA**
Avg	7.48	14.87	4.69	0.07	NA**	NA**	NA**	NA**
Std. Dev.	0.30	0.40	2.18	0.00	NA**	NA**	NA**	NA**
Measurements	3	3	3	3	NA**	NA**	NA**	NA**
Datalogger Temperature Summary 2010								
All Temperatures in °C	30-Min Temp. WARM SEASON	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)	
Min	5.64				7.08	5.80	6.77	
Max	20.06				16.44	18.81	18.81	
Avg	12.97				12.97	12.97	13.54	
Measurements	7564				22	1890	157	
# 18.2°C WAT exceeded					0			
% Compliance WAT					100%			
# 23.8°C DM exceeded							0	
% Compliance DM							100%	

[Monitoring station/Datalogger ID: EMD2D GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 3.5m below the surface, near the EMD WTP intake.]

Table 40 Evergreen Lake, 4.5m below surface, near dam (Site 4e)

3 Monthly Sampling/3 Monitoring Events July 1-Sept 30, 2009								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.3	12.9	0.84	0.07	48	7	55	19
Max	7.67	14.4	5.69	0.08	147	30	163	28
Avg	7.43	13.90	3.63	0.07	89.33	17.67	107.00	23.00
Std. Dev.	0.17	0.71	2.04	0.01	42.03	9.46	44.18	3.74
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Summary 2010								

All Temperatures in °C	30-Min Temp. WARM SEASON	Jan 1-Mar 31 Stream Std. WAT (9°C)	Jan 1-Mar 31 2-Hr Avg. Temp.	Jan 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Dec. 31 Stream Std. WAT (19.3°C)	Apr 1-Dec 31 2-HR Avg. Temp.	Apr 1-Dec 31 Stream DM (23.8°C)
Min	5.57				6.99	5.69	6.20
Max	17.20				14.62	15.87	15.87
Avg	11.96				11.95	11.96	12.39
Measurements	7564				22	1890	157
# 18.2°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: EMD2E GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 4.5m below the surface, near the EMD WTP intake.]

Segment 1e (Mainstem below Evergreen Lake and Above Harriman Diversion)

Table 41 Segment 1e Summary

Segment 1e Sampling/Monitoring Summary 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.57	13.1	7.48	0.068	7	7	29	13
Max	8.47	18.6	9.84	0.153	134	319	327	42
Avg	8.13	15.78	8.92	0.11	38.22	127.06	165.28	24.22
Std. Dev.	0.22	0.89	0.86	0.02	32.78	34.35	57.79	5.45
Measurements	18	18	18	18	18	18	18	18
Segment 1e Datalogger Temperature Summary 2010								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASON		Nov 1- Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	-0.14	-0.14	-0.11	-0.14	-0.12	2.52	-0.12	2.60
Max	7.97	24.63	5.30	7.73	7.73	19.67	24.10	24.10
Avg	0.99	13.18	1.02	0.99	1.66	13.26	13.18	15.24
Measurements	34241	52618	93	8551	710	152	13145	1093
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						3		
% Compliance WAT						98.90%		
# 23.8°C DM exceeded								1
% Compliance DM								99.95%

Table 42 Downtown Evergreen, at CDOW site (Site 5)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.57	14.8	7.75	0.07	22	7	29	14
Max	8.16	15.9	9.78	0.08	61	37	98	26
Avg	7.79	15.47	9.01	0.07	37.67	21.00	58.67	18.33
Std. Dev.	0.27	0.48	0.90	0.01	16.82	12.33	28.99	5.44
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASON		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.12	3.91	0.17	-0.09	0.17	6.27	3.93	5.36
Max	6.18	21.68	5.16	6.01	6.01	19.67	21.52	21.52
Avg	1.69	14.41	1.74	1.69	2.16	14.54	14.41	15.46
Std. Dev.	1.59	3.94	1.58	1.59	1.60	3.70	3.93	3.86
Measurements	5926	7604	16	1480	123	22	1899	158
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						1		
% Compliance WAT						95.45%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: LTLBAR GPS Coordinates: 39.6327 °N, 105.3183 °W; Sampling /monitoring site in Bear Creek near the west end of public parking lot, across from the Little Bear, CDOW fish survey site.]

[Monitoring station/Datalogger ID: EMD3 GPS Coordinates: 39.6377°N, 105.3141°W; Sampling/monitoring site upstream side of the Highway 74 vehicle bridge, downstream of the EMD WWTP plant effluent outfall.]

Table 43 Bear Creek Cabins (Site 8a)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.87	15.2	7.86	0.08	47	49	110	15
Max	8.13	16.9	9.69	0.09	134	63	183	24
Avg	8.03	16.07	8.74	0.09	81.67	57.67	139.33	20.00
Std. Dev.	0.11	0.69	0.75	0.00	37.65	6.18	31.48	3.74
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.14	0.08	0.10	-0.13	-0.03	2.52	0.16	2.60
Max	7.97	22.85	5.30	7.73	7.73	19.34	22.24	22.24
Avg	1.56	12.83	1.61	1.56	2.78	12.89	12.83	14.51
Std. Dev.	1.68	5.17	1.51	1.67	1.95	5.01	5.16	5.07
Measurements	5927	9044	16	1480	123	26	2259	188

# 9°C WAT exceeded		0					
% Compliance WAT		100%					
# 13°C DM exceeded				0			
% Compliance DM				100%			
# 19.3°C WAT exceeded					1		
% Compliance WAT					96.15%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: BCCDOW GPS Coordinates: 39.6425°N, 105.3084°W; Sampling/ monitoring site at bridge above the Bear Creek Cabins WWTP effluent discharge, at the CDOW fish survey site.]

Table 44 O'Fallon Park (Site 9)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.93	14.8	7.73	0.10	14	87	130	17
Max	8.36	17.7	9.54	0.12	83	121	204	30
Avg	8.15	15.93	8.85	0.11	57.33	108.00	165.33	22.00
Std. Dev.	0.18	1.27	0.80	0.01	30.81	14.99	30.30	5.72
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.14	-0.14	-0.11	-0.14	-0.12	2.82	-0.12	3.89
Max	7.12	24.63	1.88	6.63	6.63	19.42	24.10	24.10
Avg	0.50	13.00	0.41	0.49	1.47	13.00	13.01	15.59
Std. Dev.	1.19	5.14	0.67	1.17	2.04	4.85	5.12	5.01
Measurements	4320	8832	12	1079	90	26	2207	183
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						1		
% Compliance WAT						96.15%		
# 23.8°C DM exceeded								1
% Compliance DM								99.45%

[Monitoring station/Datalogger ID: OFPDOW GPS Coordinates: 39.6564°N, 105.2917°W; Sampling/ monitoring site north side of the creek above ETU restoration site, at the CDOW fish survey site.]

Table 45 Lair o' the Bear (Site 12)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	8.02	14	7.48	0.11	9	142	175	24
Max	8.44	18.1	9.79	0.15	33	203	226	32
Avg	8.28	15.77	8.87	0.13	22.33	182.00	204.33	29.33
Std. Dev.	0.19	1.72	1.00	0.02	9.98	28.30	21.51	3.77
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2010								

All Temperatures in °C	30-Min Temp. COLD/WARM SEASON		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2- HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	-0.09	0.19	0.02	-0.06	-0.06	3.36	0.32	3.90
Max	6.91	23.71	4.87	6.83	6.83	19.09	23.57	23.57
Avg	0.86	12.72	0.87	0.85	1.39	12.81	12.72	14.88
Std. Dev.	1.34	4.97	1.24	1.34	1.66	4.67	4.96	4.82
Measurements	6268	9046	17	1565	130	26	2260	188
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: LOBDOW GPS Coordinates: 39.6672°N, 105.2687°W; Sampling/ monitoring site in Bear Creek at the end of main path to Bear Creek from the parking lot, at the CDOW fish survey site.]

Table 46 Idleale (Shady Lane-Site 13a)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	8.04	13.7	7.51	0.11	8	164	185	13
Max	8.47	18.6	9.73	0.15	21	319	327	42
Avg	8.29	15.83	8.96	0.14	16.00	230.33	246.33	29.67
Std. Dev.	0.18	2.05	1.02	0.02	5.72	65.22	59.56	12.23
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASONS		Nov 1- Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31. 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	-0.06	-0.03	-0.01	-0.06	-0.03	3.51	-0.03	4.32
Max	7.44	23.83	4.84	7.29	7.29	19.19	23.75	23.75
Avg	0.61	13.02	0.66	0.61	1.08	13.12	13.03	15.45
Std. Dev.	1.37	5.05	1.25	1.37	1.78	4.68	5.04	4.76
Measurements	5926	9046	16	1480	123	26	2260	188
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: IDLE GPS Coordinates: 39.6621°N, 105.2406°W; Sampling/ monitoring site in Bear Creek at the CDOW fish survey site.]

Table 47 West End of Morrison (Site 14a)

5 Monthly Sampling/Monitoring Events May 1-Sept 30, 2009								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH ₃ -N, ug/L	NO ₃ +NO ₂ -N, ug/L	TIN, ug/L	Total P, ug/L
Min	8.16	13.1	7.72	0.11	7	140	159	20
Max	8.29	18.6	9.84	0.15	19	182	189	37
Avg	8.24	15.63	9.09	0.13	14.33	163.33	177.67	26.00
Std. Dev.	0.06	2.27	0.97	0.02	5.25	17.46	13.30	7.79
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2009								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	-0.09	-0.06	0.03	-0.09	-0.04	3.98	-0.01	4.61
Max	6.71	23.02	4.99	6.67	6.67	19.26	22.95	22.95
Avg	0.62	13.27	0.67	0.62	1.04	13.39	13.28	15.58
Std. Dev.	1.34	4.97	1.25	1.34	1.61	4.57	4.95	4.62
Measurements	5874	9046	16	1467	121	26	2260	188
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: MORR10 GPS Coordinates: 39.6529°N, 105.2003°W; Sampling/ monitoring site west end of Morrison, at the gated bridge to Denver Mountain parks Headquarters, at the CDOW fish survey site.]

Segment 1b (Below Harriman Diversion)

Table 48 Segment 1b Summary

Segment 1b Datalogger Temperature Summary 2010								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	-0.12	0.14	0.25	-0.09	-0.04	4.24	0.25	4.68
Max	9.83	22.78	6.34	9.53	9.53	19.30	22.70	22.70
Avg	1.66	13.44	1.75	1.66	2.91	13.50	13.44	15.55
Measurements	8800	27091	24	2198	182	78	6770	563
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						1		
% Compliance WAT						99.28%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

Table 49 Bear Creek in Bear Creek Park, at the USGS gage (Site 15a)

Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.12	0.16	0.25	-0.09	-0.04	4.40	0.31	5.24
Max	9.49	22.54	6.17	9.30	9.30	19.30	22.41	22.41
Avg	1.27	13.45	1.34	1.27	2.43	13.56	13.45	15.57
Std. Dev.	1.78	4.83	1.49	1.77	2.09	4.48	4.82	4.42
Measurements	5874	9095	16	1467	121	26	2272	189
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 19.3°C WAT exceeded						1		
% Compliance WAT						96.15%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: MORR11 GPS Coordinates: 39.6522 °N, 105.1731 °W; Monitoring site in Bear Creek near USGS gage in Bear Creek Park.]

Table 50 Bear Creek, Above Ward Ditch (Site 27a)

Datalogger Temperature Data 2010							
All Temperatures in °C	30-Min Temp.	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	1.26				4.24	1.29	4.68
Max	22.78				19.26	22.70	22.70
Avg	13.42				13.45	13.42	15.40
Std. Dev.	4.78				4.51	4.77	4.68
Measurements	8998				26	2249	187
# 19.3°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: (Above Ward) GPS Coordinates: 39.6518 °N, 105.1854 °W; Monitoring site in Bear Creek above Ward Ditch gate, east of Morrison.]

Table 51 Bear Creek below Ward Ditch (site 27b)

Datalogger Temperature Data 2010							
All Temperatures °C	30 Min Temp. Warm Season	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	0.14				4.34	0.25	5.20
Max	22.75				19.27	22.65	22.65
Avg	13.45				13.49	13.45	15.67
Std. Dev.	4.82				4.48	4.80	4.40
Measurements	8998				26	2249	187
# 19.3°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

Segment 3 (Vance Creek)

Table 52 Mt. Evans Wilderness Drainage, Vance Creek (Site 25)

5 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH ₃ -N, ug/L	NO ₃ +NO ₂ -N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.68	8.90	8.52	0.06	5	11	27	9
Max	7.91	11.10	11.10	0.07	35	28	55	16
Avg	7.80	9.70	9.98	0.07	19	20	38.33	12
Std. Dev.	0.09	0.99	1.08	0.00	12.39	6.94	12.04	3.09
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2009								
All Temperatures in °C	30-Min Temp. COLD/ WARM SEASON		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	-0.06	3.51	4.54	-0.06	4.01	7.48	3.60	8.49
Max	15.51	19.89	8.03	15.34	15.34	14.32	19.71	19.71
Avg	6.37	11.53	6.00	6.36	10.63	11.63	11.53	15.03
Std. Dev.	3.70	3.13	1.40	3.66	2.88	1.79	3.09	2.22
Measurements	1488	5856	4	371	31	17	1463	122
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					7			
% Compliance DM					77.42%			
# 17°C WAT exceeded						0		
% Compliance WAT						100%		
# 21.2°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: ALKMEL GPS Coordinates: 39.6322°N, 105.4558°W; Sampling/ monitoring site in Vance Creek.]

Segment 5 (Cub Creek)

Table 53 Segment 5 Summary

Segment 5 Sampling/Monitoring Summary 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.68	9.1	7.33	0.078	7	6	13	8
Max	8.26	17.1	10.08	0.19	28	174	184	54
Avg	8.02	13.70	8.63	0.12	16.00	113.50	129.50	28.00
Std. Dev.	0.18	2.78	1.09	0.04	6.93	54.70	58.41	18.48
Measurements	6	6	6	6	6	6	6	6
Segment 5 Datalogger Temperature Summary 2009								
All Temperatures in °C	30-Min Temp. Warm	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)	
Min	0.05				2.30	0.07	1.69	
Max	20.41				16.42	20.23	20.23	
Avg	10.60				10.61	10.60	13.05	
Measurements	21911				62	5474	454	

# 18.2°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

Table 54 Little Cub Creek, above Bear Creek confluence (Site 26)

Datalogger Temperature Data 2009							
All Temperatures in °C	30-Min Temp. WARM SEASON	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	0.55				3.67	0.55	2.57
Max	20.41				20.23	20.41	16.90
Avg	11.67				14.43	11.67	11.68
Std. Dev.	4.14				3.57	4.14	3.58
Measurements	6991				145	6991	145
# 18.2°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

[Monitoring station/Datalogger ID: LTLCUB GPS Coordinates: 39.6312°N, 105.3221°W; Sampling/ monitoring site in Little Cub Creek above Bear Creek confluence.]

Table 55 Little Cub Creek above Brook Forest Inn (Site 35)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2009								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.68	9.10	7.71	0.08	10	87	102	8
Max	8.17	13.50	10.06	0.09	21	174	184	54
Avg	7.93	12.00	8.78	0.08	15	136	151.33	29
Std. Dev.	0.20	2.05	0.97	0.00	4.50	36.36	35.49	18.99
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2009								
All Temperatures in °C	30-Min Temp.	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)	
Min	0.05				5.97	2.10	4.04	
Max	19.29				11.69	15.89	15.89	
Avg	8.97				9.63	9.13	11.47	
Std. Dev.	3.65				1.99	2.87	2.66	
Measurements	7409				5	484	41	
# 18.2°C WAT exceeded					0			
% Compliance WAT					100%			
# 23.8°C DM exceeded							0	
% Compliance DM							100%	

[Monitoring station/Datalogger ID: (ABFI) GPS Coordinates: 39.5795°N, 105.3817°W; Sampling/ monitoring site in Little Cub Creek above Brook Forest Inn WWTP discharge.]

Table 56 Cub Creek Park on Little Cub Creek (site 50)

3 Monthly Sampling/ Monitoring events July 1 – September 30								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	8.03	12.10	7.33	0.13	7	6	13	11
Max	8.26	17.10	10.08	0.19	28	141	169	52
Avg	8.11	15.40	8.47	0.16	17	91	108	27
Std. Dev.	0.11	2.33	1.17	0.03	8.65	60.42	67.91	17.91
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. WARM SEASON	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)	
Min	11.21				4.31	0.70	3.42	
Max	18.25				15.20	18.12	18.12	
Avg	11.21				11.25	11.21	13.26	
Std. Dev.	3.64				3.28	3.62	3.38	
Measurements	7511				22	1877	156	
# 18.2°C WAT exceeded					0			
% Compliance WAT					100%			
# 23.8°C DM exceeded							0	
% Compliance DM							100%	

Genesee Reservoir**Table 57** Genesee Reservoir .5 meters from surface (site 39a)

All Temperatures in °C	30MinTemp. Warm Season	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	7.03	8.29	7.03	8.07
Max	23.24	20.73	22.78	22.78
Avg	16.82	16.86	16.82	17.89
Std. Dev.	3.56	3.47	3.55	3.56
Measurements	7548	22	1886	157
# 17°C WAT exceeded		13		
% Compliance WAT		40.91%		
# 21.2°C DM exceeded				23
% Compliance DM				85.35%

Table 58 Genesee Reservoir 1.0 meters from surface (site 39b)

1 Monthly Sampling/Monitoring Events October 26, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	Total P, ug/L	Dissolved P, ug/L
Results	7.77	11.2	6.68	0.174	N/A	146	9	5
Measurements	1	1	1	1	N/A	1	1	1

2010 Temperature Summary

Temperatures °C	30-Min Temp. WARM SEASONS	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	7.03	8.16	7.03	8.07
Max	21.71	20.51	21.33	21.33
Avg	16.49	16.54	16.49	17.11
Std. Dev.	3.47	3.43	3.46	3.39
Measurements	7548	22	1886	157
# 17°C WAT exceeded		12		
% Compliance WAT		45.45%		
# 21.2°C DM exceeded				2
% Compliance DM				98.72%

Table 59 Genesee Reservoir 2.0 meters from surface (site 39c)

All Temperatures in °C	30MinTemp. Warm Season	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	7.03	7.88	7.03	7.83
Max	21.33	20.16	20.87	20.87
Avg	14.77	14.76	14.77	15.07
Std. Dev.	3.81	3.82	3.81	3.76
Measurements	7547	22	1886	157
# 17°C WAT exceeded		7		
% Compliance WAT		68.18%		
# 21.2°C DM exceeded				0
% Compliance DM				100%

Table 60 Genesee Reservoir 3.0 meters from surface (site 39d)

1 Monthly Sampling/Monitoring Events October 26, 2010								
Monthly Parameter Results	pH, SU	Temp , °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3- N, ug/L	NO3+NO2- N, ug/L	Total P ug/L	Dissolved P, ug/L
Results	7.73	11.2	6.68	0.174		143	14	5
Measurements	1	1	1	1	N/A	1	1	1

2010 Temperature Summary @ 2m

All Temperatures in °C	30-Min Temp. WARM SEASONS	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	5.40	7.07	6.06	6.87
Max	19.42	19.14	19.42	19.42
Avg	13.38	13.35	13.38	13.55
Std. Dev.	3.97	3.99	3.97	3.96
Measurements	7548	22	1886	157
# 17°C WAT exceeded		4		
% Compliance WAT		81.28%		
# 21.2°C DM exceeded				0
% Compliance DM				100%

Turkey Creek Stream Segments
(Segment 6a South Turkey Creek)

Table 61 Turkey Creek (Site 18) Segment 6a Summary

Segment 6a Sampling/Monitoring Summary 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.69	11.5	6.24	0.75	27	81	132	34
Max	8.02	16.8	8.86	1.03	51	198	232	158
Avg	7.83	13.73	7.31	0.92	37.33	130.67	168.00	79.00
Std. Dev.	0.14	2.24	1.12	0.12	10.08	49.37	45.37	56.04
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Summary 2009								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.12	-0.06	1.11	-0.12	0.00	5.13	-0.04	4.67
Max	9.85	21.80	8.38	9.76	9.76	17.74	21.45	21.45
Avg	3.27	16.61	3.42	3.29	4.31	13.09	13.20	16.33
Measurements	8800	50997	27	2168	182	25	2249	187
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 18.2°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

Table 62 Turkey Creek within Bear Creek Park, near Maint. Bldg. (Site 16a)

Datalogger Temperature Data 2009								
All Temperatures in °C	30-Min Temp. COLD/WARM SEASONS		Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	-0.09	14.15	1.11	-0.08	0.00	17.10	14.28	17.42
Max	9.83	21.27	8.37	9.76	9.76	17.74	20.86	20.86
Avg	2.80	17.35	2.89	2.83	3.87	17.48	17.35	19.21
Std. Dev.	2.13	1.47	1.93	2.13	2.06	0.27	1.46	0.79
Measurements	5874	43437	16	1437	121	3	360	30
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					0			
% Compliance DM					100%			
# 18.2°C WAT exceeded						0		
% Compliance WAT						100%		
# 23.8°C DM exceeded								0
% Compliance DM								100%

[Monitoring station/Datalogger ID: TURK2 GPS Coordinates: 39.6394°N, 105.161°W; Sampling/ monitoring site in Turkey Creek, inside Bear Creek Lake Park, at the maintenance shop site.]

Table 63 Aspen Park Metropolitan District, South Turkey Creek (Site 18)

3 Monthly Sampling/Monitoring Events July 1-Sept 30, 2010								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.69	11.5	6.24	0.75	27	81	132	34
Max	8.02	16.8	8.86	1.03	51	198	232	158
Avg	7.83	13.73	7.31	0.92	37.33	130.67	168.00	79.00
Std. Dev.	0.14	2.24	1.12	0.12	10.08	49.37	45.37	56.04
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2010								
All Temperatures in °C	30-Min Temp. Warm Season	Nov 1-Mar 31 Stream Std. WAT (9°C)	Nov 1-Mar 31 2-Hr Avg. Temp.	Nov 1-Mar 31 Stream Std. DM (13°C)	Apr 1-Oct 31 Stream Std. WAT (18.2°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)	
Min	-0.06				5.13	-0.04	4.67	
Max	21.80				15.76	21.45	21.45	
Avg	12.40				12.49	12.40	15.78	
Std. Dev.	3.98				2.98	3.95	3.29	
Measurements	7560				22	1889	157	
# 18.2°C WAT exceeded					0			
% Compliance WAT					100%			
# 23.8°C DM exceeded							0	
% Compliance DM							100%	

[Monitoring station/Datalogger ID: APMD1 GPS Coordinates: 39.5461°N, 105.2708°W; Sampling/ monitoring site in South Turkey Creek downstream of the APMD WWTP.]

Segment 6b (North Turkey Creek)

Near confluence of N. & S. Turkey Creeks, on N. Turkey Creek (Site 17a) - Logger lost and No sampling/monitoring.

Table 64 Conifer Metropolitan District, North Turkey Creek (Site19)

5 Monthly Sampling/Monitoring Events July 1-Sept 30, 2009								
Monthly Parameter Results	pH, SU	Temp, °C	D. O., mg/L	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	8.03	12.60	6.41	0.26	9	7	16	11
Max	8.13	18.70	9.26	0.55	27	120	140	29
Avg	8.09	14.73	8.09	0.41	19	69	88.00	19
Std. Dev.	0.04	2.81	1.22	0.12	7.41	46.86	52.56	7.59
Measurements	3	3	3	3	3	3	3	3
Datalogger Temperature Data 2009								
All Temperatures in °C	30-Min Temp. Cold/ Warm Seasons		Oct 1-May 31 Stream Std. WAT (9°C)	Oct 1-May 31 2-Hr Avg. Temp.	Oct 1-May 31 Stream Std. DM (13°C)	June 1-Sept 30 Stream Std. WAT (17°C)	June 1-Sept 30 2-HR Avg. Temp.	June 1-Sept 30 DM (21.2°C)
Min	0.14	4.95	4.05	0.20	3.41	9.62	5.10	9.63
Max	14.15	22.78	8.19	13.72	13.72	16.02	22.51	22.51
Avg	6.00	12.76	5.61	6.00	8.99	12.81	12.76	16.72
Std. Dev.	3.09	3.46	1.72	3.06	2.87	1.96	3.41	2.90
Measurements	1488	6126	4	371	31	18	1531	127
# 9°C WAT exceeded			0					
% Compliance WAT			100%					
# 13°C DM exceeded					3			

% Compliance DM				90.32%			
# 17°C WAT exceeded					0		
% Compliance WAT					100%		
# 21.2°C DM exceeded							6
% Compliance DM							95.28%

[Monitoring station/Datalogger ID: CMD1 GPS Coordinates: 39.542°N, 105.3155°W; Sampling/ monitoring site in North Turkey Creek downstream of the CMD WWTP.]

USGS Stream Flow Data Tables

During the Program, stream flows for Bear Creek were tracked using three gaging stations. The stations are the USGS station above Evergreen Lake (Segment 1a), the DWR/U.S. Army COE station above Morrison (Segment 1e) and the USGS station within Bear Creek Lake Park (Segment 1b). Weekly downloads of flow graphs were printed to document flows. Downloads were obtained at www.waterdata.usgs.gov. The available historic record for the gage above Evergreen Lake is 25 years. The available historic record for the gage above Morrison is 90 years (1899-2006— however, permanent reliable data was recorded from 1919). The available historic record for the USGS gage in Bear Creek Lake Park is 24 years. NOTE: Operation of this gage was discontinued on September 30, 2009. For the 2009 Program period, historical Minimum, Maximum and Average were calculated. A Deviation from Historic averages was also calculated; however, when both the Minimum and Maximum values for Deviation from Historic were negative, these values are interchanged to reflect the desired interpretation.

Table 65 2010 May Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) May 2010	Historic Daily Mean Flow (cfs) 26 Years for May	Deviation from Historic Flow (cfs)
1	40	72	-32
2	38	72	-34
3	35	72	-37
4	35	73	-38
5	38	76	-38
6	40	79	-39
7	39	81	-42
8	36	81	-45
9	34	82	-48
10	41	84	-43
11	39	83	-44
12	37	82	-45
13	34	83	-49
14	45	85	-40
15	57	87	-30
16	58	90	-32
17	63	92	-29
18	73	92	-19
19	76	97	-21
20	76	98	-22
21	82	99	-17
22	87	99	-12
23	95	96	-1
24	97	97	0
25	65	106	-41
26	63	108	-45

Date	Daily Mean Flow (cfs) May 2010	Historic Daily Mean Flow (cfs) 26 Years for May	Deviation from Historic Flow (cfs)
27	73	106	-33
28	96	104	-8
29	84	105	-21
30	72	104	-32
31	63	100	-37
MIN	34	72	-49
MAX	97	108	0
AVG	58.42	90	-31.42

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W

Table 66 2010 June Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) June 2010	Historic Daily Mean Flow (cfs) 26 Years for June	Deviation from Historic Flow (cfs)
1	58	102	-44
2	55	100	-45
3	53	99	-46
4	52	97	-45
5	56	98	-42
6	55	97	-42
7	54	101	-47
8	49	97	-48
9	49	104	-55
10	48	103	-55
11	59	97	-38
12	144	96	48
13	114	98	16
14	128	95	33
15	101	95	6
16	91	96	-5
17	85	97	-12
18	78	99	-21
19	75	91	-16
20	71	89	-18
21	69	88	-19
22	65	86	-21
23	61	83	-22
24	59	79	-20
25	56	77	-21
26	55	79	-24
27	54	76	-22
28	65	74	-9
29	53	74	-21
30	49	70	-21
MIN	48	70	-55
MAX	144	104	48
AVG	68.70	91	-22.53

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W

Table 67 2010 July Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) July 2010	Historic Daily Mean Flow (cfs) 26 Years for July	Deviation from Historic Flow (cfs)
1	48	66	-18
2	49	63	-14
3	47	61	-14
4	46	60	-14
5	49	60	-11
6	41	59	-18
7	43	60	-17
8	49	62	-13
9	49	67	-18
10	42	64	-22
11	38	60	-22
12	37	59	-22
13	34	59	-25
14	33	55	-22
15	33	52	-19
16	30	52	-22
17	28	56	-28
18	28	52	-24
19	32	53	-21
20	30	52	-22
21	40	52	-12
22	33	49	-16
23	30	52	-22
24	27	52	-25
25	26	51	-25
26	25	52	-27
27	25	49	-24
28	31	50	-19
29	29	51	-22
30	30	52	-22
31	51	51	0
MIN	25	49	-28
MAX	51	67	0
AVG	36.55	55.90	-19.35

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W

Table 68 2010 August Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) August 2010	Historic Daily Mean Flow (cfs) 26 Years for August	Deviation from Historic Flow (cfs)
1	36	52	-16
2	57	51	6
3	77	53	24
4	70	55	15
5	57	59	-2
6	54	58	-4
7	49	55	-6
8	49	53	-4
9	63	51	12
10	74	53	21
11	53	51	2
12	48	50	-2
13	46	50	-4
14	43	48	-5

Date	Daily Mean Flow (cfs) August 2010	Historic Daily Mean Flow (cfs) 26 Years for August	Deviation from Historic Flow (cfs)
15	41	46	-5
16	40	47	-7
17	39	47	-8
18	37	47	-10
19	36	48	-12
20	36	44	-8
21	34	42	-8
22	33	42	-9
23	33	44	-11
24	33	46	-13
25	32	42	-10
26	30	41	-11
27	28	40	-12
28	28	40	-12
29	27	39	-12
30	26	38	-12
31	26	37	-11
MIN	26	37	-16
MAX	77	59	24
AVG	43.06	47.39	-4.32

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W

Table 69 2010 September Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) September 2010	Historic Daily Mean Flow (cfs) 26 Years for September	Deviation from Historic Flow (cfs)
1	16	38	-22
2	15	37	-22
3	14	35	-21
4	14	35	-21
5	14	34	-20
6	15	33	-18
7	17	33	-16
8	17	34	-17
9	15	33	-18
10	15	34	-19
11	14	35	-21
12	14	35	-21
13	21	33	-12
14	23	32	-9
15	21	31	-10
16	26	30	-4
17	24	29	-5
18	21	28	-7
19	19	28	-9
20	18	28	-10
21	19	29	-10
22	21	29	-8
23	22	28	-6
24	22	28	-6
25	22	27	-5
26	22	27	-5
27	22	26	-4
28	20	27	-7

Date	Daily Mean Flow (cfs) September 2010	Historic Daily Mean Flow (cfs) 26 Years for September	Deviation from Historic Flow (cfs)
29	19	26	-7
30	18	26	-8
MIN	15	26	-15
MAX	26	38	-6
AVG	19.60	30.93	-11.33

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W

Table 70 2010 May Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) May 2010	Historic Daily Mean Flow (cfs) 91 Years for May	Deviation from Historic Flow (cfs)
1	76.2	119	-42.8
2	69.8	118	-48.2
3	64.7	118	-53.3
4	62.7	118	-55.3
5	58.3	124	-65.7
6	61.2	136	-74.8
7	60.1	152	-91.9
8	59.6	150	-90.4
9	57.7	147	-89.3
10	59.7	148	-88.3
11	57.8	147	-89.2
12	61.8	147	-85.2
13	58.6	145	-86.4
14	76	145	-69
15	117	144	-27
16	111	149	-38
17	121	152	-31
18	137	151	-14
19	137	155	-18
20	126	157	-31
21	130	156	-26
22	130	157	-27
23	131	155	-24
24	130	154	-24
25	94.9	156	-61.1
26	89.2	155	-65.8
27	94.4	154	-59.6
28	115	151	-36
29	105	151	-46
30	95.3	150	-54.7
31	81.3	148	-66.7
MIN	57.7	118	-91.9
MAX	137	157	-14
AVG	91.27	145.45	-54.18

USGS 06710500 GPS Coordinates: 39.6530°N, 105.1950°W

Table 71 2010 June Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) June 2010	Historic Daily Mean Flow (cfs) 91 Years for June	Deviation from Historic Flow (cfs)
1	75	147	-72
2	68.5	147	-78.5
3	64.3	149	-84.7
4	62.5	150	-87.5

Date	Daily Mean Flow (cfs) June 2010	Historic Daily Mean Flow (cfs) 91 Years for June	Deviation from Historic Flow (cfs)
5	63.2	156	-92.8
6	62.7	151	-88.3
7	61.1	151	-89.9
8	55.9	150	-94.1
9	55.6	153	-97.4
10	53	155	-102
11	57.4	155	-97.6
12	156	148	8
13	130	149	-19
14	133	145	-12
15	112	142	-30
16	101	138	-37
17	94.3	135	-40.7
18	86.4	134	-47.6
19	80.4	128	-47.6
20	79.9	123	-43.1
21	78.2	121	-42.8
22	71	126	-55
23	65	117	-52
24	61.7	110	-48.3
25	58.3	106	-47.7
26	57.7	105	-47.3
27	60.2	99	-38.8
28	66.6	95	-28.4
29	56.8	93	-36.2
30	52.6	93	-40.4
MIN	52.6	93	-102
MAX	156	156	8
AVG	76.01	132.37	-56.36

USGS 06710500 GPS Coordinates: 39.6530°N, 105.1950°W

Table 72 2010 July Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) July 2010	Historic Daily Mean Flow (cfs) 91 Years for July	Deviation from Historic Flow (cfs)
1	49.8	89	-39.2
2	50.4	84	-33.6
3	51.4	81	-29.6
4	47.1	78	-30.9
5	59.8	77	-17.2
6	43.2	75	-31.8
7	44.5	79	-34.5
8	53.1	75	-21.9
9	56.1	77	-20.9
10	45.2	75	-29.8
11	40.6	72	-31.4
12	38.3	72	-33.7
13	34.3	68	-33.7
14	32.1	67	-34.9
15	31.9	66	-34.1
16	27.7	65	-37.3
17	24.9	65	-40.1
18	24.2	66	-41.8

Date	Daily Mean Flow (cfs) July 2010	Historic Daily Mean Flow (cfs) 91 Years for July	Deviation from Historic Flow (cfs)
19	27.5	67	-39.5
20	27.3	66	-38.7
21	40.2	65	-24.8
22	35.1	68	-32.9
23	29.7	67	-37.3
24	24.7	66	-41.3
25	25.1	66	-40.9
26	23.8	67	-43.2
27	21.6	64	-42.4
28	27.4	66	-38.6
29	27.7	66	-38.3
30	27.7	65	-37.3
31	45.6	67	-21.4
MIN	21.6	64	-43.2
MAX	59.8	89	-17.2
AVG	36.71	70.68	-33.97

USGS 06710500 GPS Coordinates: 39.6530°N, 105.1950°W

Table 73 2010 August Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) August 2010	Historic Daily Mean Flow (cfs) 91 Years for August	Deviation from Historic Flow (cfs)
1	36.8	68	-31.2
2	48.6	69	-20.4
3	74.7	71	3.7
4	68.4	75	-6.6
5	56.5	73	-16.5
6	52.7	73	-20.3
7	48.7	70	-21.3
8	50.2	69	-18.8
9	60.3	68	-7.7
10	85.3	65	20.3
11	53.1	62	-8.9
12	47.7	63	-15.3
13	45.7	62	-16.3
14	43.5	62	-18.5
15	42.7	61	-18.3
16	39.8	60	-20.2
17	37.8	62	-24.2
18	35.7	62	-26.3
19	34.2	62	-27.8
20	36.7	62	-25.3
21	31.5	64	-32.5
22	31.5	62	-30.5
23	29.9	60	-30.1
24	32.9	59	-26.1
25	30.6	59	-28.4
26	27.4	57	-29.6
27	25.3	55	-29.7
28	26.3	54	-27.7
29	25.2	53	-27.8
30	24.1	56	-31.9
31	22.4	52	-29.6

MIN	22.4	52	-32.5
MAX	85.3	75	20.3
AVG	42.14	62.90	-20.77

USGS 06710500 GPS Coordinates: 39.6530°N, 105.1950°W

Table 74 2010 September Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) September 2010	Historic Daily Mean Flow (cfs) 91 Years for September	Deviation from Historic Flow (cfs)
1	24.1	50	-25.9
2	22.7	56	-33.3
3	23.3	53	-29.7
4	21.8	51	-29.2
5	21.9	49	-27.1
6	19.1	47	-27.9
7	18.5	48	-29.5
8	18.9	49	-30.1
9	21	47	-26
10	20.1	48	-27.9
11	17.6	49	-31.4
12	17.9	47	-29.1
13	16.4	43	-26.6
14	17.1	43	-25.9
15	15.5	41	-25.5
16	15.2	40	-24.8
17	15	40	-25
18	15.1	38	-22.9
19	14	37	-23
20	14.2	37	-22.8
21	13.4	37	-23.6
22	15	37	-22
23	18.1	37	-18.9
24	17.3	36	-18.7
25	14.6	36	-21.4
26	13.9	36	-22.1
27	13.8	36	-22.2
28	14	35	-21
29	13	35	-22
30	12.2	34	-21.8
MIN	12.2	34	-33.3
MAX	24.1	56	-18.7
AVG	17.16	42.40	-25.24

USGS 06710500 GPS Coordinates: 39.6530°N, 105.1950°W

Weather Data

Local weather data was documented at the Evergreen Metropolitan District's WWTP. The plant has been operating the National Weather Service reporting station since EMD assumed operations of the plant in 1974. Online historical records however, are available from 1961 through 2006. Historical weather data obtained from the National Oceanographic and Atmospheric Administration/National Weather Service, High Plains Climate Center.

Maximum and minimum air temperature values along with precipitation measurements recorded each morning. Daily readings entered into a NWS software program. Local weather statistics are summarized, comparing 2010 monthly maximum, minimum and mean air temperatures and monthly precipitation to 46-year (1961-2010) historical data.

Table 75 Weather Data May-September 2010 Summary

Monthly Weather Data	May 2010	June 2010	July 2010	August 2010	September 2010
Air Temp Low Max (°F)	51	55	57	60	46
Air Temp High Max (°F)	84	89	92	88	87
Air Temp High Avg (°F)	61	76	82	80	77
Total Precip (in.)	1.82	1.85	1.78	2.47	0.07
Days of Precip.	6	7	14	9	3

Table 76 2010 Weather Data vs. Historical Weather Data (46 years 1961-2010)

	Avg Daily Min (°F)	Avg Daily Max (°F)	Avg Mon. Mean (°F)	Precip (in.)
May 2010	32	61	46.57	1.82
May Hist	33.9	65.2	49.6	2.57
% Deviation	94%	94%	94%	71%
June 2010	43.90	76	59.7	1.85
June Hist	41.1	75.3	58.2	2.14
% Deviation	107%	101%	103%	86%
July 2010	48.06	80	65.9	1.78
July Hist	46.8	81.6	64.2	2.23
% Deviation	103%	98%	103%	80%
August 2010	45	78	64.2	2.47
August Hist	45.3	79.3	62.4	2.31
% Deviation	99%	98%	103%	107%
Sept. 2010	38.2	77	57.65	0.07
Sept. Hist	37.1	72.1	54.6	1.47
% Deviation	103%	107%	106%	5%

Stream Flow vs. Local Weather

Stream flows, as measured at the USGS gage above Evergreen Lake, were compared to local weather observations obtained from the NWS reporting station located at the EMD WWTP. The following tables illustrate the relationship between high air temperatures and measured precipitation, and their effect on stream flows measured above Evergreen Lake.

Table 77 2010 May Bear Creek Evergreen vs. Weather Data

Date	May 2010 Daily Mean Flow (cfs)	May 2010 Daily Air Max Temp (°F)	May 2010 Precip. (in.)
1	40	45	
2	38	52	
3	35	45	
4	35	70	
5	38	67	
6	40	56	
7	39	51	0.08
8	36	47	
9	34	51	
10	41	66	
11	39	62	
12	37	M	0.48
13	34	34	0.21
14	45	38	0.3

Date	May 2010 Daily Mean Flow (cfs)	May 2010 Daily Air Max Temp (°F)	May 2010 Precip. (in.)
15	57	52	0.57
16	58	60	0.18
17	63	60	
18	73	69	
19	76	66	
20	76	63	
21	82	67	
22	87	67	
23	95	79	
24	97	65	
25	65	64	
26	63	65	
27	73	70	
28	96	82	
29	84	84	
30	72	77	
31	63	66	
MIN	34	34	0.08
MAX	97	84	0.57
AVG	58.42	61	0.30
TOTAL			1.82

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W Daily Mean flows were obtained from the USGS gaging station above Evergreen Lake. Weather data obtained from the NWS reporting station located at the EMD WWTP.

Table 78 2010 June Bear Creek Evergreen vs. Weather Data

Date	June 2010 Daily Mean Flow (cfs)	June 2010 Daily Max Air Temp (°F)	June 2010 Precip (in.)
1	58	73	
2	55	74	
3	53	71	
4	52	76	
5	56	86	
6	55	76	
7	54	86	
8	49	89	
9	49	70	
10	48	79	
11	59	74	0.13
12	144	64	0.86
13	114	46	0.3
14	128	50	0.28
15	101	60	0.03
16	91	73	
17	85	81	
18	78	81	
19	75	76	
20	71	75	
21	69	75	
22	65	77	
23	61	86	
24	59	74	
25	56	87	

Date	June 2010 Daily Mean Flow (cfs)	June 2010 Daily Max Air Temp (°F)	June 2010 Precip (in.)
26	55	88	
27	54	82	0.15
28	65	72	0.1
29	53	82	
30	49	83	
MIN	48	46	0.03
MAX	144	89	0.86
AVG	68.70	76	0.26
TOTAL			1.85

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W Daily Mean flows were obtained from the USGS gaging station above Evergreen Lake. Weather data obtained from the NWS reporting station located at the EMD WWTP.

Table 79 2010 July Bear Creek Evergreen vs. Weather Data

Date	July 2010 Daily Mean Flow (cfs)	July 2010 Daily Max Air Temp (°F)	July 2010 Precip (in.)
1	48		
2	49	84	0.01
3	47	83	0.2
4	46	81	
5	49	86	0.24
6	41	86	
7	43	78	0.08
8	49	82	0.1
9	49	56	*
10	42	*	
11	38	76	0.02
12	37	80	0.02
13	34	80	
14	33	85	
15	33	90	0.04
16	30	90	
17	28	86	
18	28	91	
19	32	92	0.01
20	30	83	
21	40	88	0.38
22	33	71	0.25
23	30	80	0.05
24	27	81	
25	26	85	
26	25	74	
27	25	79	
28	31	87	0.15
29	29	86	
30	30	78	
31	51	81	0.23
MIN	25	56	0.01
MAX	51	92	0.38
AVG	36.55	82	0.13
TOTAL			1.78

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W Daily Mean flows were obtained from the USGS gaging station above Evergreen Lake. Weather data obtained from the NWS reporting station located at the EMD WWTP.

- Data Missing Not Recorded

Table 80 2010August Bear Creek Evergreen vs. Weather Data

Date	August 2010 Daily Mean Flow (cfs)	August 2010 Daily Max Air Temp (°F)	August 2010 Precip (in.)
1	36	80	
2	57	84	0.18
3	77	80	0.25
4	70	78	0.12
5	57	78	
6	54	75	
7	49	79	0.02
8	49	83	0.13
9	63	77	0.15
10	74	77	0.77
11	53	79	
12	48	83	
13	46	83	
14	43	80	
15	41	70	
16	40	77	
17	39	80	
18	37	82	
19	36	88	
20	36	76	0.7
21	34	79	
22	33	85	
23	33	87	
24	33	78	0.15
25	32	75	
26	30	81	
27	28	87	
28	28	84	
29	27	84	
30	26	83	
31	26	81	
MIN	26	70	0.02
MAX	77	88	0.77
AVG	43.06	80	0.27
TOTAL			2.47

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W Daily Mean flows were obtained from the USGS gaging station above Evergreen Lake. Weather data obtained from the NWS reporting station located at the EMD WWTP.

Table 81 2010 September Bear Creek Evergreen vs. Weather Data

Date	September 2010 Daily Mean Flow (cfs)	September 2010 Daily Max Air Temp (°F)	September 2010 Precip (in.)
1	26	73	
2	24	83	
3	24	62	
4	24	74	
5	22	86	
6	21	86	
7	21	73	
8	21	77	
9	23	73	
10	21	82	

Date	September 2010 Daily Mean Flow (cfs)	September 2010 Daily Max Air Temp (°F)	September 2010 Precip (in.)
11	21	70	
12	20	75	
13	20	77	
14	20	80	
15	20	79	
16	19	80	0.01
17	19	80	
18	18	80	
19	18	75	
20	17	87	
21	17	83	
22	18	72	0.02
23	22	71	0.04
24	18	70	
25	17	74	
26	16	72	
27	16	82	
28	15	78	
29	15	83	
30	15	76	
MIN	15	62	0.01
MAX	26	87	0.04
AVG	19.60	77	0.02
TOTAL			0.07

USGS 06710385 GPS Coordinates: 39.6228°N, 105.3361°W Daily Mean flows were obtained from the USGS gaging station above Evergreen Lake. Weather data obtained from the NWS reporting station located at the EMD WWTP.