

2009 Data Report

Bear Creek Watershed Association



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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. 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.

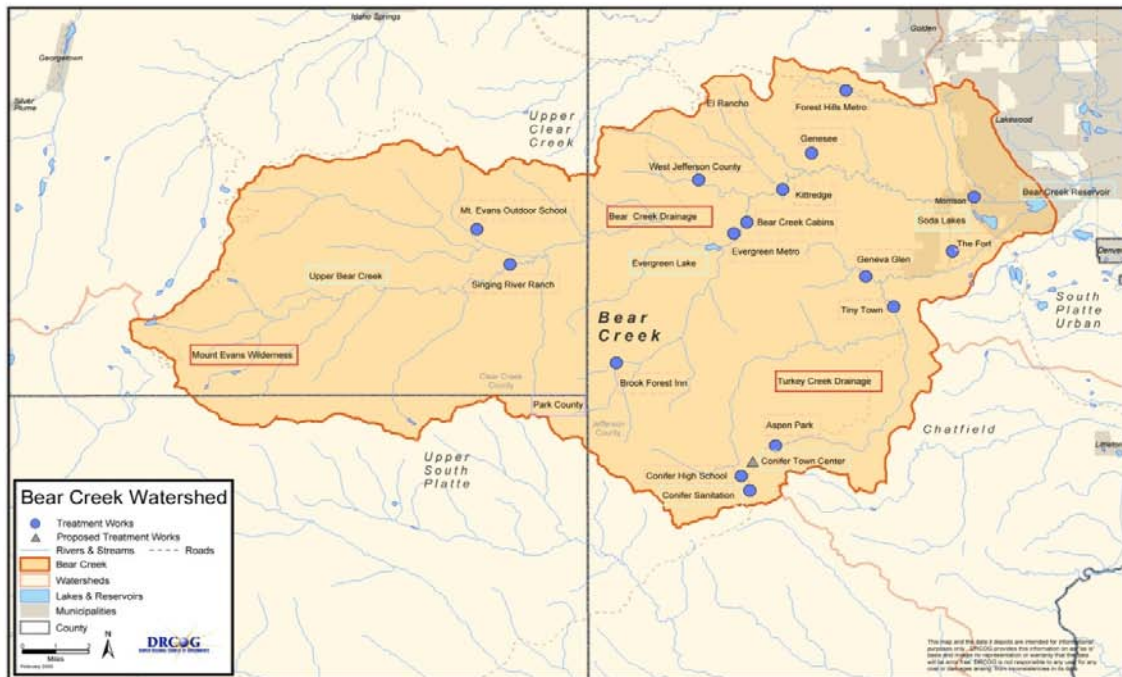


Figure 1 Bear Creek Watershed

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 (Figure 3). 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, see Figure 4). These types of monitoring efforts are for limited duration and/or 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 (see Figure 5 for partial location of BCWA watershed sampling locations)
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.



Figure 2 Bear Creek Reservoir with Sampling Stations



Figure 3 Bear Creek Park with BCWA Sampling Sites



Figure 4 Coyote Gulch Sampling Points and Restoration Drop Structures

P1 - Bear Creek Reservoir Monitoring Program

The Association modified and adopted the 2009 reservoir and watershed monitoring programs and Quality Assurance Project Plan (QAPP) in cooperation with the Water Quality Control Division staff (version 2009.02). The monitoring plan sections detail the 2009 reservoir and watershed monitoring programs. This monitoring plan serves as a supplement to the adopted Association QAPP (Bear Creek Watershed Association, 2006). Modifications to the monitoring plan resulted 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 near Brookforest Inn, site 35. Include this site for seasonal chemistry.
- 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. 2009 watershed chemistry and field measurements monitoring complete in September, no October or November sampling.
- New monitoring sites added in 2009 for Summit Lake in the Mount Evans Wilderness, 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 additional 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 by September 2009.
- 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 2009 monitoring sites with the BCWA site identifiers, data logger location and chemistry-monitoring sites by new stream segment descriptions.
- Identify reference sites for segments
- Larger scale maps maintained by Association.

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, trophic 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. Figure 4 shows Coyote Gulch sampling sites. A map of partial sampling sites and wastewater treatment plant locations is shown in Figure 5.

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 2009 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 1,3,4 and 5.

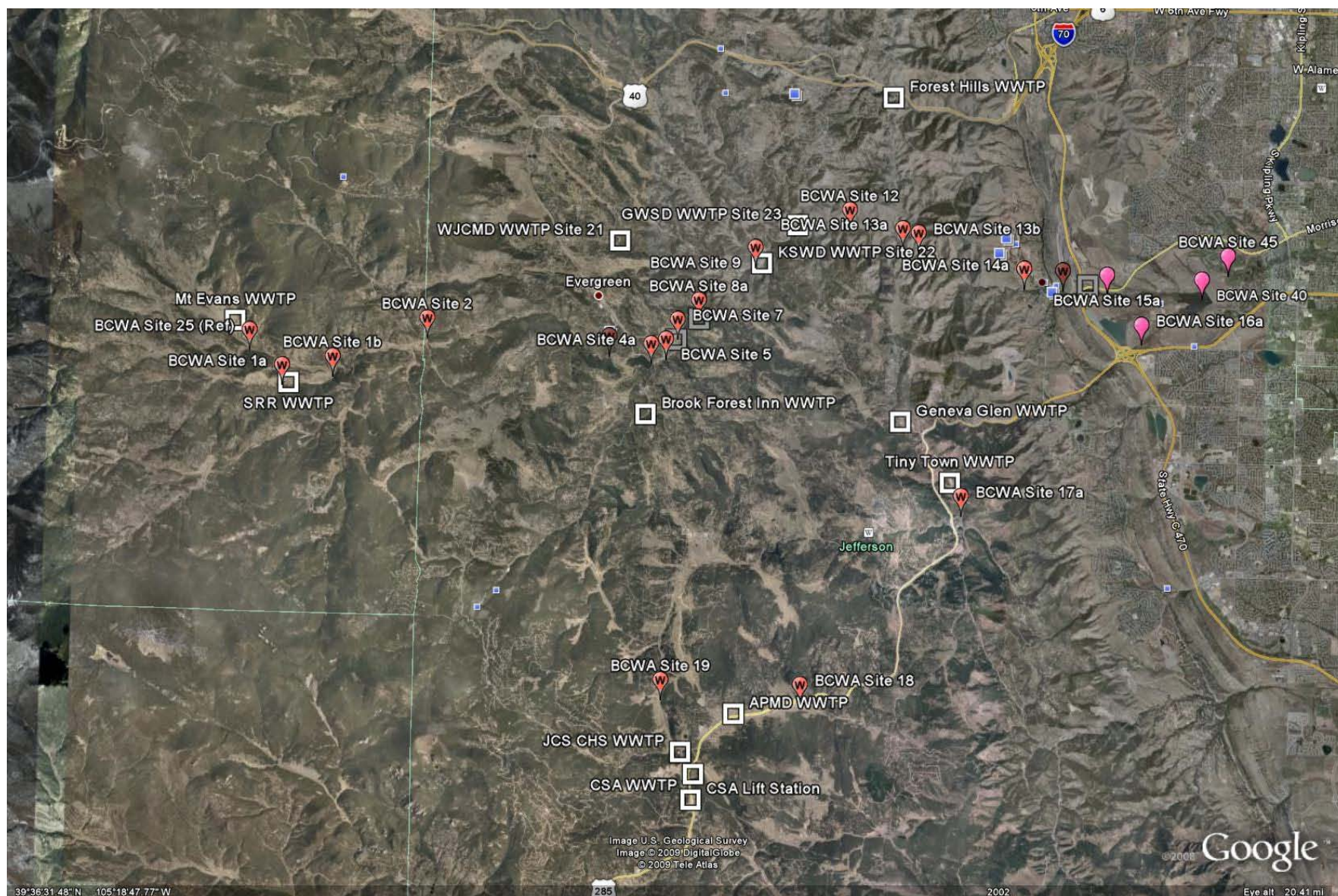


Figure 5 Bear Creek Watershed Sampling locations

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)	

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		2 ug/l

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 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 2008-2009 Cold-season and 2009 Warm-season water quality data set is an electronic data summary report.

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 2009 monitoring program began May 1, 2009 with completion on September 2009. The in-stream monitoring program provides more detailed water quality information specifically for temperature, pH, dissolved oxygen, specific conductance, total ammonia, nitrate+nitrite and total phosphorous in Bear Creek watershed streams.

The 2008-2009 Cold-season temperature monitoring program collected data from 9 in-stream Watershed locations, including the seven identified Colorado Division of Wildlife (CDOW) fish survey sites, and the five “larger” wastewater plant dischargers to Bear Creek. No monitoring or sampling was performed at any of the Watershed locations.

The 2009 Warm-season sampling and monitoring program collected data from 26 locations (including the five wastewater treatment plants-WWTP) within the Watershed. The Program included the seven identified Colorado Division of Wildlife (CDOW) fish survey sites.

Monitoring for pH, dissolved oxygen, temperature and specific conductance was performed monthly at 26 Watershed locations, including the five WWTPs. Sampling for Total Ammonia, Nitrate+Nitrite and Total Phosphorous was performed coincidentally with monthly monitoring. Nineteen of the twenty-two locations sampled (including WWTPs), were coincident with temperature dataloggers. Analyses were performed by GEI Consultants/Chadwick Ecological Consultants, Inc. in Littleton, Colorado. WWTP effluent data summarizes monthly process control sheets and results of permit- and non-permit required effluent analyses. Data includes pH, dissolved oxygen, temperature, effluent flow, total ammonia, nitrate and total phosphorous.

Flow data summarizes the three flow gages located on Bear Creek. These locations include above Evergreen Lake, above Morrison and below Morrison within Bear Creek Lake Park. 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 2009 program.

Table 3 BCWA Monitoring Sites

Site ID	Site Location by Stream Segment	2009 May-September		2009 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 ID	Site Location by Stream Segment	2009 May-September		2009 Off-season	Reference
		Data Logger	Chemistry	Data Logger	Site
Site 5	Above EMD WWTP, at CDOW downtown site	x	x	x	R
Site 7	Below EMD WWTP effluent	x	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 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 a Yellow Springs Instruments, Inc. (YSI) Model 556 MPS 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. At the completion of the Program, the memory was downloaded to a computer for use as a quality control check. Prior to the Program, the meter was calibrated by certified technicians at QA Balance in Aurora, Colorado. Prior to each monitoring event, the meter was calibrated for each parameter, using a purchased calibration solution for specific conductance and technician-mixed pH buffers (two-point calibration, 7.00 and 10.01). All calibrations were documented on a Calibration Logsheet.

Fresh batteries installed in the meter at the start of the Program and batteries replaced when the observed battery charge reached 50%. The YSI multi-meter utilizes an YSI software program to download and present collected data. Ecowatch software presents the data in graphic and tabular formats and data exported into a spreadsheet program. 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 seventeen 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 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 Evergreen Analytical in Wheat Ridge, Colorado for effluent testing of Total Ammonia and Total Phosphorous. Evergreen Analytical uses the following methods for testing: EPA-approved Method 4500-NH₃ D., *Standard Methods for the Analysis of Water and Wastewater, 20th Edition* for Total Ammonia analysis and EPA Method 200.7, Digestion and ICP analysis for Total Phosphorous.

Samples taken in the field were documented on Monthly Logsheets and on EMD Chain of Custody forms. Samples were taken in 1-liter polyethylene bottles, unpreserved, and immediately iced. For Warm-season samples, sampling events resulted in same-day transport to GEI Consultants, Inc. /Chadwick Ecological Division in Littleton, Colorado. Samples were iced during transport. GEI Consultants use QuickChem Method 10-107-06-3 D for Total Ammonia analyses, Method 4500-NO₃ I, *Standard Methods for the Analysis of Water and Wastewater, 21st Edition* for Nitrate +Nitrite analyses and Method 4500 P. G, *Standard Methods for the Analysis of Water and Wastewater, 21st Edition* for Total Phosphorous analyses. Analyses are performed with a Lachat QuickChem FIA+ 8000 series analyzer.

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 model H1 and H8 and model Water Temp Pro v2 (U22) programmable dataloggers. Prior to the start of the Program, all model dataloggers were returned to Onset for NIST (National Institute of Standards and Technology) two-point certification and a ‘tune-up’. The two-point certification was performed against calibration standards at 10°C and 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 Water Temp Pro models were utilized at all locations except the Evergreen Lake profile station and at the WWTP effluents. Model HOBO 8 loggers were used at the Evergreen Lake profile station and model HOBO 1 loggers were used at all WWTP effluents. The dataloggers are placed into watertight cases (Models HOBO 1 and 8) and secured to weights before being placed underwater. The Program uses Onset computer software specifically designed for these dataloggers, which enables launch and readout (start and stop) and viewing of downloaded data. Data download devices (Shuttles) were employed to download temperature data from the HOBO model and Water Temp Pro units in the field. This provided downloads with little or no omission of data. The software automatically presents the downloaded data in graph and table formats and allows data export into a spreadsheet format.

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 35 days for the H1 series logger, 165 days for the H8 series logger and 905 days for the U22 (Water Temp Pro) series logger. Certain Onset datalogger models begin recording temperatures immediately, once launched. The Association also employs newer model 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. (In 2006, the Association purchased “shuttle” devices capable of field-downloading data from newer model dataloggers. This capability eliminated much of the erroneous measurements mentioned above.)

A typical data retrieval procedure is as follows for the loggers located at WWTP effluents: Older HOBO 1 series loggers were utilized at the WWTPs because of their secure location. A laptop with the Onset software was brought to the effluent locations and the loggers were removed from their cases, data downloaded, relaunched (started) and returned to the effluent flow. After downloading, the logger cases are prepared for re-immersion by inserting a fresh desiccant packet and coating the o-ring with silicone sealant. Each logger is closed hand-tight and re-immersed.

The HOBO 8 series loggers were utilized at the Evergreen Lake profile Site. For downloading, these loggers were removed from their cases, connected to a shuttle device and data downloaded. After downloading, the logger cases are prepared for the re-immersion by coating the o-ring with silicone sealant. Each logger is closed hand-tight and re-immersed. HOBO 8 loggers continue with programmed measurements and do not require a re-launch. The shuttle device is then offloaded to the PC at the EMD office. Occasionally, the download process occurred precisely at the measurement instance and a measurement was lost.

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.

Precautions were taken during the Program to avoid lost temperature data. In previous years, dataloggers have been stolen from their location and all data for that recording period lost. In an effort to minimize lost data, all dataloggers located in Watershed stream Sites and WWTP effluent were retrieved and/or downloaded on an approximate monthly schedule. Summary results from the temperature dataloggers are presented in the table format.

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 Logsheet 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 of 18.2°C, against the underlying standard Daily Maximum Temperature (DM) criteria of 23.8°C and against the Maximum Weekly Average Temperature (MWAT) criteria of 20°C. Percentages of compliance were calculated. Weekly Average Temperatures were determined by calculating the mean temperature of seven consecutive days of data beginning with either May 1, 2008 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 1a 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 (NH3), Nitrate (NO3), Total Phosphorous (P); Temp Datalogger (logger)
WJCMD	Flow, pH, Temp, DO, NH3, NO3, P, logger
KSWD	Flow, pH, Temp, DO, NH3, NO3, P, logger
GWSD	Flow, pH, Temp, DO, NH3, NO3, NO2, P, logger
Morrison	Flow, pH, Temp, DO, NH3, P, 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 identified as ALKDOW. The gage location is adjacent to the Denver Mountain Parks golf course

and restaurant (Keys on the Green) parking lot. The gage station received restoration in early July 2005. The dam structure creating the pool for level sensing was rebuilt. 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. The third gaging station is located in Bear Creek Segment 1b (within Bear Creek Lake Park) and is operated by USGS (06710605). Weekly stream flow graphs were printed from all three stations and filed for record. Monthly average daily flows from all three gages exported to a spreadsheet for comparison with historical data.

There were 24 years of historical record available for the gage above Evergreen Lake (October 1984 through September 2008). For the gage located in Morrison, there were 89 years of historical 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.

BCWA Monitoring Site Characterizations

P4 – 2009 Supporting Watershed Study Efforts

Special Flow Study

A portable velocity meter spot checked estimated flows at CDOW fish survey sites (Table 5). 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 5 2009 Bear Creek Watershed Stream Flow Data

	May-09	Jun-09	Jul-09	Aug-09	Sep-09
Bear Creek	Flow (cfs)				
Site 36- Summit				5.4	1.24
Site 37 - Upper Bear Creek				4.9	1.35
Site 38 - Bear Tracks					8.36
Site 25 - Vance	13.9	26.8	8.3	6.4	2.9
Site 1a - Singing River	43.5	53.3	38.3	28.6	13.1
USGS Gage EGL	54	71	38	27	14
Site 35 - Cub Creek (BFI)				1	0.83
Site 3a - Keys on the Green	48	75	38	27	14
Site 5 - Little Bear			56.7		13.1
Site 7 - Below EMD WWTP		110.5	52.3	27.2	13
Site 8a - Bear Creek Cabins			51.8	34.9	13.9
Site 9 - O'Fallon Park	94.4		45.7	34.3	15.7
Site 12 - Lair O' The Bear	112.7		52.5	31.3	14.3
Site 13a - Idledale	126.2	97.3	56.3	40.7	15.9
Site 14a - Morrison Park West			60.9	32.8	10.6
USGS Gage BCP	72	113	29	18	5.3
Turkey Creek					
Site 19 - North Turkey Creek	30.7	15.4	2.2	1.21	0.31
Site 18 - South Turkey Creek	1.5	2.9	0.8	0.6	0.1

Macroinvertebrate Assessment

The macroinvertebrate integrity of Bear Creek is under assessment. Macroinvertebrate samples collected at the 8 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. The cooperative macroinvertebrate sampling was done by the Association on September 15, 2009 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.

CDOW Fish Survey Bear Creek

CDOW conducted their annual fish survey at nine locations September 2009. The survey included six historic sites and three additional sites. The added fishery survey sites were upstream of Evergreen Lake (ALKDOW), 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".

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. Other software programs that contain raw data include Onset Computer Corporation Boxcar software and YSI Ecowatch software.

Laboratory results consisted of Total Ammonia, Nitrate+Nitrite and Total Phosphorous from GEI Consultants, Inc. in Littleton. Results in spreadsheet form transmitted to the EMD staff electronically via email attachments. Results incorporated into the spreadsheet files for individual sampling locations.

Depositories

The Association data is located at three 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 BT Consulting, LLC for data summary and analyses. BT Consulting, LLC serves as a data depository for the Association and also maintains a full data record for all watershed sampling. 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.

2009 Association Data

The P1 monitoring program is contained in a spreadsheet titled *Bear Creek Reservoir 2008 Master Spreadsheet*. The spreadsheet contains all data analyses. Copies of the spreadsheet distributed to Association membership, WQCD staff and interested parties in February 2009 after approval from the Association Board (Bear Creek Association February 2009).

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 2009). Other data records developed in 2009 for the Association data record include temperature record plus chemistry for all watershed sample site: a) QA/QC spreadsheet data only; b) QA/QC spreadsheet data with summary information and standard analyses. A spreadsheet of available total inorganic nitrogen (TIN) data for P1 sites (2000-2009) and selected watershed sites in 2007.

Electronic Transfers WQCD/ Depositories

1. Spreadsheet watershed QA/QC spreadsheet data only (WQCD - 4); depositories (3)
2. Spreadsheet watershed QA/QC spreadsheet with summary information and standard analyses (WQCD - 2); depositories (3)
3. Temperature record (WQCD - 2); depositories (3);
4. *Bear Creek Reservoir 2008 Master Spreadsheet*, plus WQCC annual report, 2009 Data report, 2009 Fishery master, 2009 macroinvertebrate spreadsheet (raw data), 2009 flow spreadsheet, Coyote Gulch master spreadsheet, site master spreadsheet (WQCD - 2), depositories (3)

Summary Bear Creek Watershed 2009 Monitoring Data

Overview

Sampling and Monitoring Program Notes

Data organization reflects the Colorado Water Quality Control Division's re-segmentation and application of water quality standards to water bodies 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. Bear Creek and Turkey Creek Segments will be addressed, in addition to Evergreen Lake and Summit Lake. All data collected is presented in table form, with analyses summarized.

Temperature dataloggers that were in stream segments since January 1, 2009 were removed from their locations in early March. The loggers were sent to the manufacturer for annual recalibration and recertification. The loggers were returned to their Sites and programmed to begin data collection at 30-minute intervals by May 1. 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. When a routine observation of dataloggers occurred on May 18, several loggers were repositioned in the stream flow because of fluctuating flows. On July 17, during another routine check of loggers, it was discovered that Site 17a logger had disappeared. It was not found and temperature data for that Site is missing for this report.

Stream and lake sampling and monitoring data, including pH, Temperature, Dissolved Oxygen, Specific Conductance, Ammonia, Nitrate+Nitrite, Total Inorganic Nitrogen (calculated) and Total Phosphorous was collected from May through September, at 21 sites. Stream and lake temperature dataloggers were used at 24 Sites, including the Evergreen Lake profile station, excluding the five WWTPs. Eight selected Sites collected datalogger temperatures from January 1 through September 30. The sixteen remaining sites collected temperature data from May through September. pH calibration difficulties were experienced during the monitoring event on September 2. Manual flows were measured at 16 sites in the watershed during the May to September timeframe.

WWTP effluent measurements and samples were obtained by operators as necessary according to discharge permit requirements. Process control measurements were taken during the normal course of plant operations. Wastewater effluent sampling and monitoring results presented in tables below are for the entire 2009 period. WWTP effluent flow, pH, Temperature, Dissolved Oxygen, Ammonia, Nitrate, Nitrite, Total Inorganic Nitrogen (calculated) and Total Phosphorous are presented in the tables below. Temperature dataloggers recorded measurements at the identical frequency as the stream loggers (30-minute intervals) during the period from January 1 through September 30.

Bear Creek historical and average daily flow data was compiled from the three reporting gages on the stream. Data was accessed via the USGS and Colorado Division of Water Resources websites for gages location above Evergreen Lake, above the town of Morrison and above Bear Creek Reservoir, within Bear Creek Lake Park. Average mean flows for 2009 were obtained during May through September, and all available historical records were accessed. The stream gage above Bear Creek Lake was removed from service on September 30.

Weather data was recorded and reported by Evergreen Metropolitan District personnel, operating the NOAA weather station #2790 at the EMD wastewater treatment plant. Daily high and low temperatures and measured precipitation were recorded and transmitted monthly to NOAA. Historical weather data was accessed through the NOAA High Plains Climate Center website.

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 eight sites situated from above Evergreen Lake to the west end of Morrison in the Bear Creek Watershed. Segment 1a (Sites 1a, 2, 3a), Segment 1e (Sites 5, 8a, 9, 12, 13a, 14a) comprise the Cold-season locations for temperature dataloggers. The program began in early November 2008 and ended in March 2009. The data presented in this report reflects the temperature measurements collected from January 1 through September 30, 2009. (This change represents the revision of reporting data collected in a calendar year.)

The Warm-season program locations included twenty sites in Bear Creek Segments 1a, 1b, 1d, 1e, 3 and 5 (including four total at the Evergreen Lake profile station) and four sites in Turkey Creek Segments 6a and 6b, for a total of twenty-four sites. Additionally, the five major wastewater treatment plants discharging into Segment 1e (EMD, WJCMD, KSWD, GWSD) and 1b (Morrison) were monitored. The 2009 Warm-season program for temperature data collection began on May 1 and concluded on September 30.

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.

169,273 individual temperature data points were obtained from the twenty-four 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. The WAT is determined by calculating the seven-day average temperature of all measurements collected at each Site in seven consecutive days, beginning with the first day of data collection. There were 439 weekly averages calculated for the program period. The DM is calculated by averaging temperature measurements recorded in a two-hour period and determining the maximum of these values in one day. 38,649 two-hour blocks were averaged and 3219 Daily Maximum values were calculated.

52,827 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.

Segment 1d (Evergreen Lake) required a specific calculation to determine compliance with temperature standards for Cold Lake, Large (CLL). Dataloggers placed at 1, 2 and 3 meters below the surface recorded measurements every 30 minutes. In a spreadsheet, the values were aligned by date and time and the three values averaged. The resulting, averaged 30-minute values were analyzed and compared against water quality standards for CLL.

Table 6 Bear Creek Watershed 2009 Temperature Compliance by Segment

	Cold-season		Growing Season	
Segment 3	9°C WAT	13°C DM	17°C WAT	21.2°C DM
# Exceedances	NA	NA	0	0
% Compliance	NA	NA	100%	100%
Segment 1a	9°C WAT	13°C DM	17°C WAT	21.2°C DM
# Exceedances	4	22	0	0
% Compliance	86.6%	90.3%	100%	100%
Segment 1d	WAT	DM	18.2°C WAT (CLL)	23.8°C DM (CLL)
# Exceedances	NA	NA	0	0
% Compliance	NA	NA	100%	100%
Segment 1e	9°C WAT	13°C DM	19.3°C WAT	23.8°C DM
# Exceedances	0	0	0	0
% Compliance	100%	100%	100%	100%
Segment 1b	9°C WAT	13°C DM	19.3°C WAT	23.8°C DM

	Cold-season		Growing Season	
# Exceedances	NA	NA	0	0
% Compliance	NA	NA	100%	100%
Segment 5	9°C WAT	13°C DM	18.2°C WAT	23.8°C DM
# Exceedances	NA	NA	0	0
% Compliance	NA	NA	100%	100%
Segment 6a	9°C WAT	13°C DM	18.2°C WAT	23.8°C DM
# Exceedances	NA	NA	0	0
% Compliance	NA	NA	100%	100%
Segment 6b	9°C WAT	13°C DM	17°C WAT	21.2°C DM
# Exceedances	NA	NA	0	1
% Compliance	NA	NA	100%	99%

NA-Indicates no logger data obtained.

Table 7 Bear Creek 2009 Number of Temperature Measurements

2009 Total Number of Measurements (Off- and Growing seasons)				
	# 30-min. Temps.	# Calculated WAT	# 2-Hr. Avgs. For DM calculation	# Calculated DM
Segment 3	7340	21	1835	153
Segment 1a	28503	81	7125	593
Segment 1d	21994	21	1832	153
Segment 1e	70844	201	17709	1473
Segment 1b	9280	26	2320	194
Segment 5	9280	26	2320	194
Segment 6a	14688	42	3672	306
Segment 6b	7344	21	1836	153
Watershed totals	169273	439	38649	3219

Segment 8 (Site 36) and Segment 7 (Sites 37 and 38) did not have temperature dataloggers and therefore do not have sufficient data to determine compliance with water quality standards for temperature.

Segment 3 (Site 25)

- 100% of the recorded temperature values complied with the 17°C Weekly Average Temperature (WAT) standards for June1 through September 30.
- 100% of the recorded temperature values complied with the 21.2°C Daily Maximum (DM) Temperature standards for June1 through September 30.

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

- 100% of the recorded temperature values complied with the 17°C Weekly Average Temperature (WAT) standards for June1 through September 30.
- 100% of the recorded temperature values complied with the 21.2°C Daily Maximum (DM) Temperature standards for June1 through September 30.
- 86.6% of the recorded temperature values complied with the 9°C Weekly Average Temperature (WAT) standard Oct 1 through May 31.
- 90.3% of the recorded temperature values complied with the 13°C Daily Maximum (DM) Temperature standard for Oct 1 through May 31.

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

- 100% 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)

- 100% of the recorded temperature values complied with the 9°C Weekly Average Temperature (WAT) standard Nov 1 through Mar 31.
- 100% of the recorded temperature values complied with the 13°C Daily Maximum (DM) Temperature standard for Nov 1 through Mar 31.
- 100% of the recorded temperature values complied with the 19.3°C Weekly Average Temperature (WAT) standard Apr 1 through Oct 31.
- 100% 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)

- 100% of the recorded temperature values complied with the 19.3°C Weekly Average Temperature (WAT) standard Apr 1 through Oct 31.
- 100% of the recorded temperature values complied with the 23.8°C Daily Maximum (DM) Temperature standard for Apr 1 through Oct 31.

Segment 5 (Sites 26 and 35)

- 100% of the recorded temperature values complied with the 18.2°C Weekly Average Temperature (WAT) standard Apr 1 through Oct 31.
- 100% of the recorded temperature values complied with the 23.8°C Daily Maximum (DM) Temperature standard for Apr 1 through Oct 31.

Segment 6a (Sites 16a and 18)

- 100% of the recorded temperature values complied with the 18.2°C Weekly Average Temperature (WAT) standard Apr 1 through Oct 31.
- 100% of the recorded temperature values complied with the 23.8°C Daily Maximum (DM) Temperature standard for Apr 1 through Oct 31.

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

- 100% of the recorded temperature values complied with the 17°C Weekly Average Temperature (WAT) standard June 1 through Sept 30.
- 99% of the recorded temperature values complied with the 21.2°C Daily Maximum (DM) Temperature standard for Apr 1 through Oct 31.

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.

Table 8 WWTP Number of Temperature Measurements

	# 30-min. measurements	# Calculated DAT	# Calculated WAT
EMD WWTP	10513	220	30
WJCMD WWTP	10582	220	30
KSWD WWTP	10585	220	30
GWSD WWTP	10571	220	30
Morrison WWTP	10576	220	30
Totals (Jan 1-Sept 30)	52827	1100	150

- **EMD WWTP (Discharging into Segment 1e)**-The Weekly Average Temperature (WAT) was calculated to be 13.4°C and the Daily Average temperature was 13.4°C from January 1 through September 30.

- **WJMCD WWTP(Discharging into Segment 1e)**-The Weekly Average Temperature (WAT) was calculated to be 13.8°C and the Daily Average temperature was 13.8°C from January 1 through September 30.
- **KSWD WWTP (Discharging into Segment 1e)**-The Weekly Average Temperature (WAT) was calculated to be 12.3°C and the Daily Average temperature was 12.4°C from January 1 through September 30.
- **GWSD WWTP (Discharging into Segment 1e)**-The Weekly Average Temperature (WAT) was calculated to be 14.7°C and the Daily Average temperature was 14.7°C from January 1 through September 30.
- **Morrison WWTP (Discharging into Segment 1b)**-The Weekly Average Temperature (WAT) was calculated to be 16°C and the Daily Average temperature was 16°C from January 1 through September 30.

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.

Site 37 experienced a low pH measurement on July 7. Although the pH sensor calibrated correctly, the low value may be attributed to red algae noticed at the Summit Lake shoreline, near the outlet of the lake. The profile station in Evergreen Lake (Sites 4a-4e) experienced low pH values on the August 6 monitoring event at Sites 4c, 4d and 4e (2-, 3- and 4-meter down). On September 3, the profile station in Evergreen Lake experienced a low pH value at Site 4e (4 meters down). The Evergreen Metropolitan District water treatment plant intake pipe is located approximately 5 feet below the surface, so pH values could not be corroborated. Low flows in Bear Creek (and through Evergreen Lake) on the exceedance days could be a contributing factor.

Table 9 Bear Creek Watershed 2009 Water Quality Compliance by Segment

	Stream Std.	Stream Std.	Stream Std.	Stream Std.
	pH (6.5-9 SU)	DO (6.0 mg/L)	NH3-N ug/L (TVS)	NO3-N (10,000ug/L)*
Segment 8				
# Exceedances	0	0	0	0
# Measurements	3	3	2	3
% Compliance	100%	100%	100%	100%
Segment 7				
# Exceedances	1	0	0	0
# Measurements	4	4	3	4
% Compliance	75%	100%	100%	100%
Segment 3				
# Exceedances	0	0	0	0
# Measurements	5	5	5	5
% Compliance	100%	100%	100%	100%
Segment 1a				
# Exceedances	0	0	0	0
# Measurements	10	10	10	10
% Compliance	100%	100%	100%	100%
Segment 1d				
# Exceedances	3	2	0	0
# Measurements	25	5	4	8
% Compliance	88%	60%	100%	100%

	Stream Std. pH (6.5-9 SU)	Stream Std. DO (6.0 mg/L)	Stream Std. NH3-N ug/L (TVS)	Stream Std. NO3-N (10,000ug/L)*
Segment 1e				
# Exceedances	1	0	0	0
# Measurements	35	35	35	35
% Compliance	97%	100%	100%	100%
Segment 1b				
# Exceedances	NA**	NA	NA	NA
# Measurements	NA	NA	NA	NA
% Compliance	NA	NA	NA	NA
Segment 5				
# Exceedances	0	0	0	0
# Measurements	2	2	2	2
% Compliance	100%	100%	100%	100%
Segment 6a				
# Exceedances	0	1	0	0
# Measurements	5	5	5	5
% Compliance	100%	80%	100%	100%
Segment 6b				
# Exceedances	0	0	0	0
# Measurements	5	5	5	5
% Compliance	100%	100%	100%	100%

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

** -No Sites in Segment 1b were sampled or monitored.

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:** 75% of the measured pH and 100% of 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)

- 88% of the measured pH values and 60% 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)

- **Site 9:** 80% of the measured pH and 100% of 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.
- **(All other 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 80% of 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.

Summary

Temperature Compliance

Segments 3, 1a, 1d, 1e, 1b, 5 and Turkey Creek Segments 6a and 6b showed little impairment during both the Off- and Growing Seasons. Comparisons with adopted temperature standards resulted in 100% compliance for the WAT and +99% compliance for the DM calculated for the Growing Season throughout the Watershed, utilizing the 85th%-tile qualifier. Comparisons with adopted temperature standards resulted in 95.2% compliance for the calculated WAT and 96.4% 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 September, summarized in 169,273 30-minute measurements at twenty-four 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-four Sites in the Watershed from Mt. Evans Wilderness to just above 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. Segment 1a was the only location experiencing exceedances for the Off Season period. Segment 1a had 4 exceedances in WAT and 22 exceedances in DM limits resulting in the above-

mentioned compliance issues. These exceedances occurred at Sites 2 and 3a, which follow the reach of Bear Creek most exposed to direct sunlight, during lower than average flows in May.

Turkey Creek Segment 6b experienced 1 exceedance in DM during the Growing Season timeframe, resulting in the above-mentioned compliance issue. There were no other exceedances recorded in the watershed during the Growing Season for WAT or DM.

Wastewater plant discharges into Bear Creek did not cause temperature impairment. A comprehensive temperature data collection effort from January through September, summarized in 58,827 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 none 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. Daily Average Temperatures for all five effluents was 14°C and Weekly Average Temperatures for all effluents was 14.1°C during the January 1 through September 30 timeframe.

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 five monthly sampling and monitoring events occurred from May through September at twenty-one Sites throughout the watershed. 94 measurements of pH and DO were performed at these Sites. 93.6% compliance for pH and 90.4% compliance for Dissolved Oxygen were achieved. 71 samples were analyzed for Total Ammonia and 77 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.

Wastewater plant discharges into Bear Creek result in no evidence of water quality impairment. 100% of the wastewater plant effluent pH, Total Phosphorous and Total Ammonia values met permit limits. All 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 2009 and showed no evidence of thermal pollution. There were no permit violations reported for any parameter from any wastewater treatment plant in 2009. 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 gages above Morrison and within Bear Creek Lake Park followed the Evergreen gage values. Even with the higher than average precipitation in May through July, the stream flows remained well below to slightly below monthly historic averages. Only 3 days in June and 4 days in July exceeded historic average flows. The precipitation events during May 24-26, June 2 and June 26-27 did not increase flows to historic averages. A surprising factor in the 2009 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 as compared to historic averages. Measurable precipitation exceeded historic averages in May, June and July (greatly so in June), but drastically decreased in August, and September was slightly below average. Even though average Monthly Maximum temperatures were high and monthly precipitation low during August, WAT standards were not exceeded and only one DM standard was recorded.

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 July and August, which coincided with the slightly above precipitation in July and significantly lower precipitation in August. 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 in May.

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 September 30. 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. 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 10 Evergreen Metropolitan District (Site 20)

EMD WWTP Effluent Summary 2009									
2009 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	6.50	6.50	2.75	30	2400	7	2440	40	0.3473
Max	7.19	19.00	6.10	12600	9220	1000	9258	460	1.1492
Avg	6.76	12.63	4.23	2523	4705	102	5312	154	0.5174
Std. Dev.	0.13	3.83	0.56	3205	2030	271	2182	94	0.1023
Measurements	259	247	247	58	13	12	12	52	365
Effluent Datalogger Temperature Summary Jan.1- Sept. 30, 2009									
All Temperatures in °C		30-Min Temp.		Daily Avg.Temp.		Weekly Avg. Temp.			
Min		7.4		7.4		7.8			
Max		18.6		18.5		18.2			
Avg		13.4		13.4		13.4			
Std. Dev.		4.1		4.1		4.1			
Measurements		10513		220		30			

[Datalogger ID: EMD5 GPS Coordinates: 39.6376°N, 105.3150°W; Sampling/monitoring site is the EMD WWTP effluent. The datalogger is 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.-6,500, Mar.-6,400, Apr.-5,300, May-5,800 June-8,200 July-8,000 Aug.-6,400 Sept.-5,200; Oct.-4,200; Nov.-5,900; Dec.-4,700; pH 6.5-9.0

Table 11 West Jefferson County Metropolitan District (Site 21)

WJCMD WWTP Effluent Summary 2009									
2009 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	6.56	9.30	2.54	30	1180	7	1202	50	0.2770
Max	7.15	18.60	4.30	4320	3100	1000	5100	830	0.8019
Avg	6.79	13.37	3.28	185	1945	122	2173	192	0.4942
Std. Dev.	0.13	2.91	0.39	592	614	277	1036	137	0.0909
Measurements	260	243	243	52	13	12	12	52	365
Effluent Datalogger Temperature Summary Jan.1- Sept. 30, 2009									
All Temperatures in °C			30-Min Temp.		Daily Avg.Temp.		Weekly Avg. Temp.		
Min			8.6		8.8		9.1		
Max			22.1		18.2		18.0		
Avg			13.8		13.8		13.8		
Std. Dev.			3.4		3.3		3.3		
Measurements			10582		220		30		

[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 12 Kittredge Sanitation and Water District (Site 22)

KSWD WWTP Effluent Summary 2009									
2009 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	6.52	3.60	0.24	24	2300	160	4353	200	0.0311
Max	7.85	20.50	16.10	3030	24000	1000	22500	680	0.1059
Avg	6.81	11.28	3.15	741	11445	330	11945	377	0.0566
Std. Dev.	0.14	4.69	2.95	695	6542	217	5096	114	0.0081
Measurements	239	217	217	50	13	11	11	25	365
Effluent Datalogger Temperature Summary Jan.1- Sept. 30, 2009									
All Temperatures in °C			30-Min Temp.		Daily Avg.Temp.		Weekly Avg. Temp.		
Min			2.0		2.8		3.4		
Max			19.0		17.6		17.2		
Avg			12.3		12.3		12.4		
Std. Dev.			4.8		4.8		4.9		
Measurements			10585		220		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 13 Genesee Water and Sanitation District (Site 23)

GWSD WWTP Effluent Summary 2009									
2009 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	6.48	9.00	5.40	71	630	0	1217	130	0.0260
Max	7.50	19.00	9.80	1252	6370	57200	12000	660	0.3780
Avg	7.00	13.77	7.33	<310	2669	<3808	<5691	392	0.2685
Std. Dev.	0.19	2.94	0.40	283	1269	<8191	<2766	118	0.0355
Measurements	361	361	360	53	54	47	46	53	365
Effluent Datalogger Temperature Summary Jan.1- Sept. 30, 2009									
All Temperatures in °C		30-Min Temp.		Daily Avg.Temp.		Weekly Avg. Temp.			
Min		10.6		10.8		10.9			
Max		19.0		18.8		18.6			
Avg		14.7		14.7		14.7			
Std. Dev.		3.0		3.0		3.0			
Measurements		10571		220		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 14 Town of Morrison (Site 24)

Morrison WWTP Effluent Summary 2009					
2009 Process Control and Permit Sampling and Monitoring					
Parameter	pH, SU	Temp, °C	Total NH ₃ -N, ug/L	Total P, ug/L	Flow, MGD
Min	6.5	7.2	<100	200	0.05
Max	7.9	23.7	3100	930	0.14
Avg	7.2	15.5	453	533	0.08
Std. Dev.	0.3	4.5	474	200	0.02
Measurements	365	365	51	50	365
Effluent Datalogger Temperature Summary Jan. 1-Sept. 30, 2009					
All Temperatures in °C		30-Min Temp.		Daily Avg.Temp.	
Min		7.4		7.4	
Max		22.1		21.7	
Avg		16.0		16.0	
Std. Dev.		5.0		5.0	
Measurements		10576		220	

[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

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 Growing 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.

Mt Evans Wilderness (Segments 7 and 8)

Table 15 Summit Lake Site 36 (In Summit Lake near outlet) Segment 8

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 NH ₃ -N, ug/L	NO ₃ +NO ₂ -N, ug/L	TIN, ug/L	Total P, ug/L
Min	6.99	5.30	6.91	0.019	10	47	57	7
Max	8.85	8.51	8.35	0.020	24	109	133	17
Avg	7.79	7.16	7.74	0.019	17	86	95	11
Std. Dev.	0.78	1.36	0.61	0.000	7	28	38	4
Measurements	3	3	3	3	2	3	2	3

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

Table 16 Segment 7 Summary

Segment 7 Sampling/Monitoring Summary 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	6.28	6.37	7.50	0.018	12	77	89	5
Max	8.19	9.01	12.09	0.037	27	121	138	25
Avg	7.23	7.88	8.86	0.025	19	107	121	12
Std. Dev.	0.81	1.00	1.88	0.007	6	18	23	8
Measurements	4	4	4	4	3	4	3	4

Table 17 Summit Lake Site 37 Segment 7

3 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	6.28	6.37	7.50	0.018	12	77	89	6
Max	7.84	9.01	8.08	0.022	27	121	137	25
Avg	6.90	7.96	7.78	0.021	17	103	120	13
Std. Dev.	0.67	1.14	0.24	0.002	7	19	22	9
Measurements	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 18 Summit Lake Site 38 (Bear Creek at Bear Tracks) Segment 7

1 Monthly Sampling/Monitoring Event Sept 3, 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	8.19	7.66	12.09	0.037	17	121	138	5
Max	8.19	7.66	12.09	0.037	17	121	138	5
Avg	8.19	7.66	12.09	0.037	17	121	138	5
Std. Dev.	0.00	0.00	0.00	0.000	0	0	0	0
Measurements	1	1	1	1	1	1	1	1

[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 19 Segment 1a Summary**

Segment 1a Sampling/Monitoring Summary 2009								
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	6.51	3.74	7.27	0.037	9	2	22	3
Max	8.56	13.10	14.75	0.072	31	84	98	35
Avg	7.60	9.22	10.42	0.052	16	45	62	15
Std. Dev.	0.59	2.78	2.75	0.013	7	27	27	10
Measurements	10	10	10	10	10	10	10	10
Segment 1a Datalogger Temperature Summary 2009								
All Temperatures in °C	30-Min Temp.	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	-0.23	-0.13	-0.23	-0.12	4.87	2.12	4.16	
Max	20.48	10.85	15.73	15.73	15.75	20.42	20.42	
Avg	8.92	4.49	4.58	6.01	11.96	11.88	14.17	
Measurements	28503	30	2734	227	51	4391	366	
# 9°C WAT exceeded		4						
% Compliance WAT		86.6%						
# 13°C DM exceeded				22				
% Compliance DM				90.3%				
# 17°C WAT exceeded					0			
% Compliance WAT					100%			
# 21.2°C DM exceeded							0	
% Compliance DM							100%	

Table 20 Lost & Found (Singin' River Ranch-Site 1a)

5 Monthly Sampling/Monitoring Events May 1-Sept 30, 2009								
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	6.88	3.74	7.41	0.037	12	53	67	3
Max	8.05	11.20	14.75	0.043	25	84	98	29
Avg	7.41	7.84	10.64	0.040	16	69	84	12
Std. Dev.	0.38	2.50	2.85	0.002	5	13	11	9
Measurements	5	5	5	5	5	5	5	5
Datalogger Temperature Data 2009								
All Temperatures in °C	30-Min Temp.	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	-0.09	-0.02	-0.07	-0.03	4.87	2.12	4.16	
Max	16.63	7.94	12.18	12.18	12.89	16.52	16.52	
Avg	6.70	2.08	2.15	2.95	10.46	10.37	12.12	
Std. Dev.	5.06	3.14	3.36	4.26	2.09	2.63	2.51	
Measurements	10581	13	1181	98	17	1464	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 21 Above Evergreen Lake, at Clear Creek County line (Site 2)

Datalogger Temperature Data 2009							
All Temperatures in °C	30-Min Temp.	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	3.38	6.97	3.39	5.43	6.65	3.47	6.35
Max	20.27	10.06	15.19	15.19	14.97	19.99	19.99
Avg	11.57	8.60	8.65	11.24	12.39	12.31	15.01
Std. Dev.	3.30	1.10	2.42	2.34	2.23	3.05	2.83
Measurements	7340	4	372	31	17	1463	122
# 9°C WAT exceeded		1					
% Compliance WAT		75%					
# 13°C DM exceeded				9			
% Compliance DM				71%			
# 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 22 Above Evergreen Lake, at CDOW site (Site 3a)

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 NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	6.51	7.27	7.27	0.055	9	2	22	6
Max	8.56	13.10	14.05	0.072	31	39	70	35
Avg	7.79	10.60	10.20	0.063	17	22	39	17
Std. Dev.	0.70	2.32	2.63	0.006	9	14	17	10
Measurements	5	5	5	5	5	5	5	5
Datalogger Temperature Data 2009								
All Temperatures in °C	30-Min Temp.	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	-0.23	-0.13	-0.23	-0.12	7.09	3.95	6.13	
Max	20.48	10.85	15.73	15.73	15.75	20.42	20.42	
Avg	8.48	2.80	2.94	3.83	13.04	12.95	15.37	
Std. Dev.	6.28	4.36	4.57	5.63	2.30	3.09	2.87	
Measurements	10582	13	1181	98	17	1464	122	
# 9°C WAT exceeded		3						
% Compliance WAT		77%						
# 13°C DM exceeded				13				
% Compliance DM				87%				
# 17°C WAT exceeded					0			
% Compliance WAT					100%			
# 21.2°C DM exceeded							0	
% Compliance DM							100%	

[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 comprise 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. These data are 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. Site 4d (Table 23) below was selected to contain the Dissolved Oxygen calculations (averaged surface to 3.0m down) and datalogger Temperature calculations (averaged 1-3.0m down). Temperatures associated with the Sampling/Monitoring events presented in the tables below, are separate from the data collected to evaluate compliance.

Table 23 Evergreen Lake, at surface, near dam (Site 4a)

2 Monthly Sampling/5 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	7.07	8.91	5.81	0.063	23	39	67	19
Max	8.17	10.31	12.44	0.097	41	44	80	20
Avg	7.66	9.61	8.70	0.074	32	42	74	20
Std. Dev.	0.41	0.70	2.39	0.013	9	3	7	1
Measurements	5	2	5	5	2	2	2	2

[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.]

Table 24 Evergreen Lake, 1.0m below surface, near dam (Site 4b)

3 Monthly Sampling/5 Monitoring Events May 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	6.65	8.89	5.89	0.063	34	9	51	13
Max	8.00	16.49	12.31	0.097	34	20	51	34
Avg	7.44	13.22	8.62	0.074	34	15	51	24
Std. Dev.	0.46	3.14	2.31	0.013	0	5	0	9
Measurements	5	5	5	5	1	3	1	3

[Monitoring station/Datalogger ID: EMD2B GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 1.0m below surface, near the EMD WTP intake.]

Table 25 Evergreen Lake, 2.0m below surface, near dam (Site 4c)

0 Monthly Sampling/5 Monitoring Events May 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	6.06	8.80	6.10	0.064	NA	NA	NA	NA
Max	7.94	15.01	12.46	0.097	NA	NA	NA	NA
Avg	7.28	12.47	8.72	0.075	NA	NA	NA	NA
Std. Dev.	0.65	2.74	2.28	0.012	NA	NA	NA	NA
Measurements	5	5	5	5	NA	NA	NA	NA

[Monitoring station/Datalogger ID: EMD2C GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 2.0m below the surface, near the EMD WTP intake.]

Table 26 Evergreen Lake, 3.0m below surface, near dam (Site 4d)

The Dissolved Oxygen values reported below resulted from the averaged values at each site (4a-4d) during each monitoring event. The datalogger temperature reported below summarizes the values obtained at each site, then averaged to compare against state water quality standards.

0 Monthly Sampling/5 Monitoring Events May 1-Sept 30, 2009								
Monthly Results	pH, SU	Temp, °C	D. O., mg/L (Avg. 0-3m)	Sp. Cd., mS/cm	Total NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	5.63	8.45	5.65	0.067	NA	NA	NA	NA
Max	7.92	14.16	12.46	0.103	NA	NA	NA	NA
Avg	7.04	11.57	8.31	0.077	NA	NA	NA	NA
Std. Dev.	0.81	2.37	2.40	0.014	NA	NA	NA	NA
Measurements	5	5	5	5	NA	NA	NA	NA
Datalogger Temperature Summary 2009								
All Temperatures in °C	Site 4b 1m 30-min. Temp, °C	Site 4c 1m 30-min. Temp, °C	Site 4d 1m Depth, 30-min. Temp, °C	Avg. Sites 4b-4d 30-min. Temp, °C	CLL Std. WAT 18.2°C	2-hr AVG for DM	CLL Std. DM 23.8°C	
Min	6.62	6.22	5.81	6.35	8.13	6.35	7.39	
Max	20.95	19.42	19.04	19.17	17.71	18.82	18.82	
Avg	14.76	14.00	13.02	13.93	14.05	13.93	14.57	
Std. Dev.	3.07	2.98	2.63	2.86	2.75	2.86	2.81	
Measurements	7332	7331	7331	7331	21	1832	153	
# 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, 3.0m below the surface, near the EMD WTP intake.]

Table 27 Evergreen Lake, 4.0m below surface, near dam (Site 4e)

3 Monthly Sampling/5 Monitoring Events May 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	5.09	7.53	1.83	0.070	142	12	169	19
Max	7.87	13.61	12.22	0.107	142	27	169	28
Avg	6.85	10.80	5.47	0.082	142	22	169	24
Std. Dev.	1.02	2.30	4.04	0.013	0	7	0	4
Measurements	5	5	5	5	1	3	1	3

[Monitoring station/Datalogger ID: EMD2E GPS Coordinates: 39.6314 °N, 105.3231 °W; Sampling /monitoring site in Evergreen Lake near the dam, 4.0m below the surface, near the EMD WTP intake.]

Segment 1e (Mainstem Below Evergreen Lake and Above Harriman Diversion)**Table 28 Segment 1e Summary**

Segment 1e Sampling/Monitoring Summary 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	7.77	8.82	6.08	0.075	12	11	41	12
Max	9.11	18.51	13.63	0.176	128	486	500	42
Avg	8.29	14.15	9.49	0.133	28	197	225	27
Std. Dev.	0.35	3.30	2.36	0.031	21	101	101	7
Measurements	35	35	35	35	35	35	35	35
Segment 1e Datalogger Temperature Summary 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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)	
Min	-0.17	-0.01	-0.14	-0.12	7.83	5.67	6.42	
Max	22.87	3.72	8.69	8.69	18.46	22.81	22.81	
Avg	10.98	1.03	1.19	2.25	14.60	14.46	16.33	
Measurements	70844	54	4857	402	147	12852	1071	
# 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%	

Table 29 Downtown Evergreen, at CDOW site (Site 5)

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 NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.77	8.82	6.28	0.075	18	11	41	12
Max	8.34	17.05	12.84	0.118	36	184	213	28
Avg	8.05	13.29	9.38	0.094	27	76	104	20

Std. Dev.	0.20	3.50	2.31	0.017	6	70	71	7
Measurements	5	5	5	5	5	5	5	5
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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)	
Min	0.22	0.72	0.25	1.01	7.83	5.71	6.42	
Max	20.25	3.72	5.04	5.04	18.46	20.21	20.21	
Avg	10.64	1.86	1.98	2.62	14.60	14.46	15.44	
Std. Dev.	6.34	0.97	1.14	1.27	2.91	3.11	3.00	
Measurements	10582	9	809	67	21	1836	153	
# 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: 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.]

Table 30 Below EMD WWTP effluent (Site 7)

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 NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.80	9.11	6.08	0.084	14	31	48	13
Max	8.33	17.56	12.86	0.126	82	223	237	26
Avg	8.02	13.74	9.24	0.100	34	109	143	22
Std. Dev.	0.22	3.62	2.36	0.016	25	71	70	5
Measurements	5	5	5	5	5	5	5	5
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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)	
Min	5.77	NA	NA	NA	7.95	5.78	6.58	
Max	20.22	NA	NA	NA	18.43	20.14	20.14	
Avg	14.50	NA	NA	NA	14.63	14.50	15.62	
Std. Dev.	3.08	NA	NA	NA	2.87	3.08	3.00	
Measurements	7344	NA	NA	NA	21	1836	153	
# 9°C WAT exceeded		NA						
% Compliance WAT		NA						
# 13°C DM exceeded				NA				
% Compliance DM				NA				
# 19.3°C WAT exceeded					0			
% Compliance WAT					100%			
# 23.8°C DM exceeded							0	
% Compliance DM							100%	

[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 31 Bear Creek Cabins (Site 8a)

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 NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.81	9.44	6.36	0.096	21	105	129	17
Max	8.59	18.24	13.03	0.130	128	260	387	27
Avg	8.16	14.31	9.46	0.109	48	199	247	23
Std. Dev.	0.28	3.76	2.36	0.012	40	58	88	3
Measurements	5	5	5	5	5	5	5	5
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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)	
Min	-0.17	0.65	-0.14	-0.12	7.92	5.67	6.55	
Max	21.27	3.65	8.46	8.46	18.39	21.18	21.18	
Avg	10.51	1.60	1.74	3.79	14.51	14.38	15.84	
Std. Dev.	6.45	0.97	1.72	2.12	2.86	3.13	3.30	
Measurements	10583	9	809	67	21	1836	153	
# 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: 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 32 O'Fallon Park (Site 9)

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 NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.92	9.81	6.32	0.128	18	182	200	25
Max	9.11	18.51	13.63	0.146	34	299	333	33
Avg	8.48	14.49	9.88	0.139	22	236	258	29
Std. Dev.	0.39	3.53	2.67	0.007	6	39	44	3
Measurements	5	5	5	5	5	5	5	5
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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)	
Min	-0.14	0.25	-0.12	-0.12	8.14	5.69	6.68	
Max	22.68	3.09	8.69	8.69	18.23	22.51	22.51	
Avg	10.26	0.99	1.13	2.49	14.42	14.28	16.66	
Std. Dev.	6.70	0.91	1.68	2.28	2.72	3.23	3.43	
Measurements	10583	9	809	67	21	1836	153	
# 9°C WAT exceeded		0						
% Compliance WAT		100%						
# 13°C DM exceeded				0				
% Compliance DM				100%				
# 19.3°C WAT					0			

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

[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 33 Lair o' the Bear (Site 12)

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 NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.97	10.48	6.41	0.145	12	181	206	24
Max	8.95	17.42	12.99	0.166	28	386	402	37
Avg	8.48	14.27	9.55	0.159	21	254	275	31
Std. Dev.	0.32	2.88	2.37	0.007	6	70	67	5
Measurements	5	5	5	5	5	5	5	5
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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)	
Min	-0.09	0.05	-0.07	-0.03	8.55	5.90	6.99	
Max	22.87	2.72	7.31	7.31	18.25	22.81	22.81	
Avg	10.23	0.62	0.78	1.55	14.54	14.40	16.92	
Std. Dev.	6.90	0.86	1.42	1.93	2.63	3.30	3.22	
Measurements	10584	9	810	67	21	1836	153	
# 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 34 Idledale (Shady Lane-Site 13a)

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 NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.95	10.88	6.29	0.155	13	167	213	25
Max	8.99	17.02	12.59	0.175	46	486	500	42
Avg	8.44	14.55	9.41	0.166	24	278	301	36
Std. Dev.	0.34	2.81	2.20	0.007	12	113	105	6
Measurements	5	5	5	5	5	5	5	5
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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)	
Min	-0.09	-0.01	-0.06	-0.03	8.73	6.00	7.10	
Max	22.68	2.82	8.54	8.54	18.35	22.58	22.58	

Avg	10.29	0.57	0.74	1.57	14.65	14.51	17.03
Std. Dev.	6.98	0.91	1.55	2.36	2.62	3.32	3.18
Measurements	10584	9	810	67	21	1836	153
# 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 35 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 NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.98	11.16	6.42	0.156	13	143	165	18
Max	8.83	16.79	12.58	0.176	27	321	334	38
Avg	8.40	14.42	9.53	0.164	19	228	247	29
Std. Dev.	0.30	2.62	2.14	0.007	5	68	67	7
Measurements	5	5	5	5	5	5	5	5
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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)	
Min	-0.12	0.01	-0.08	-0.06	9.09	6.36	7.42	
Max	21.92	2.83	8.18	8.18	18.40	21.86	21.86	
Avg	10.42	0.56	0.75	1.47	14.84	14.69	16.79	
Std. Dev.	7.01	0.88	1.55	2.05	2.56	3.19	2.96	
Measurements	10584	9	810	67	21	1836	153	
# 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)

No Site in Segment 1b was sampled or monitored for water quality.

Table 36 Segment 1b Summary

Segment 1b Datalogger Temperature Summary 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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	6.59				9.39	6.62	7.68
Max	21.44				18.56	21.43	21.43

Segment 1b Datalogger Temperature Summary 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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Avg	14.52				14.87	14.52	16.26
Measurements	9280				26	2320	194
# 9°C WAT exceeded							
% Compliance WAT							
# 13°C DM exceeded							
% Compliance DM							
# 19.3°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

Table 37 Bear Creek in Bear Creek Park, at the USGS gage (Site 15a)

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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 DM (23.8°C)
Min	6.59				9.39	6.62	7.68
Max	21.44				18.56	21.43	21.43
Avg	14.93				15.08	14.93	16.81
Std. Dev.	3.12				2.54	3.11	2.86
Measurements	7344				21	1836	153
# 9°C WAT exceeded							
% Compliance WAT							
# 13°C DM exceeded							
% Compliance DM							
# 19.3°C WAT exceeded					0		
% Compliance WAT					100%		
# 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 38 Bear Creek, Above Ward Ditch (Site 27a)

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 (19.3°C)	Apr 1-Oct 31 2-HR Avg. Temp.	Apr 1-Oct 31 Stream DM (23.8°C)
Min	7.44				11.00	7.49	9.06
Max	20.51				16.99	20.43	20.43
Avg	14.10				14.67	14.10	15.70
Std. Dev.	2.77				2.03	2.76	2.65
Measurements	1936				5	484	41
# 9°C WAT exceeded							
% Compliance WAT							
# 13°C DM exceeded							
% Compliance DM							
# 19.3°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

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

Segment 2 (No Watershed Monitoring)

Segment 3 (Vance Creek)

Table 39 **Mt. Evans Wilderness Drainage, Vance Creek (Site 25)**

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	7.35	5.68	7.14	0.059	10	16	27	6
Max	8.63	11.31	13.42	0.078	19	24	37	53
Avg	7.92	8.34	10.21	0.066	13	20	33	23
Std. Dev.	0.45	2.13	2.54	0.007	3	3	5	16
Measurements	5	5	5	5	5	5	5	5
Datalogger Temperature Data 2009								
All Temperatures in °C	30-Min Temp.	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	2.26				6.32	2.33	5.65	
Max	19.63				13.70	19.54	19.54	
Avg	10.59				10.69	10.59	13.89	
Std. Dev.	3.45				2.33	3.43	3.13	
Measurements	7340				21	1835	153	
# 9°C WAT exceeded								
% Compliance WAT								
# 13°C DM exceeded								
% Compliance DM								
# 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 4a (No Watershed Monitoring)

Segment 5 (Cub Creek)

Table 40 **Segment 5 Summary**

Segment 5 Sampling/Monitoring Summary 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	7.89	11.27	7.30	0.076	16	91	120	9
Max	8.29	11.94	8.34	0.088	29	161	177	10
Avg	8.09	11.61	7.82	0.082	23	126	149	10
Std. Dev.	0.20	0.33	0.52	0.006	7	35	29	1
Measurements	2	2	2	2	2	2	2	2
Segment 5 Datalogger Temperature Summary 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	1.59				5.77	2.10	4.04	
Max	19.32				14.95	19.07	19.07	
Avg	10.37				10.68	10.37	12.72	

Measurements	9280				26	2320	194
# 9°C WAT exceeded							
% Compliance WAT							
# 13°C DM exceeded							
% Compliance DM							
# 18.2°C WAT exceeded					0		
% Compliance WAT					100%		
# 23.8°C DM exceeded							0
% Compliance DM							100%

Table 41 Little Cub Creek, above Bear Creek confluence (Site 26)

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	2.88				5.77	2.90	4.78
Max	19.32				14.95	19.07	19.07
Avg	11.62				11.73	11.62	13.98
Std. Dev.	3.24				2.56	3.23	2.95
Measurements	7344				21	1836	153
# 9°C WAT exceeded							
% Compliance WAT							
# 13°C DM exceeded							
% Compliance DM							
# 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 42 Little Cub Creek above Brook Forest Inn (Site 35)

2 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 NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.89	11.27	7.30	0.076	16	91	120	9
Max	8.29	11.94	8.34	0.088	29	161	177	10
Avg	8.09	11.61	7.82	0.082	23	126	149	10
Std. Dev.	0.20	0.33	0.52	0.006	7	35	29	1
Measurements	2	2	2	2	2	2	2	2
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	1.59				5.97	2.10	4.04	
Max	16.15				11.69	15.89	15.89	
Avg	9.13				9.63	9.13	11.47	

Std. Dev.	2.89				1.99	2.87	2.66
Measurements	1936				5	484	41
# 9°C WAT exceeded							
% Compliance WAT							
# 13°C DM exceeded							
% Compliance DM							
# 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.]

Turkey Creek Stream Segments

(Segment 6a South Turkey Creek)

Table 43 Turkey Creek (Site 16a) Segment 6a Summary

Segment 6a Sampling/Monitoring Summary 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	7.95	13.33	5.46	0.391	13	2	24	14
Max	8.41	16.04	10.46	1.013	28	74	87	30
Avg	8.14	14.36	7.93	0.719	19	27	46	21
Std. Dev.	0.17	0.92	2.01	0.234	6	26	23	6
Measurements	5	5	5	5	5	5	5	5
Datalogger Temperature Summary 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	3.17				7.17	3.24	4.69	
Max	21.03				16.53	20.90	20.90	
Avg	13.00				13.13	13.00	15.38	
Measurements	14688				42	3672	306	
# 9°C WAT exceeded								
% Compliance WAT								
# 13°C DM exceeded								
% Compliance DM								
# 18.2°C WAT exceeded					0			
% Compliance WAT					100%			
# 23.8°C DM exceeded							0	
% Compliance DM							100%	

Table 44 Turkey Creek within Bear Creek Park, near Maint. Bldg. (Site 16a)

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	5.21				8.06	5.24	6.05
Max	19.87				16.53	19.65	19.65
Avg	13.73				13.81	13.73	15.45
Std. Dev.	2.74				2.29	2.74	2.61
Measurements	7344				21	1836	153
# 9°C WAT exceeded							

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)
% Compliance WAT							
# 13°C DM exceeded							
% Compliance DM							
# 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 45 Aspen Park Metropolitan District, South Turkey Creek (Site 18)

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 NH3-N, ug/L	NO3+NO2-N, ug/L	TIN, ug/L	Total P, ug/L
Min	7.95	13.33	5.46	0.391	13	2	24	14
Max	8.41	16.04	10.46	1.013	28	74	87	30
Avg	8.14	14.36	7.93	0.719	19	27	46	21
Std. Dev.	0.17	0.92	2.01	0.234	6	26	23	6
Measurements	5	5	5	5	5	5	5	5
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	3.17				7.17	3.24	4.69	
Max	21.03				15.40	20.90	20.90	
Avg	12.27				12.45	12.27	15.32	
Std. Dev.	3.36				2.12	3.34	3.10	
Measurements	7344				21	1836	153	
# 9°C WAT exceeded								
% Compliance WAT								
# 13°C DM exceeded								
% Compliance DM								
# 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.]

Parmalee Gulch, Near Hwy 285 (Site 28) - No sampling or monitoring.

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 46 Conifer Metropolitan District, North Turkey Creek (Site19)

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	7.72	8.60	6.17	0.162	10	11	32	7
Max	8.97	17.67	12.37	0.782	21	409	428	50
Avg	8.26	12.47	9.26	0.380	16	169	185	29
Std. Dev.	0.44	3.48	2.37	0.224	4	154	153	14
Measurements	5	5	5	5	5	5	5	5
Datalogger Temperature Data 2009								
All Temperatures in °C	30-Min Temp.	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	1.78				4.73	1.82	3.82	
Max	21.65				14.77	21.40	21.40	
Avg	10.93				11.05	10.93	14.30	
Std. Dev.	3.77				2.77	3.75	3.69	
Measurements	7344				21	1836	153	
# 9°C WAT exceeded								
% Compliance WAT								
# 13°C DM exceeded								
% Compliance DM								
# 17°C WAT exceeded					0			
% Compliance WAT					100%			
# 21.2°C DM exceeded								1
% Compliance DM								99%

[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 47 2009 May Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) May 2009	Historic Daily Mean Flow (cfs) 25 Years for May	Deviation from Historic Flow (cfs)
1	47	72	-25
2	47	72	-25
3	49	72	-23
4	44	73	-29

Date	Daily Mean Flow (cfs) May 2009	Historic Daily Mean Flow (cfs) 25 Years for May	Deviation from Historic Flow (cfs)
5	44	76	-32
6	45	79	-34
7	53	81	-28
8	56	81	-25
9	49	82	-33
10	52	84	-32
11	51	83	-32
12	51	82	-31
13	55	83	-28
14	47	85	-38
15	49	87	-38
16	58	90	-32
17	53	92	-39
18	51	92	-41
19	57	97	-40
20	49	98	-49
21	48	99	-51
22	60	99	-39
23	48	96	-48
24	73	97	-24
25	74	106	-32
26	69	108	-39
27	59	106	-47
28	53	104	-51
29	49	105	-56
30	50	104	-54
31	54	100	-46
MIN	44	72	-23
MAX	74	108	-56
AVG	53	90	-37

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

Table 48 2009 June Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) June 2009	Historic Daily Mean Flow (cfs) 25 Years for June	Deviation from Historic Flow (cfs)
1	72	102	-30
2	87	100	-13
3	78	99	-21
4	70	97	-27
5	68	98	-30
6	66	97	-31
7	61	101	-40
8	56	97	-41
9	56	104	-48
10	56	103	-47
11	56	97	-41
12	54	96	-42
13	55	98	-43
14	55	95	-40
15	54	95	-41
16	49	96	-47
17	47	97	-50
18	48	99	-51
19	50	91	-41
20	55	89	-34
21	62	88	-26

Date	Daily Mean Flow (cfs) June 2009	Historic Daily Mean Flow (cfs) 25 Years for June	Deviation from Historic Flow (cfs)
22	56	86	-30
23	58	83	-25
24	58	79	-21
25	72	77	-5
26	109	79	30
27	95	76	19
28	73	74	-1
29	80	74	6
30	62	70	-8
MIN	47	70	30
MAX	109	104	-51
AVG	64	91	-27

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

Table 49 2009 July Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) July 2009	Historic Daily Mean Flow (cfs) 25 Years for July	Deviation from Historic Flow (cfs)
1	57	66	-9
2	60	63	-3
3	62	61	1
4	61	60	1
5	64	60	4
6	57	59	-2
7	46	60	-14
8	43	62	-19
9	40	67	-27
10	39	64	-25
11	39	60	-21
12	42	59	-17
13	42	59	-17
14	40	55	-15
15	36	52	-16
16	34	52	-18
17	32	56	-24
18	31	52	-21
19	30	53	-23
20	31	52	-21
21	30	52	-22
22	30	49	-19
23	30	52	-22
24	27	52	-25
25	27	51	-24
26	46	52	-6
27	56	49	7
28	38	50	-12
29	36	51	-15
30	45	52	-7
31	46	51	-5
MIN	27	49	7
MAX	64	67	-27
AVG	42	56	-14

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

Table 50 2009 August Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) August 2009	Historic Daily Mean Flow (cfs) 25 Years for August	Deviation from Historic Flow (cfs)
1	41	52	-11
2	34	51	-17
3	29	53	-24
4	28	55	-27
5	27	59	-32
6	28	58	-30
7	27	55	-28
8	24	53	-29
9	24	51	-27
10	24	53	-29
11	23	51	-28
12	22	50	-28
13	21	50	-29
14	22	48	-26
15	22	46	-24
16	20	47	-27
17	20	47	-27
18	23	47	-24
19	21	48	-27
20	19	44	-25
21	18	42	-24
22	17	42	-25
23	16	44	-28
24	16	46	-30
25	18	42	-24
26	20	41	-21
27	19	40	-21
28	16	40	-24
29	16	39	-23
30	17	38	-21
31	18	37	-19
MIN	16	37	-11
MAX	41	59	-32
AVG	22	47	-25

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

Table 51 2009 September Bear Creek Evergreen vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) September 2009	Historic Daily Mean Flow (cfs) 25 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

Date	Daily Mean Flow (cfs) September 2009	Historic Daily Mean Flow (cfs) 25 Years for September	Deviation from Historic Flow (cfs)
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
29	19	26	-7
30	18	26	-8
MIN	14	26	-4
MAX	26	38	-22
AVG	19	31	-12

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

Table 52 2009 May Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) May 2009	Historic Daily Mean Flow (cfs) 90 Years for May	Deviation from Historic Flow (cfs)
1	100.0	119	-19
2	98.7	118	-19.3
3	99.8	118	-18.2
4	89.9	118	-28.1
5	84.7	124	-39.3
6	84.4	136	-51.6
7	85.4	152	-66.6
8	83.9	150	-66.1
9	76.5	147	-70.5
10	80.8	148	-67.2
11	77.7	147	-69.3
12	73.4	147	-73.6
13	72.9	145	-72.1
14	68.3	145	-76.7
15	65.9	144	-78.1
16	70.1	149	-78.9
17	72.3	152	-79.7
18	67.9	151	-83.1
19	65.4	155	-89.6
20	64.7	157	-92.3
21	62.1	156	-93.9
22	61.8	157	-95.2
23	61.3	155	-93.7
24	63.3	154	-90.7
25	76.6	156	-79.4
26	81.5	155	-73.5
27	83.9	154	-70.1
28	79.2	151	-71.8
29	71.5	151	-79.5
30	69.3	150	-80.7
31	70.4	148	-77.6
MIN	61.3	118	-18.2

Date	Daily Mean Flow (cfs) May 2009	Historic Daily Mean Flow (cfs) 90 Years for May	Deviation from Historic Flow (cfs)
MAX	100	157	-95.2
AVG	76	145	-69

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

Table 53 2009 June Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) June 2009	Historic Daily Mean Flow (cfs) 90 Years for June	Deviation from Historic Flow (cfs)
1	97.6	147	-49.4
2	140.0	147	-7
3	127.0	149	-22
4	115.0	150	-35
5	107.0	156	-49
6	101.0	151	-50
7	93.3	151	-57.7
8	85.7	150	-64.3
9	82.0	153	-71
10	79.9	155	-75.1
11	79.9	155	-75.1
12	77.3	148	-70.7
13	76.6	149	-72.4
14	78.0	145	-67
15	77.0	142	-65
16	70.7	138	-67.3
17	65.8	135	-69.2
18	63.9	134	-70.1
19	67.0	128	-61
20	66.6	123	-56.4
21	74.1	121	-46.9
22	67.4	126	-58.6
23	67.0	117	-50
24	69.1	110	-40.9
25	79.8	106	-26.2
26	108.0	105	3
27	92.5	99	-6.5
28	77.5	95	-17.5
29	79.1	93	-13.9
30	65.4	93	-27.6
MIN	63.9	93	3
MAX	140	156	-75.1
AVG	84	132	-48

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

Table 54 2009 July Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) July 2009	Historic Daily Mean Flow (cfs) 90 Years for July	Deviation from Historic Flow (cfs)
1	58.6	89	-30.4
2	61.2	84	-22.8
3	71.7	81	-9.3
4	67.7	78	-10.3
5	69.1	77	-7.9
6	65.2	75	-9.8
7	53.6	79	-25.4
8	49.1	75	-25.9
9	45.1	77	-31.9
10	42.8	75	-32.2

Date	Daily Mean Flow (cfs) July 2009	Historic Daily Mean Flow (cfs) 90 Years for July	Deviation from Historic Flow (cfs)
11	49.8	72	-22.2
12	46.7	72	-25.3
13	49.8	68	-18.2
14	45.0	67	-22
15	35.6	66	-30.4
16	34.5	65	-30.5
17	32.6	65	-32.4
18	32.2	66	-33.8
19	31.2	67	-35.8
20	31.7	66	-34.3
21	29.8	65	-35.2
22	29.9	68	-38.1
23	27.7	67	-39.3
24	26.6	66	-39.4
25	26.0	66	-40
26	25.8	67	-41.2
27	40.5	64	-23.5
28	49.9	66	-16.1
29	43.8	66	-22.2
30	54.8	65	-10.2
31	54.2	67	-12.8
MIN	25.8	64	-7.9
MAX	71.7	89	-41.2
AVG	45	71	-26

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

Table 55 2009 August Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) August 2009	Historic Daily Mean Flow (cfs) 90 Years for August	Deviation from Historic Flow (cfs)
1	47.2	68	-20.8
2	40.2	69	-28.8
3	33.2	71	-37.8
4	31.6	75	-43.4
5	28.9	73	-44.1
6	29.8	73	-43.2
7	27.6	70	-42.4
8	24.9	69	-44.1
9	23.0	68	-45
10	23.0	65	-42
11	22.3	62	-39.7
12	21.1	63	-41.9
13	19.9	62	-42.1
14	20.7	62	-41.3
15	22.0	61	-39
16	21.6	60	-38.4
17	20.2	62	-41.8
18	23.8	62	-38.2
19	23.0	62	-39
20	18.6	62	-43.4
21	17.0	64	-47
22	16.4	62	-45.6
23	15.6	60	-44.4
24	14.3	59	-44.7
25	14.9	59	-44.1
26	19.0	57	-38

27	18.9	55	-36.1
28	15.8	54	-38.2
29	14.4	53	-38.6
30	14.8	56	-41.2
31	17.9	52	-34.1
MIN	14.3	52	-20.8
MAX	47.2	75	-47
AVG	23	63	-40

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

Table 56 2009 September Bear Creek Morrison vs. Historic Bear Creek Flow

Date	Daily Mean Flow (cfs) September 2009	Historic Daily Mean Flow (cfs) 90 Years for September	Deviation from Historic Flow (cfs)
1	16.1	50	-33.9
2	14.2	56	-41.8
3	12.3	53	-40.7
4	12.5	51	-38.5
5	13.0	49	-36
6	12.8	47	-34.2
7	15.3	48	-32.7
8	16.1	49	-32.9
9	16.3	47	-30.7
10	14.1	48	-33.9
11	13.5	49	-35.5
12	13.9	47	-33.1
13	19.7	43	-23.3
14	23.5	43	-19.5
15	21.4	41	-19.6
16	21.8	40	-18.2
17	23.0	40	-17
18	20.0	38	-18
19	17.7	37	-19.3
20	16.7	37	-20.3
21	18.1	37	-18.9
22	22.6	37	-14.4
23	22.4	37	-14.6
24	23.1	36	-12.9
25	23.2	36	-12.8
26	22.0	36	-14
27	20.3	36	-15.7
28	20.7	35	-14.3
29	18.8	35	-16.2
30	18.1	34	-15.9
MIN	12.3	34	-12.8
MAX	23.5	56	-41.8
AVG	18	42	-24

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

Table 57 2009 May Bear Creek Above BC Reservoir vs. Historic BC Flow

Date	Daily Mean Flow (cfs) May 2009	Historic Daily Mean Flow (cfs) 24 Years for May	Deviation from Historic Flow (cfs)
1	80	100	-20
2	76	97	-21
3	77	97	-20
4	69	94	-25
5	65	101	-36
6	65	106	-41

7	66	111	-45
8	67	109	-42
9	59	107	-48
10	65	107	-42
11	62	105	-43
12	58	103	-45
13	58	99	-41
14	53	101	-48
15	52	101	-49
16	59	108	-49
17	54	119	-65
18	50	116	-66
19	50	126	-76
20	42	127	-85
21	40	126	-86
22	47	122	-75
23	41	114	-73
24	87	113	-26
25	79	130	-51
26	93	134	-41
27	76	131	-55
28	65	123	-58
29	61	126	-65
30	59	124	-65
31	61	116	-55
MIN	40	94	-20
MAX	93	134	-86
AVG	62	113	-50

USGS 06710605 GPS Coordinates: 39.6522°N, 105.1731°W

Table 58 2009 June Bear Creek Above BC Reservoir vs. Historic BC Flow

Date	Daily Mean Flow (cfs) June 2009	Historic Daily Mean Flow (cfs) 24 Years for June	Deviation from Historic Flow (cfs)
1	87	118	-31
2	145	115	30
3	134	110	24
4	113	106	7
5	100	107	-7
6	92	107	-15
7	83	112	-29
8	75	101	-26
9	71	117	-46
10	69	121	-52
11	69	109	-40
12	67	106	-39
13	67	106	-39
14	67	100	-33
15	66	96	-30
16	60	95	-35
17	56	95	-39
18	52	97	-45
19	54	90	-36
20	53	86	-33
21	55	83	-28
22	54	79	-25
23	57	76	-19
24	62	71	-9

25	64	66	-2
26	88	67	21
27	72	64	8
28	58	63	-5
29	61	66	-5
30	43	64	-21
MIN	43	63	30
MAX	145	121	-52
AVG	73	93	-20

USGS 06710500 GPS Coordinates: 39.6522°N, 105.1731°W

Table 59 2009 July Bear Creek Above BC Reservoir vs. Historic BC Flow

Date	Daily Mean Flow (cfs) July 2009	Historic Daily Mean Flow (cfs) 24 Years for July	Deviation from Historic Flow (cfs)
1	37	58	-21
2	50	51	-1
3	61	47	14
4	54	45	9
5	54	43	11
6	52	43	9
7	41	44	-3
8	35	48	-13
9	28	51	-23
10	24	51	-27
11	32	46	-14
12	29	43	-14
13	34	42	-8
14	29	40	-11
15	22	38	-16
16	19	35	-16
17	15	40	-25
18	14	36	-22
19	13	33	-20
20	13	32	-19
21		31	
22		30	
23		34	
24		32	
25	14	30	-16
26	27	31	-4
27	41	28	13
28	36	31	5
29	28	32	-4
30	42	34	8
31	36	32	4
MIN	13	28	14
MAX	61	58	-27
AVG	33	39	-8

USGS 06710500 GPS Coordinates: 39.6522°N, 105.1731°W

Table 60 2009 August Bear Creek Above BC Reservoir vs. Historic BC Flow

Date	Daily Mean Flow (cfs) August 2009	Historic Daily Mean Flow (cfs) 24 Years for August	Deviation from Historic Flow (cfs)
1	29	32	-3
2	26	30	-4
3	17	32	-15
4	15	40	-25

Date	Daily Mean Flow (cfs) August 2009	Historic Daily Mean Flow (cfs) 24 Years for August	Deviation from Historic Flow (cfs)
5	13	44	-31
6	13	44	-31
7		41	
8	9.4	37	-27.6
9	7.1	35	-27.9
10	8.4	36	-27.6
11	7.6	36	-28.4
12	7	33	-26
13	6.6	32	-25.4
14	7.1	31	-23.9
15	8.4	30	-21.6
16	8.3	33	-24.7
17	6.6	33	-26.4
18		32	
19		33	
20	6.2	29	-22.8
21	6.6	26	-19.4
22	6.4	27	-20.6
23	6	32	-26
24	4.3	35	-30.7
25	5	29	-24
26	7.7	28	-20.3
27	7	26	-19
28	4.2	26	-21.8
29	4.8	26	-21.2
30	5	25	-20
31	6.1	23	-16.9
MIN	4.2	23	-3
MAX	29	44	-31
AVG	9	32	-23

USGS 06710500 GPS Coordinates: 39.6522°N, 105.1731°W

Table 61 2009 Sept. Bear Creek Above BC Reservoir vs. Historic BC Flow

Date	Daily Mean Flow (cfs) September 2009	Historic Daily Mean Flow (cfs) 24 Years for September	Deviation from Historic Flow (cfs)
1	4	23	-19
2	3.8	23	-19.2
3	3.6	22	-18.4
4	2.8	21	-18.2
5	3	21	-18
6	3.4	20	-16.6
7	5.7	20	-14.3
8	6.4	21	-14.6
9	6.4	20	-13.6
10	4.5	19	-14.5
11	4	19	-15
12	4.5	20	-15.5
13	9.4	19	-9.6
14	13	19	-6
15		17	
16		15	
17	13	15	-2
18	9.6	15	-5.4
19	7.2	15	-7.8
20	5	15	-10

Date	Daily Mean Flow (cfs) September 2009	Historic Daily Mean Flow (cfs) 24 Years for September	Deviation from Historic Flow (cfs)
21	9	16	-7
22	14	16	-2
23		15	
24		15	
25		14	
26		15	
27	9.4	14	-4.6
28		14	
29	8.2	15	-6.8
30	7.7	15	-7.3
MIN	2.8	14	-2
MAX	14	23	-19.2
AVG	7	18	-12

USGS 06710500 GPS Coordinates: 39.6522°N, 105.1731°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 2009 monthly maximum, minimum and mean air temperatures and monthly precipitation to 45-year (1961-2009) historical data.

Table 62 Weather Data May-September 2009 Summary

Monthly Weather Data	May 2009	June 2009	July 2009	August 2009	September 2009
Air Temp Low Max (°F)	48	53	54	53	44
Air Temp High Max (°F)	80	81	87	89	84
Air Temp High Avg (°F)	65	70	78	78	70
Total Precip (in.)	2.76	3.98	2.56	0.71	1.42
Days of Precip.	8	17	18	10	10

Table 63 2009 Weather Data vs. Historical Weather Data (45 years 1961-2009)

	Avg Daily Min (°F)	Avg Daily Max (°F)	Avg Mon. Mean (°F)	Precip (in.)
May 2009	38	65	51	2.76
May Hist	33.9	65.2	49.6	2.57
% Deviation	112%	100%	103%	107%
June 2009	43	70	57	3.98
June Hist	41.1	75.3	58.2	2.14
% Deviation	105%	93%	98%	186%
July 2009	47	78	62	2.56
July Hist	46.8	81.6	64.2	2.23
% Deviation	100%	95%	96%	115%
August 2009	45	78	61	0.71
August Hist	45.3	79.3	62.4	2.31
% Deviation	99%	98%	98%	31%
Sept. 2009	39	70	55	1.42

	Avg Daily Min (°F)	Avg Daily Max (°F)	Avg Mon. Mean (°F)	Precip (in.)
Sept. Hist	37.1	72.1	54.6	1.47
% Deviation	105%	97%	100%	96%

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 64 2009 May Bear Creek Evergreen vs. Weather Data

Date	May 2009 Daily Mean Flow (cfs)	May 2009 Daily Air Max Temp (°F)	May 2009 Precip. (in.)
1	47	57	
2	47	38	
3	49	43	0.17
4	44	57	
5	44	63	
6	45	67	
7	53	76	
8	56	78	
9	49	63	
10	52	56	0.32
11	51	48	0.04
12	51	68	
13	55	77	
14	47	70	
15	49	69	
16	58	67	0.3
17	53	62	
18	51	73	
19	57	80	
20	49	80	
21	48	75	
22	60	56	
23	48	68	
24	73	59	0.33
25	74	65	0.93
26	69	60	0.63
27	59	50	0.04
28	53	65	
29	49	70	
30	50	73	
31	54	70	
MIN	44	38	0.04
MAX	74	80	0.93
AVG	53	65	0.35
TOTAL			2.76

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 65 2009 June Bear Creek Evergreen vs. Weather Data

Date	June 2009 Daily Mean Flow (cfs)	June 2009 Daily Max Air Temp (°F)	June 2009 Precip (in.)
1	72	71	0.6
2	87	66	0.76

Date	June 2009 Daily Mean Flow (cfs)	June 2009 Daily Max Air Temp (°F)	June 2009 Precip (in.)
3	78	46	0.1
4	70	64	0.4
5	68	69	0.01
6	66	71	0.01
7	61	73	
8	56	65	
9	56	59	
10	56	67	
11	56	65	0.05
12	54	63	0.02
13	55	65	0.02
14	55	69	0.02
15	54	70	0.17
16	49	65	0.1
17	47	75	T
18	48	73	
19	50	72	0.18
20	55	71	
21	62	69	0.15
22	56	76	
23	58	80	
24	58	77	0.22
25	72	78	
26	109	77	1.01
27	95	81	0.16
28	73	77	
29	80	74	
30	62	81	
MIN	47	46	0.01
MAX	109	81	1.01
AVG	64	70	0.23
TOTAL			3.98

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 66 2009 July Bear Creek Evergreen vs. Weather Data

Date	July 2009 Daily Mean Flow (cfs)	July 2009 Daily Max Air Temp (°F)	July 2009 Precip (in.)
1	57	82	
2	60	84	0.12
3	62	71	0.02
4	61	77	0.03
5	64	67	0.22
6	57	70	0.12
7	46	79	0.11
8	43	83	
9	40	86	
10	39	73	
11	39	83	0.41
12	42	85	
13	42	81	0.22
14	40	81	0.07
15	36	87	
16	34	80	
17	32	80	

Date	July 2009 Daily Mean Flow (cfs)	July 2009 Daily Max Air Temp (°F)	July 2009 Precip (in.)
18	31	81	
19	30	78	
20	31	86	0.02
21	30	85	
22	30	68	
23	30	79	0.01
24	27	79	0.01
25	27	80	
26	46	73	0.06
27	56	73	0.15
28	38	77	0.36
29	36	77	0.06
30	45	64	0.49
31	46	58	0.08
MIN	27	58	0.01
MAX	64	87	0.49
AVG	42	78	0.14
TOTAL			2.56

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 67 2009 August Bear Creek Evergreen vs. Weather Data

Date	August 2009 Daily Mean Flow (cfs)	August 2009 Daily Max Air Temp (°F)	August 2009 Precip (in.)
1	41	74	0.14
2	34	75	
3	29	85	
4	28	89	
5	27	82	
6	28	82	0.03
7	27	82	
8	24	86	
9	24	77	
10	24	74	
11	23	78	
12	22	82	
13	21	86	
14	22	83	0.03
15	22	72	0.05
16	20	72	
17	20	69	T
18	23	67	0.15
19	21	71	0.1
20	19	79	
21	18	79	
22	17	80	
23	16	88	
24	16	88	
25	18	77	0.01
26	20	69	0.04
27	19	73	0.02
28	16	79	
29	16	76	
30	17	73	
31	18	66	0.14

Date	August 2009 Daily Mean Flow (cfs)	August 2009 Daily Max Air Temp (°F)	August 2009 Precip (in.)
MIN	16	66	0.01
MAX	41	89	0.15
AVG	22	78	0.07
TOTAL			0.71

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 68 2009 September Bear Creek Evergreen vs. Weather Data

Date	September 2009 Daily Mean Flow (cfs)	September 2009 Daily Max Air Temp (°F)	September 2009 Precip (in.)
1	16	84	
2	15	81	
3	14	80	
4	14	78	
5	14	78	
6	15	78	
7	17	74	0.04
8	17	80	
9	15	80	0.08
10	15	75	0.01
11	14	80	
12	14	66	
13	21	59	0.34
14	23	73	0.11
15	21	74	
16	26	74	0.02
17	24	65	
18	21	69	
19	19	71	
20	18	72	
21	19	77	
22	21	38	0.53
23	22	46	0.16
24	22	42	0.09
25	22	56	0.04
26	22	58	
27	22	79	
28	20	79	
29	19	63	
30	18	81	
MIN	14	38	0.01
MAX	26	84	0.53
AVG	19	70	0.14
TOTAL			1.42

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.