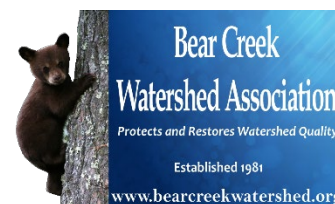


Technical Memorandum BCWA



Date: February 5, 2020
To: Bear Creek Watershed Association
From: Russell N. Clayshulte, Manager

Re: BCWA TM 2019.11 Macroinvertebrates

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Historical 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*).

Standard Index Sample Period

The WQCD recommends standard index sampling periods be between July 1 to October 1 for the Bear Creek Watershed elevations (Sampling protocols outlined in Appendix B of Policy 10-1-2017. 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.

Sample Method

The BCWA utilizes the Water Quality Control Division sample collection timed-kick net methodology protocol (*WQCD SOP-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.

2019 sampling

The 2019 sampling sites replicated the 2018 sampling sites (Table 1). The sites were monitored on August 19, 2019. There was considerable stream bed alteration at all sample sites due to previous excessive high flows. There were no duplicates taken in 2019.

The WQCD 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 were calculated using CDPHE EDAS Access database. All collected species are confirmed against the EDAS database.

Table 1 **Sample Sites**

Site ID	Location Description	Lat	Long	Drainage Basin	Segment	Station Type
Site 15a	Skunk Hollow within Bear Creek Park	39.6522	-105.1731	Bear Creek	1b	P1 S
Site 14b	West Morrison at 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	Little Bear at CDOW downtown site	39.6327	-105.3183	Bear Creek	1e	P3
Site 3a	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	Wilderness boundary	39.61169	-105.4802	Bear Creek	1a	P3
Site 90	Wadsworth	39.66533	-105.0822	Bear Creek	2	P1 S

Field Data

Sampling was done on August 2, 2019. Sampling was done with low stream flows.

Table 2 **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
122C	13a	Idledale	Transition
122a	12	Lair O' Bear	Transition
122b	9	O' Fallon	Transition
5762	8b	BCC @ Bridge	Transition
5763	5	Little Bear	Transition
5764	3a	Keys @ bridge	Mountain
5768d	2a	Golden Willow	Mountain
5768c	58	Mt Evans Wilderness	Mountain
BCWA90	90	Wadsworth	Plains & Xeric

Table 3 Biotype Thresholds

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

MMI 2019

Two sites (BCWA site 5 in Evergreen and BCWA Site 15a Bear Creek Lake Park) had low MMI scores that are below the attainment threshold and constitute impairment (Table 4). The suspected impairment at site 5 was potentially caused by parking lot sealing operations that were done just prior to the August sampling. The sealant used on the parking lot contained coal tar, which is known to degrade water quality and impair macroinvertebrates (BCWA *PGO20 Coal Tar Concerns and Alternatives*). Coal-tar-based sealant is a thick black liquid that is applied to many parking lots, driveways and road surfaces in the Bear Creek Watershed, including the Evergreen parking lot across from Little Bear. The sealant is used to protect against cracking, natural deterioration and water & snow-melt damage. A significant component of coal tar is polycyclic aromatic hydrocarbons, or PAHs. Some PAHs are highly toxic chemicals. They have known harmful impacts on humans and animals (terrestrial and aquatic).

BCWA Site 15a was extensively altered by flooding and stream bed scouring, which has produced a poor habitat.

There are four sites that are below the attainment threshold (BCWA Site 9 at O’Fallon Park, BCWA Site 8b at the Bear Creek Cabins, BCWA Site 3a Keys on the Green at the bridge, and BCWA site 90 at Wadsworth).

Table 4 2019 MMI Scores and Total Taxa

	15a	14a	13a	12	9	8b	5	3a	2a	58	90
TOTAL (#/sq. meter)	2417	293	282	288	294	301	308	294	293	1089	1451
NUMBER OF TAXA	28	21	21	21	22	16	22	18	22	32	30
SHANNON-WEAVER (H')	2.47	2.07	2.7	1.99	2.63	2.45	3.36	2.5	3.54	3.82	3.74
TOTAL EPT TAXA	9	10	9	11	8	5	7	3	9	15	10
EPT INDEX (% of Total Taxa)	32	48	43	52	36	31	32	17	41	47	33
EPHEMEROPTERA ABUNDANCE (% of Total Density)	58	70	63	74	57	42	16	44	19	29	65
CO MMI Score (Policy 10-1 2017)	30.1	55.6	51.3	54.7	44.2	48.4	37.6	41.4	51.8	72.2	49

Historic Comparison

Table 5 Historic Comparison 2009-2019

BCWA Station ID	Location	Biotype	MMI									
			2009	2010	2011	2012	2014	2015	2016	2017	2018	2019
15a	BCLP @ bridge	Transition					66.4	59.1	67.0	56.4	51	30.2
14a	Morrison @ Gage	Transition	69.8	80.5	74.5	72.9	48.8	73.5	72.0	63.9	66	55.6
13a	Idledale	Transition	62.1	69.8	57.1	68.0	59.3	59.2	50.0	62.2	65	51.3
12	Lair O’ Bear	Transition	58.5	62.2	56.4	51.3	49.5	72.2	46.0	62.9	52	54.7
9	O’ Fallon	Transition	53.6	57.7	45.5	49.9	44.8	59.1	57.0	60.1	56	44.2
8b	BCC @ Bridge	Transition	55.6	39.1	51.1	44.3	49.6	62.3	59.0	57.4	50	48.4
5	Little Bear	Transition	52.3	56.6	42.9	40.0	56.2	68.9	75.0	38.4	29	37.6
3a	Keys @ bridge	Mountain	38.6	36.9	45.3	46.9	43.9	63.6	37.0	57.9	51	41.4
2a	Golden Willow	Mountain				71.9	60.8	56.6	65.0	58.1	64	51.8

BCWA Station ID	Location	Biotype	MMI									
			2009	2010	2011	2012	2014	2015	2016	2017	2018	2019
58	Mt Evans Wilderness	Mountain			55.5	72.5	67.0	53.8	67.0	75.6	68	72.2
90	Wadsworth	Plains & Xeric							55.0	39.9	60	49

Table 6 Field Data

BCWA Site	Description	Bear Creek Stream Segment	WQCD Timed Kicknet	Habitat	Collected by	Date Collected	Time	Channel width (ft)	embeddness (%)	Periphyton %	Thickness	water clarity	Air Temp	Flows	Rock dams
15a	BCP @ bridge	1b	Yes	Fast Riffle	RC/TL	8/19/2019	9:10 AM	11	40%	10%	1	sm	28.1	11.9	yes
14a	Morrison @ gage	1e	Yes	Fast Riffle	RC/TL	8/19/2019	11:10 AM	22	40%	5%	1	sm	34.3	26	yes
13a	Idledale	1e	Yes	Fast Riffle	RC/TL	8/19/2019	11:35 AM	10	40%	5%	1	sm	34.8	26	yes
12	Lair O' Bear	1e	Yes	Fast Riffle	RC/TL	8/19/2019	12:00 PM	30	60%	8%	2	sm	37.0	27	yes
9	O' Fallon	1e	Yes	Fast Riffle	RC/TL	8/19/2019	12:35 PM	30	35%	5%	1	sm	37.0	27	yes
8b	BCC at Bridge	1e	Yes	Fast Riffle	RC/TL	8/19/2019	1:00 PM	35	30%	5%	1	c	32.0	27	yes
5	Little Bear	1e	Yes	Fast Riffle	RC/TL	8/19/2019	1:35 PM	40	40%	20%	3	sm	32.0	27	yes
3a	Keys @ bridge	1a	Yes	Fast Riffle	RC/TL	8/19/2019	1:55 PM	45	60%	5%	1	c	32.0	28	yes
2a	Golden Willow	1a	Yes	Fast Riffle	RC/TL	8/19/2019	2:15 PM	35	30%	5%	1	c	32.0	28	no
58	Above SRR	1a	Yes	Fast Riffle	RC/TL	8/19/2019	3:00 PM	20	15%	5%	1	c	30.0	20	no
90	Wadsworth	1c	Yes	Fast Riffle	RC/TL	8/19/2019	10:30 PM	30	60%	30%	4	c	32.0	16	yes