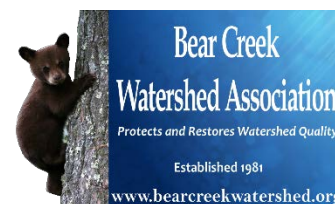


# Technical Memorandum BCWA

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**Date:** February 12, 2017  
**To:** Bear Creek Watershed Association  
**From:** Russell N. Clayshulte, Manager  
  
**Re:** BCWA TM 2016.11b Macroinvertebrates

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## 2016 Stations

Since 2004, the BCWA has conducted macroinvertebrate sampling and data collection at up to 14 sites along the mainstem of Bear Creek (*BCWA Fact Sheet 32 Stream Macroinvertebrates*), including Colorado Parks and Wildlife fish survey sites along Bear Creek: Bear Creek Lake Park, 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 within Dedisse Park, Singing River Ranch, Bear Tracks near Mount Evans Wilderness, above Singing River Ranch, and Golden Willow Bridge.

There was no macroinvertebrate sampling done in 2013 due to the September flood event (Fact Sheet 16 September 2013 Flood, Fact Sheet 14 Flood Recovery Tips, Fact Sheet 17 Health, Hydrology & Sediments, and Fact Sheet 18 Flood Score Card). The mainstem of Bear Creek was extensively altered by the flood event, with deep stream bed scouring. Macroinvertebrate habitat was clearly affected by the flood event. In 2014, the BCWA selected ten sample sites to continue the Macroinvertebrate sampling program (*BCWA TM 2014.13 Macroinvertebrates BCW*).

The WQCD recommended standard index period is July 1 to October 1 for the Bear Creek Watershed elevations (Sampling protocols outlined in Appendix B of Policy 10-1. Aquatic Life Use Attainment Methodology To Determine Use Attainment For Rivers And Streams). However, the division recognizes that uncharacteristic flow conditions, including but not limited to, seasonal irrigation releases and return flows, often preclude sample representativeness and sampler safety within the recommended index periods. In these circumstances, the division will consider samples collected up to four weeks after the recommended sampling season index period on a case by case basis.

The 2016 sampling sites replicated the 2015 sampling sites with the addition of a new site at Wadsworth. There was considerable stream bed alteration at all sample sites due previous excessive high flows. There were no duplicates taken at the following sites in 2016:

**Table 1**      **Sample Sites**

Site ID	Location Description	Lat	Long	Drainage Basin	Segment	Station Type
Site 15a	West UDFC gaging station within Bear Creek Park	39.6522	-105.1731	Bear Creek	1b	P1 S
Site 14b	West end of Morrison, just west of DWR gaging station	39.653	-105.1953	Bear Creek	1e	P3
Site 13a	Below Idledale, Shady Lane at CDOW site	39.6626	-105.2409	Bear Creek	1e	P3
Site 12	Lair o' the Bear Park, at CDOW site	39.6672	-105.2587	Bear Creek	1e	P3
Site 9	O'Fallon Park, west end at CDOW Site	39.6567	-105.2895	Bear Creek	1e	P3
Site 8b M	Macro upstream of bridge at Old Stage Rd.	39.6437	-105.3074	Bear Creek	1e	P4 Macro
Site 5	Above EMD WWTP, at CDOW downtown site	39.6327	-105.3183	Bear Creek	1e	P3
Site 3a	Above Evergreen Lake at CDOW Site Keys on the Green	39.6331	-105.3372	Bear Creek	1a	P3
Site 2a	Golden Willow Bridge	39.63404	-105.4026	Bear Creek	1a	P3
Site 58	Above Singing River Ranch Wilderness boundary	39.61169	-105.4802	Bear Creek	1a	P3
Site 90	Wadsworth	39.66533	-105.0822	Bear Creek	2	P1 S

Sample collection was done by the Water Quality Control Division timed-kick net methodology protocol (*WQCDSOP-001 Benthic Macroinvertebrate Sampling Protocols, May 2010; BCWA ME04 Macroinvertebrate Field Sample Method*). Only fast riffles were targeted for sampling. Riffle habitat refers to the portions of the stream where moderate velocities and substrate roughness produce turbulent conditions which break the surface tension of the water and may produce whitewater.

GEI Consultants analyzed samples collected by the BCWA for benthic macroinvertebrates. Samples collected by the Association follow the *BCWA M04 Macroinvertebrate Field Sample Method*. Data for samples are reported as number of organisms per square meter. Percent of total is also reported. The species are counted consistent with the CDPHE EDAS import columns for taxa and species. This data is then converted into MMI scores. MMI scores calculated using CDPHE EDAS Access database. All collected species are confirmed against the EDAS database.

**Field Data**

Sampling was done on August 23 and 24, 2016. Sampling was done with low stream flows that was effective sampling.

**Table 2**      **Habitat**

Bear Creek Watershed Association Macroinvertebrate Sample Program									
BCWA Site	Description	Bear Creek Stream Segment	WQCD Timed Kicknet	Habitat	Collected by	Date Collected	Time	Channel width (ft), embeddedness (%), algal cover (%), water clarity	Flow, cfs
15a	BCP @ bridge	1b	Yes	Fast Riffle	RC/TL/	8/24/2016	9:00 AM	13', 35%, 8% at 2/3, Sm	11
14a	Morrison @ gage	1e	Yes	Fast Riffle	RC/TL/	8/24/2016	10:10 AM	21', 40%, 5% at 2, Sm	18
13a	Idledale	1e	Yes	Fast Riffle	RC/TL/	8/24/2016	10:40 AM	23', 40%, 10% at 2/3/Sm	18

Bear Creek Watershed Association Macroinvertebrate Sample Program									
BCWA Site	Description	Bear Creek Stream Segment	WQCD Timed Kicknet	Habitat	Collected by	Date Collected	Time	Channel width (ft), embeddedness (%), algal cover (%), water clarity	Flow, cfs
12	Lair O' Bear	1e	Yes	Fast Riffle	RC/TL/	8/24/2016	11:15 AM	30', 60%, 5% at 2, Sm	18
9	O' Fallon	1e	Yes	Fast Riffle	RC/TL/	8/24/2016	11:40 AM	25', 45%, 15% at 2, Sm	18
8b	BCC at Bridge	1e	Yes	Fast Riffle	RC/TL/	8/24/2016	12:05 PM	30', 30%, 5% at 2, Sm	18
5	Little Bear	1e	Yes	Fast Riffle	RC/TL/	8/24/2016	12:30 PM	35', 30%, 5% at 2, Sm	18
3a	Keys @ bridge	1a	Yes	Fast Riffle	RC/TL/	8/24/2016	1:00 AM	26', 40%, 5% at 2, c	21
2a	Golden Willow	1a	Yes	Fast Riffle	RC/TL/	8/24/2016	1:30 AM	25', 35%, 5% at 2, c	19
58	Above SRR	1a	Yes	Fast Riffle	RC/TL/	8/23/2016	9:55 AM	21', 20%, 5% at 1, c	14
90	Wadsworth	1c	Yes	Fast Riffle	RC/TL/	8/24/2016	9:52 AM	33', 45%, 15% at 2/3/Sm	15

**Table 3 Field Data**

Site 15a-BCP @ Bridge		Site 14a-Morrison Park West		Site 13a-Idledale		Site 12-Lair O' Bear	
pH	8.06	pH	8.26	pH	8.13	pH	8.14
Temp	16.1	Temp	15.7	Temp	15.4	Temp	14.9
DO	8.59	DO	7.57	DO	7.31	DO	7.28
SC	232.4	SC	183.9	SC	189.5	SC	178.9
Site 9-O'Fallon		Site 8b BCC @ Bridge		Site 5 Little Bear		Site 3a Keys	
pH	8.19	pH	7.88	pH	7.77	pH	7.88
Temp	15.6	Temp	17.0	Temp	16.7	Temp	12.4
DO	7.43	DO	7.09	DO	6.92	DO	7.78
SC	131.6	SC	109.3	SC	81.9	SC	64.6
Site 2a- Golden Willow		Site 58- Above SRR		Site (90 ) Wadsworth			
pH	7.88	pH	7.80	pH	8.04		
Temp	12.0	Temp	8.5	Temp	21.9		
DO	7.82	DO	8.14	DO	10.08		
SC	54.5	SC	42.7	SC	487.8		

**Table 4 WQCD Station Identifications Linked with BCWA Sites**

WQCD Station ID	BCWA Station ID	Location	Biotype
5756a	15a	BCLP @ Bridge	Transition
122	14a	Morrison @ Gage	Transition
122a	12	Idledale	Transition
122b	9	Lair O' Bear	Transition
122C	13a	O'Fallon Park	Transition
5762	8	BCC @ Bridge	Transition
5763	5	Little Bear	Transition
5764	3a	Keys @ Bridge	Mountain
5768d	2a	Golden Willow	Mountain
5768c	58	Mt Evans Wilderness	Mountain
	90	Wadsworth	Transition

**Table 5 Biotype Thresholds**

Biotype		Attainment Threshold	Impairment Threshold
1	Transition	52	42
2	Mountains	50	42
3	Plains & Xeric	37	22

**MMI 2016**

**Table 6 2016 MMI Scores and Total Taxa**

	Site 15a-BCP	Site 14a-Morrison	Site 13a-Idledale	Site 12-Lair O' Bear	Site 9-O'Fallon	Site 8b-BCC	Site 5-Little Bear	Site 3a-Keys	Site 2a-Golden Willow	Site 58-Above SRR	Site 90-Wadsworth
<b>Site Variables</b>											
Ecoregion	21d	21d	21c	21c	21c	21c	21c	21c	21c	21c	251
Elevation (meters)	1,731	1,766	1,959	1,999	2,076	2,117	2,151	2,165	2,264	2,546	1,639
Slope	0.03	0.03	0.01	0.01	0.02	0.03	0.02	0.02	0.01	0.02	0.01
<b>MMI Metric Values</b>											
Percent non-insect taxa	14	4	18	18	14	14	0	17	7	4	10
EP taxa <sup>1</sup>	3	6	4	3	7	5	5	2	9	10	5
Percent Chironomidae	17	13	4	5	4	16	17	23	39	5	12
Percent Sensitive Family Plains	48	29	23	10	21	34	59	14	23	12	28
Predator, Shredder Taxa	9	8	6	7	6	8	12	6	10	10	4
Clinger Taxa <sup>1</sup>	11	10	7	8	9	11	9	8	14	13	4
<b>MMI Metric Scores</b>											
Percent non-insect taxa	49	86	35	37	49	49	100	41	76	87	64
EP taxa <sup>1</sup>	45	75	41	28	66	42	40	7	76	69	72
Percent Chironomidae	76	82	95	94	96	78	76	66	43	95	83
Percent Sensitive Family Plains	78	47	38	17	34	56	95	22	38	19	46
Predator, Shredder Taxa	64	57	43	50	43	57	86	43	71	71	29
Clinger Taxa <sup>1</sup>	92	82	45	51	55	70	51	41	87	61	38
<b>Total MMI Score</b>	<b>67</b>	<b>72</b>	<b>50</b>	<b>46</b>	<b>57</b>	<b>59</b>	<b>75</b>	<b>37</b>	<b>65</b>	<b>67</b>	<b>55</b>
<b>Additional Metrics</b>											
Hilsenhoff Biotic Index	4.68	4.70	2.88	3.36	4.46	4.60	4.47	5.04	4.83	2.71	5.04
Shannon-Diversity Index	3.40	2.82	2.60	2.14	2.39	2.71	3.01	2.59	3.81	3.40	3.02

**Historic Comparison**

**Table 7 Historic Comparison 2009-2016**

WQCD Station ID	BCWA Station ID	Location	Biotype	MMI						
				2016	2015	2014	2012	2011	2010	2009
5756a	15a	BCLP @ bridge	Transition	67.0	59.1	66.4				
122	14a	Morrison @ Gage	Transition	72.0	73.5	48.8	72.9	74.5	80.5	69.8
122C	13a	Idledale	Transition	50.0	59.2	59.3	68.0	57.1	69.8	62.1
122a	12	Lair O' Bear	Transition	46.0	72.2	49.5	51.3	56.4	62.2	58.5
122b	9	O' Fallon	Transition	57.0	59.1	44.8	49.9	45.5	57.7	53.6
5762	8b	BCC @ Bridge	Transition	59.0	62.3	49.6	44.3	51.1	39.1	55.6
5763	5	Little Bear	Transition	75.0	68.9	56.2	40.0	42.9	56.6	52.3

WQCD Station ID	BCWA Station ID	Location	Biotype	MMI						
				2016	2015	2014	2012	2011	2010	2009
5764	3a	Keys @ bridge	Mountain	37.0	63.6	43.9	46.9	45.3	36.9	38.6
5768d	2a	Golden Willow	Mountain	65.0	56.6	60.8	71.9			
5768c	58	Mt Evans Wilderness	Mountain	67.0	53.8	67.0	72.5	55.5		
	90	Wadsworth	Transition	55.0						