



# Camas Creek Seepage Survey

by Alex Moody

*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 Groundwater Management Area. The survey occurred on November 1<sup>st</sup>, 2017 and included six measurements of Camas Creek and its tributaries.*

## Methods and Sites

Potential sites were selected prior to field work based on public accessibility and the likelihood of there being measurable flow. All sites were visually inspected and measured if there was flow. Stream discharge was measured with a SonTek Flow Tracker at all sites. 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.

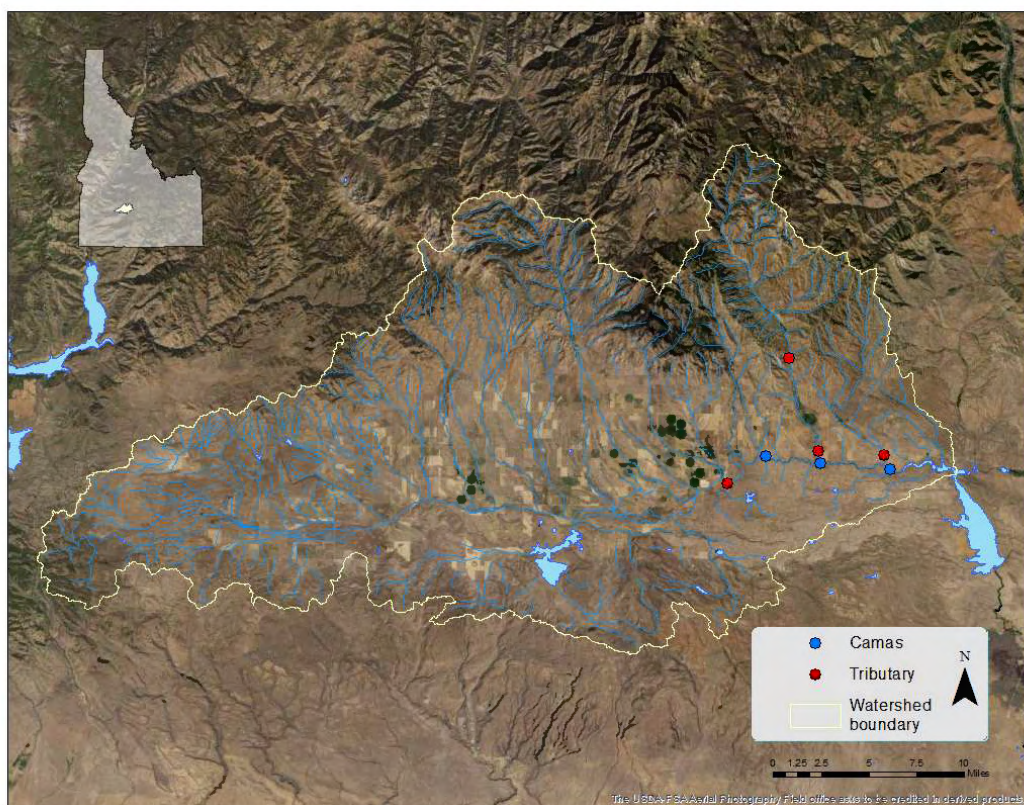


Figure 1: Map of the Camas Prairie Watershed (HUC8 17040220) and measured sites in the seepage survey

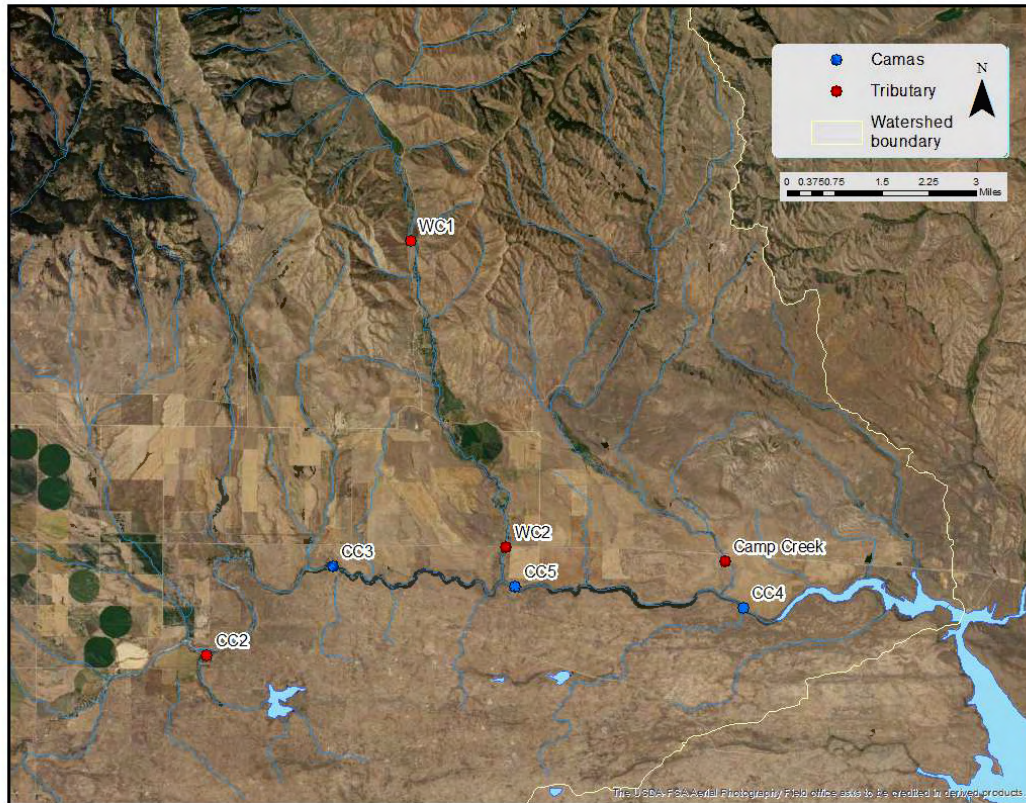


Figure 2: Eastern extent of the Camas Prairie where the seepage survey was conducted

The survey included four measurements in Camas Creek ( CC2, CC3, CC4, and CC5 ) and four measurements in tributaries ( WC1, WC2, Camp Creek 1). Four other tributaries - Deer, Daughtery, and Elk Creeks - were dry or not flowing and were not measured. Note that the site number only refers to the order in which we visited the sites. Table 1 provides locations and relative stream order of the measured streams.

**CC2:** Camas Creek 2 was selected by moving downstream of the initial CC1 site, which was giving negative velocity readings and seemed to be impounded at an unknown point downstream (fig. 3). Access to the site is via Lincoln Avenue-700 E off of Highway 20. Crossing over the bridge leads to a gate at which point the road to the north leads to the stream. The measurement was taken on the upstream side of the road (fig. 4).

**CC3:** The most upstream measurement on the Camas was at Macon Flat Road where a BLM bridge crosses the creek.

**CC4:** The most downstream Camas measurement was reached by following Macon Flat road southeast from CC3 and turning north onto the track following the powerlines. There is a gully that can be descended to a point in the stream approximately 400 yards upstream of the beginning of the slackwater from Magic Reservoir. Pelagic sediment from the previous reservoir levels filled much of the canyon, though the creek was in a suitable bed of sand and cobble with uniform flow. See figure 5





Figure 3: Impounded Camas Creek



Figure 4: Flow over the road at CC2

**CC5:** The fifth 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 to the stream.

**WC1 & WC2:** Willow Creek drains into Camas Creek approximately 7.6 km upstream of the slackwater and 0.3 km upstream from the CC5 measurement/USGS gage. WC1 was selected to be close to the aquifer boundary in order to observe gains or losses to the aquifer within Willow Creek. WC2 was 30 meters east of a bridge crossing and WC2 was measured at the southern mouth of the culvert under highway 20. The two measurements showed a 0.035 cfs gain, which is within the 2-3% measurement error, thus discharge is assumed to be constant in this reach of the tributary. The measurement nearest the confluence of Willow Creek and Camas Creek is used to represent Willow Creek inflows in this report.

**Camp Creek:** Camp creek was measured approximately 150 meters downstream from the highway crossing. After excavation, there was an adequate cross-section for measuring, though the error was high.

Table 1: Discharge measurement site data

Site ID	Tributary	Distance to slackwater <sup>1</sup> (km)	LAT	LONG
CC2	N	20	43.3179	-114.6422
CC3	N	13	43.3372	-114.5996
WC1	Y	7.6	43.4124	-114.5757
WC2	Y	7.6	43.3419	-114.5450
CC5	N	7.3	43.3328	-114.5419
Camp Creek	Y	1.5	43.3389	-114.4759
CC4	N	0.9	43.3284	-114.4701

<sup>1</sup>Distance to slackwater for tributaries is measured from the confluence with Camas Creek



Figure 5: Camas Creek incised into the surrounding basalt near the beginning of Magic Reservoir's slackwater

## Results and Discussion

Camas Creek gained 19.98 cfs over the reach measured in the survey with measured inflows from tributaries accounting for approximately 62% of the flow at the most downstream measurement. Willow Creek contributed a majority of total flow, 58%, during the day of the survey, and was the primary source of water in Camas Creek that originated outside of the aquifer. A survey conducted in November 1957 showed 89% of flows that day coming from Willow Creek [Walton, 1962]. Table 2 shows the discharge measurements in both the Camas and tributaries. Calculations are as follows:

- Discharge: output of the SonTek stream gauge
- Camas gain: difference between measurements made in Camas Creek
- Cumulative  $GW_{in}$ : total estimated groundwater discharge. All discharge except WC2 is considered groundwater flow into Camas Creek
- Reach  $GW_{in}$ : estimated groundwater discharge in a reach between two Camas Creek measurements
- GW % of reach gain: groundwater proportion of reach gain
- GW % of  $Q_{total}$ : groundwater proportion of streamflow
- % of Total  $GW_{in}$ : reach  $GW_{in}$  of total estimated  $GW_{in}$

Groundwater discharge in the reach between CC5 and CC4 (USGS gage to Magic Reservoir) is where 78% of total estimated groundwater discharge occurs. Mean daily discharge at CC5 the day of the survey as reported by the USGS gage was 15.9 cfs with an 11% difference with the SonTek discharge of 14.26 cfs. The percent difference is outside of the range of both ISO (3.1%) and statistical (6%) uncertainty. Despite the discrepancy between the two measurements, there is still appreciable groundwater discharge into Camas Creek between the gage and Magic Reservoir. A seepage survey in May 1977 reported approximately 5 cfs

Table 2: Camas Creek Flows on 1 November 2017

Site ID	Q (cfs)	Camas Gain	Cumulative GW <sub>in</sub> (cfs)	Reach GW <sub>in</sub> (cfs)	GW % of Reach Gain	GW % of Q <sub>total</sub>	% of Total GW <sub>in</sub>	Uncertainty ISO\STATS(%)
CC2	0.45	-	0.45	-	-	-	-	6.0\8.0
CC3	1.18	0.73	1.18	0.73	100%	100%	8.24%	2.9\8.2
WC2	12.29	-	-	-	-	-	-	3.7\2.9
CC5	14.26	13.08	1.98	0.79	6.05%	13.85%	8.93%	3.1\6.0
Camp Creek	0.32	-	-	-	-	-	-	4.8\19.0
CC4	21.16	6.90	8.87	6.90	100%	41.93%	77.73%	2.6\2.5

of groundwater gain over the same reach, which was approximately 20% of flow entering Magic Reservoir [Young, 1978].

Our uncertainties arise from measurement uncertainty and the method of tributary inspection. Measurement uncertainty decreases with the magnitude of streamflow (fig. 6), though the absolute uncertainties in the tributary flows are relatively small compared to the overall flow of Camas Creek as it enters the reservoir. Tributaries were inspected at their intersection with US Highway 20. If no water was present, no further inspection upstream was made. Elk, Deer, and Soldier Creeks were flowing during the spring survey of Young [1978], though many had infiltrated into the unconfined aquifer prior to their reaching the highway. We cannot be certain if these streams were flowing upstream during the present survey, though we assume any runoff had already infiltrated into the underlying aquifer.

Camas Creek streamflow is dominated by runoff events such as spring snow melt (fig 7) and daily discharges can vary over three orders of magnitude in a given water year. All known seepage surveys have been conducted during low-flow conditions with the discharge being no more than 24 cfs at Magic Reservoir. Future seepage surveys during the climbing or receding limbs of the hydrograph in high-flow years would provide insight into baseflow under varying conditions, improve the understanding of the aquifer, and may provide important information for managers at Magic Reservoir and water users in the Camas Prairie.

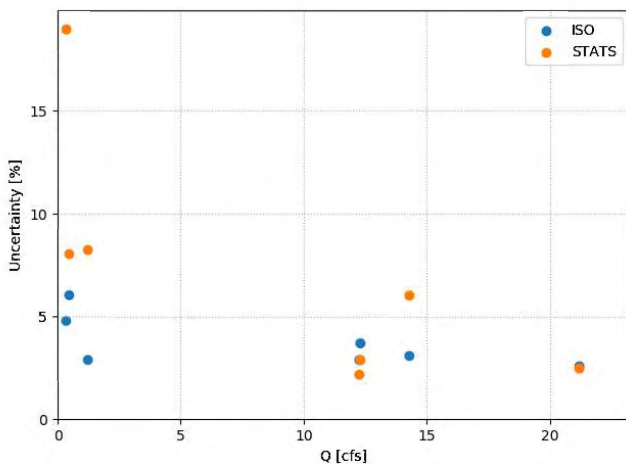


Figure 6: Discharge vs. uncertainty as estimated by the SonTek Flow Tracker

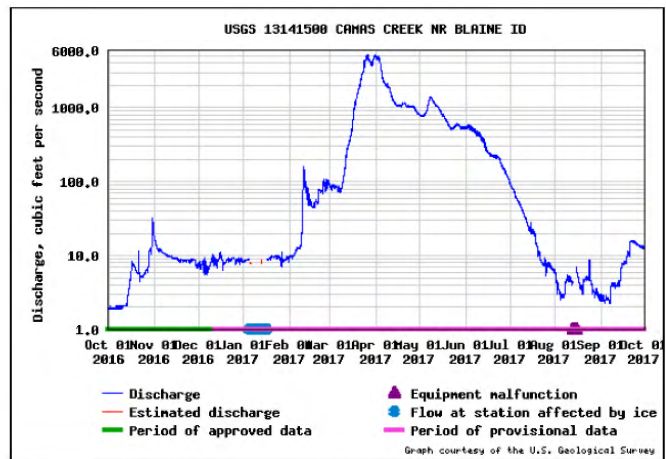


Figure 7: Hydrograph of Camas Creek during water year 2017

## References

William Clarence Walton. *Ground-Water Resources of Camas Prairie, Camas and Elmore Counties, Idaho*. US Government Printing Office, 1962.

Harold William Young. *Water resources of Camas Prairie, south-central Idaho*. Department of the Interior, Geological Survey, 1978.