

Camas Creek Seepage Survey, Fall 2018

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This report summarizes the results of a seepage survey conducted on Camas Creek, which flows into the Big Wood River at Magic Reservoir. Camas Creek originates within the boundary of the Big Wood ground water Management Area. The survey was conducted on November 15th, 2018 and included seven measurements of Camas Creek and its tributaries.

Methods and Sites

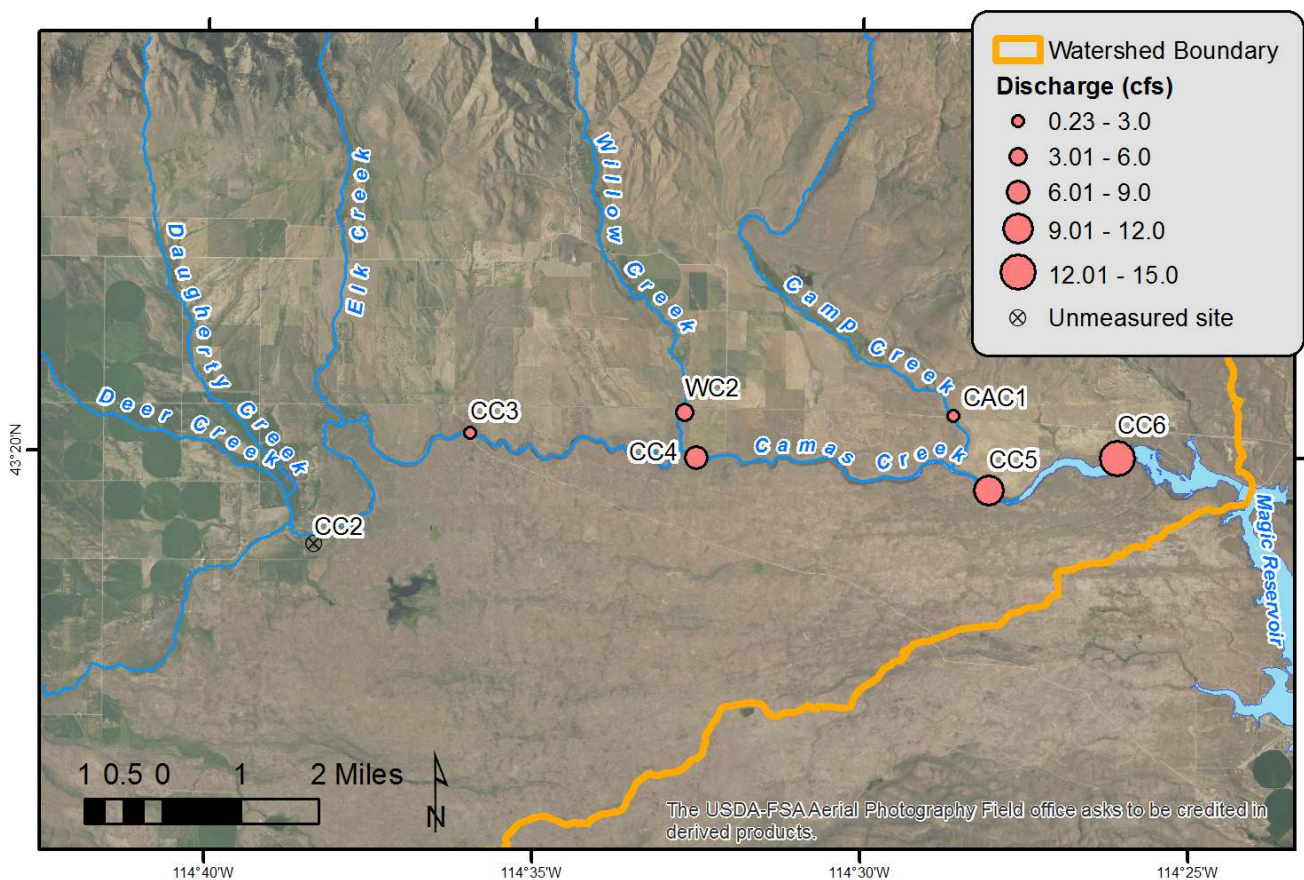


Figure 1: The Camas Prairie Watershed (HUC8 17040220) and location of measured sites in the November 2018 seepage survey.

Potential sites were selected based on public accessibility, likelihood of there being measurable flow, and repeatability. Sites visited during the previous year were revisited and one new site was added (CC6) because Magic Reservoir stage was lower than during the Fall 2017 seepage survey [Moody, 2018]. All sites were visually inspected and measured if there was flow. Stream discharge was measured with a SonTek Flow Tracker at all sites except at CC4, which was measured with an Acoustic Doppler Current Profiler (ADCP). For each measured stream cross-section, 25 vertical profiles were measured as allowed

by the channel width and at 60% of stream depth. If 25 measurements could not be made due to stream width constraints, measurements were made every 0.3 ft.

Table 1: Discharge measurement site data

Site ID	Tributary	River Mile from CC2	Flowing/Measured		2018		2017	
			2017	2018	Lat	Long	Lat	Long
CC2	N	0	Y	N	43.3166	-114.6391		
CC3	N	2.43	Y	Y	43.3372	-114.5996		
WC1	Y	-	Y	Y	43.4151	-114.5758	43.3419	-114.5450
WC2	Y	-	Y	Y	43.3419	-114.5450		
CC4	N	6.11	Y	Y	43.3328	-114.5419		
CAC1	Y	-	Y	Y	43.3408	-114.4769	43.3389	-114.4759
CC5	N	10.34	Y	Y	43.3284	-114.4701		
CC6	N	12.31	N	Y	43.3332	-114.4349		

The survey included four measurements in Camas Creek (CC3, CC4, CC5, CC6) and three measurements in tributaries (WC1, WC2, CAC1). Camas Creek was inspected at CC2, though water was ponded and not flowing. No inspection was made between CC2 and CC3 due to lack of access. Where flows begins in the CC2-CC3 reach is unknown, but measurable flow was present at CC3. Three other tributaries - Deer, Daughtery, and Elk Creeks - were dry or not flowing and were not measured. Table 1 provides locations of the measurements and notes the old coordinates if a slightly different site was selected relative to the 2017 survey. Previous site descriptions can be found in the 2017 report. New sites or adjustments to measurement locations are noted below:

CC4: The second measurement site on Camas Creek was co-located with [USGS gage 13141500](#). The site is accessed by driving south from Highway 20 on County Line Road and walking down a break in the cliff.

WC1: WC1 was moved this year due to frozen conditions and slackwater from a downstream beaver dam.

Camp Creek (CAC1): Camp creek was measured on the north side of Highway 20 right before it enters a culvert. This site is about 200 meters north of the site measured during the 2017 survey.

CC4 and CC5: The site names were reconciled with their relative location downstream. In the 2017 survey, CC4 was further downstream than CC5. CC4 is the USGS gage site for this survey.

CC6: A lower reservoir level in Magic Reservoir allowed access to an additional downstream site. CC6 was accessed at the signed Moonstone Access off of Highway 20.

Table 2: Camas Creek Flows on 15 November 2018

Site ID	Q (cfs)	Reach Gain	Cumulative GW _{in} (cfs)	Reach GW _{in} (cfs)	Gain rate ($\frac{cfs}{mi}$)	GW % of Reach Gain	GW % of Q	% of Total GW _{in}	Uncertainty ISO\STATS(%)
CC3	0.77	-	0.77	0.77	-	-	100%	10%	3.7 \ 4.0
WC1	5.25	-	-	-	-	-	-	-	2.5 \ 2.5
WC2	5.29	-	-	-	-	-	-	-	2.8 \ 5.3
CC4	8.13	7.36	2.84	2.07	0.56	28%	35%	26%	$\sigma = 0.494$
CAC1	0.23	-	0.23	0.23	-	100%	100%	3%	7.8 \ 22.6
CC5	11.82	3.69	6.53	3.46	0.82	100%	55%	43%	2.6 \ 1.8
CC6	13.37	1.55	8.08	1.55	0.79	100%	60%	19%	2.4 \ 1.4

Results and Discussion

Camas Creek gained a total of 13.37 cfs between CC2 and CC6 with ground water discharge accounting for 60% of flow at CC6. Willow Creek was the only tributary originating outside of the valley-fill deposits and accounted for 65% of total flow at the gage (CC4) and 40% of flow at CC6. The largest proportion of ground water discharge occurs between CC4 and CC5 downstream of the USGS gage as Camas Creek incises further into basalt. Gain rates below the gage are approximately 0.8 cfs per mile and are higher than rates upstream of the gage, which are 0.56 cfs per mile.

Provisional instantaneous discharge at the USGS gage was reported as 7.10 cfs when we measured 8.13 with the ADCP (13% higher, fig. 2). The standard deviation of the measurement, which is a compilation of six passes across the same transect, was 0.494 cfs. The percent difference between the gage and our measurement was about the same percentage as last year, though the gage was higher in 2017. Gage average daily discharge was 6.96 cfs the day of the measurement, which is in the 24th percentile for mean November flows. The hydrograph and statistics show

Table 2 shows the discharge measurements and reach gains for the survey. Calculations are as follows:

- Q: Discharge measured by the SonTek stream gauge or ADCP
- Camas gain: difference between measurements made in Camas Creek
- Cumulative GW_{in}: total estimated ground water discharge. All discharge except WC2 is considered ground water flow into Camas Creek
- Reach GW_{in}: estimated ground water discharge in a reach between two Camas Creek measurements
- Gain rate: Estimated flux of ground water seepage per mile in a reach
- GW % of reach gain: ground water proportion of reach gain
- GW % of Q: ground water proportion of streamflow measured at the site
- % of Total GW_{in}: reach GW_{in} of total estimated GW_{in}

Measurement uncertainty is inversely related to discharge with the lowest flows having the highest percent uncertainty. This is expected because the low-discharge creeks are shallow and narrow making it impossible to make 25 measurements or properly submerge the instrument, leading to an increase in measurement errors. Other than Camp Creek, which was the lowest flow and only accounts for 1% of total flow in Camas Creek, uncertainties remained below 5.3%.

Table 3: Groundwater discharge comparison, 2017 and 2018. Grey rows indicate tributaries. Gain rates are for ground water discharge along Camas Creek only, thus gain rate for CC5 does not include Camp Creek, which is assumed to be wholly ground water discharge.

SiteID	Q (cfs)		Reach GW _{in} (cfs)		Gain rate ($\frac{cfs}{mi}$)		GW % of Q		GW % of Reach Gain	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
CC2	.45	-	.45	-	-	-	100%	-	-	-
CC3	1.18	0.77	0.73	.77	-	-	100%	100%	-	-
WC2	12.29	5.29	-	-	-	-	-	-	-	-
CC4	14.26	8.13	0.79	2.07	0.21	0.56	14%	35%	6%	28%
CAC1	0.32	0.23	0.32	0.23	-	-	-	-	-	-
CC5	21.16	11.82	6.57	3.46	1.55	0.82	42%	55%	100%	100%
CC6	-	13.37	-	1.55	-	0.79	-	60%	-	100%

Table 3 compares the results of the 2017 and 2018 seepage surveys. Lower surface runoff volumes coincide with lower gains from ground water. A reduction in gains past the gage is roughly proportional to the reduction in total flow at CC5 (53% and 56%, respectively). While most stream flow measurements, ground water discharge estimates, and gain rates were less in 2018, the gain rate per mile more than doubled in the CC3-CC4 reach. Past CC5, the gain rate was around half as compared to 2017.

The CC5-CC6 reach, not previously measured in IDWR or USGS seepage surveys, shows continual and steady discharge to Magic Reservoir. Overall, 5.23 cfs of ground water discharged to Camas Creek between the CC4 (gage) and CC6, which assumes flow in Camp Creek is all derived from ground water discharge.

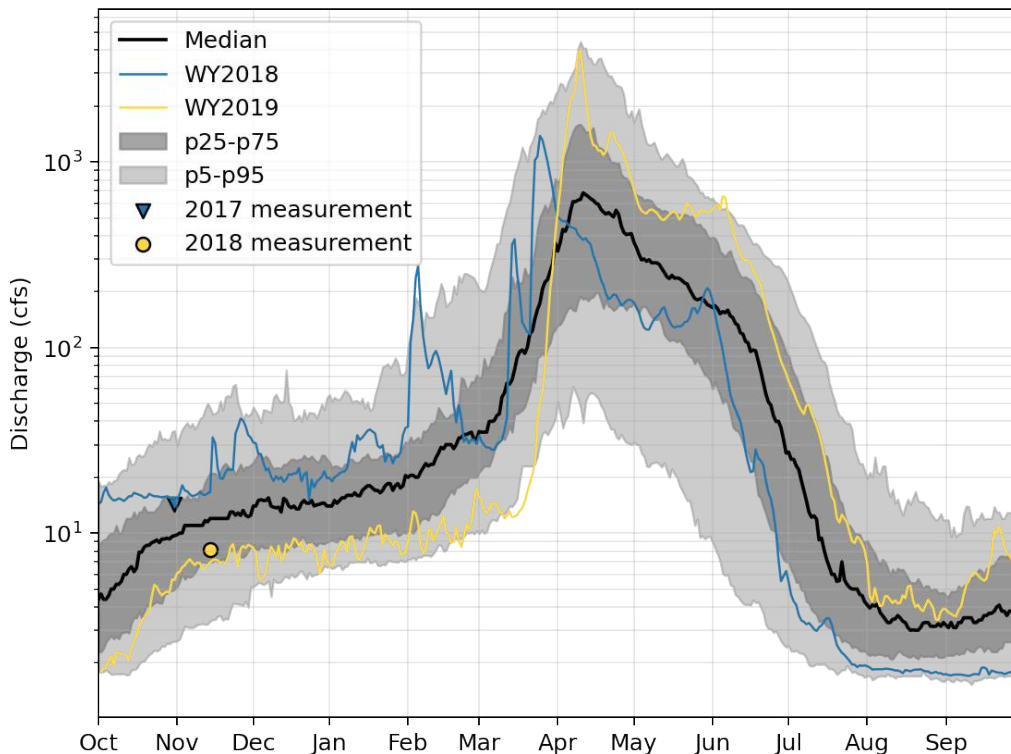


Figure 2: Hydrograph for the period of record at the Camas Creek gage (USGS 13141500). The hydrograph is presented as the median (black line) , 25th-75th percentiles (dark grey shaded area), and 5th-95th percentiles (light grey shaded area). Seepage run measurements at the gage are shown along with the respective water year daily hydrographs.

References

A. Moody. Camas seepage survey. Technical report, Idaho Department of Water Resources, January 2018. URL <https://idwr.idaho.gov/files/publications/20180108-OFR-Camas-Creek-Seepage-Survey.pdf>.