COLORADO
Parks and Wildlife
Department of Natural Resources

Water Resources Section
6060 Broadway
Denver, CO 80216
P 303.297.1192 | F 303.291.7456

13 November 2015

Ms. Linda Bassi, Chief
Stream and Lake Protection Section
Colorado Water Conservation Board
1313 Sherman Street, Suite 721
Denver CO 80203

SUBJ: Instream Flow Recommendations for Streams on the Soapstone Prairie Natural Area (City of Fort Collins) and Red Mountain Open Space (Larimer County) Properties; Boxelder Creek, Sand Creek and Lonetree Creek, Larimer County and Weld County, Water Division 1, for January, 2016 CWCB Meeting

Dear Linda:

The information contained in and referred to in this letter and the associated instream flow file folders that are ready for posting to the CWCB website, form the basis for the instream flow recommendations for Boxelder Creek, Sand Creek, and Lonetree Creek. It is Colorado Parks and Wildlife's (CPW) intent that these three streams be considered by the Colorado Water Conservation Board (CWCB or Board) at their January, 2016 regular meeting. The investigations related to these instream flow recommendations were conducted by City of Fort Collins' Natural Areas Program, Larimer County Open Space and Colorado Parks and Wildlife personnel; these investigations were initiated in 2013 and continued into 2015. It is the CPW staff's opinion that the information contained in this letter is sufficient for the Board's staff to initiate instream flow appropriations on the above referenced water bodies and to specifically address the findings required in Rule 5(i) of the Instream Flow Rules.

The State of Colorado's Instream Flow (ISF) Program was created in 1973 when the Colorado General Assembly passed Senate Bill 97 which called for the recognition of "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (see 37-92-102 (3) C.R.S.). This statute vests the Board with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's ISF Program, the statute directs the Board to request and consider instream flow recommendations from other local, state and federal agencies. These three stream segments should be considered for inclusion into the ISF Program because they have natural environments that can be preserved to a reasonable degree with an instream flow water right.

The CPW is forwarding these stream flow recommendations to the Board to meet CPW's legislative declarations "... that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors ... and

that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.) and "... that the natural, scenic, scientific, and outdoor recreation areas ... protected, preserved, enhanced and managed for the use, benefit, and enjoyment of the people of this state and (its) visitors ... and that, to carry out such program and policy, there shall be a continuous operation of acquisition, development, and management of ... lands, waters, and facilities." (See §33-10-101 (1) C.R.S.). In addition to these statutory directives, the current CPW strategic planning documents (*DOW Strategic Plan*, 2010 and *A Path Forward*, 2014) state that "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations...by protecting and enhancing the quality and quantity of aquatic habitats." and that "Ensuring the long term viability of native fish and wildlife ... and sport fish populations." - these statements encapsulate CPW's primary objectives and provide a guide to the agency's linkage to the goals and objectives of the CWCB ISF Program.

Background

Several years ago, CPW personnel initiated work with staff from the City of Fort Collins Natural Areas Program (City) and Larimer County's (County) Open Space Department to develop ISF recommendations on several streams located on the Soapstone Prairie Natural Area and the Red Mountain Open Space properties north of Fort Collins in Larimer and Weld Counties. These natural area properties are largely prairie grassland with several perennial water features that are somewhat unique for this area and elevation. ISF and natural lake level appropriations on two streams and four ponds (Spottlewood Creek, Graves Creek, and Spottlewood Ponds 1-4) on Soapstone Prairie were secured in the 2014 - 15 appropriation cycle. It is important to note that Boxelder Creek, Sand Creek, and Lonetree Creek are very similar streams - both in terms of biology and hydrology.

Prairie Hydrology

Recall that the 2015 streams and ponds were all situated in spring driven hydrologic systems with very stable flows and relatively stable temperature regimes. Their hydrology was not snowmelt driven like other Colorado streams but were sustained by diffuse spring sources that were scattered throughout the drainages. The hydrology of Boxelder Creek, Sand Creek, and Lonetree Creek is very similar. While it is true that some snow accumulates in the area, it is limited and rapidly melts or sublimates (due to persistent winds). Spring, summer, and early fall hydrology is influenced by storm events that are common to the Colorado Front Range. These storm events cause short term increases in stream flow but measurements show that these streams rapidly return to spring driven baseflows. It is important to note that Sand Creek and Boxelder Creek have higher elevation, forested headwaters and as such, they display some snowmelt driven hydrologic characteristics and some spring flow characteristics. Another characteristic of these stream systems is that they flow and dry up at predictable points along their course.

Due to the above described hydrology, a water availability investigation for these streams was somewhat difficult. There are no nearby similar gages that we could use and no applicable models for streams in this elevation band with similar hydrologic drivers. Water availability determinations were made utilizing staff professional judgment, the best available information, consultations with water users and other state officials, CWCB temporary gage measurements and staff spot measurements during the period of our investigations of these streams.

Lonetree Creek and Sand Creek both have headwaters in Wyoming and the flow into Colorado southwest of Cheyenne, Wyoming. Similarly, Boxelder Creek has its headwaters very close to the state line, but for the most part, the Boxelder basin is entirely within Colorado. All three creeks flow in a southerly direction toward Ft. Collins, Colorado. All three creeks have perennial flow in the headwaters but go underground or become intermittent before they flow into any major tributary of the Cache la Poudre River.

Biology

As stated above, Lonetree Creek starts in Wyoming and flows parallel to Interstate 25 (on the west side) for about four miles in Colorado before it goes under the highway and on towards the southeast; while in Colorado, it is entirely in Weld County. There is rarely any contiguous perennial streamflow in Lonetree Creek on the east side of the interstate. In 2010, Colorado State University (Cathcart and Stacy) conducted a fish inventory on Lonetree Creek. Six species of fish were collected (five of which are native to the eastern slope of Colorado). One of the species found in Lonetree Creek was the Iowa Darter, a state listed species of special concern. Lonetree Creek is being investigated as a potential reintroduction site for other native fish such as northern redbelly dace and/or common shiner. Lonetree Creek supports aquatic macroinvertebrates and lush riparian wetlands which are undoubtedly important for terrestrial and avian species.

Also stated above is the fact that the other two creeks that are the subject of this recommendation letter are very similar in terms of their hydrology and biology. They are both large enough, cold enough, and high enough in elevation that they have trout populations. Therefore, they are more typical of Colorado streams than the other streams we have studied on the Ft. Collins and Larimer County properties.

Sand Creek is, by far, the largest stream in the Red Mountain Open Space. Sand Creek arises in Wyoming and then flows through a deep canyon (Haygood Canyon) in the northwest corner of the Red Mountain Open Space property. The stream then flows through prairie grassland habitats before it goes underground and becomes intermittent. Sand Creek currently supports a wild population of brook trout and also supports a small population of the non-native fathead minnow in the lower reaches. CPW is currently engaged in discussions with Wyoming Game and Fish regarding a reclamation project and reintroduction of native cutthroat trout in the Sand Creek basin. The Sand Creek basin has also been the subject of a detailed botanical inventory by Larimer County personnel (see attached inventory documentation).

Boxelder Creek is formed by the confluence of two major tributaries (the North Branch and South Branch) southwest of Cheyenne, Wyoming. The South Branch is entirely in Colorado and the North Branch flows out of Wyoming; therefore, there is a very small portion of the Boxelder Creek watershed in Wyoming. Boxelder Creek also supports a brook trout fishery and is also being investigated as a potential reintroduction site for greenback cutthroat trout. Larimer County and CSU data indicates that Boxelder Creek supports an excellent and diverse aquatic macroinvertebrate community as well as lush riparian wetlands which are undoubtedly important for terrestrial and avian species (see attached).

As stated above, the purpose of this letter is to formally transmit ISF recommendations from CPW to CWCB for the Board's consideration for the 2016 appropriation year. Please refer to the following fact sheets and the recommendation summary table (attached) for additional information.

CPW personnel will be present at the January, 2016 CWCB meeting to answer any questions that the Board might have regarding these flow recommendations. We appreciate your consideration.

Sincerely,

Jay W. Skinner
CPW Instream Flow Program Coordinator

FACT SHEET

Boxelder Creek

Upper Terminus: The Confluence of the South Branch and North Branch of Boxelder Creek (see Recommendation Summary Table for legal description)

Lower Terminus: A point where surface flow ceases or the confluence with Sand Creek (see Recommendation Summary Table for legal description)

Natural Environment:

Larimer County and Colorado State University data indicates that Boxelder Creek supports a wild and self-sustaining brook trout fishery. Since Boxelder Creek supports brook trout, it is being studied and investigated as a possible reintroduction site for native greenback cutthroat trout. Its stable hydrology and temperature regime and its relative isolation make it particularly suitable for active native fishery management activities. The CSU and County data also indicates that Boxelder Creek has a diverse macroinvertebrate community and a healthy riparian zone. Due to the relative rarity of water features such as this on the high prairie, it is reasonable to assume that this feature is important to both terrestrial wildlife and avian species.

R2CROSS Results:

During 2014, CPW, CWCB, Larimer County and City of Fort Collins personnel collected R2CROSS data at two sites within the proposed ISF segment. The results of the R2CROSS modeling are summarized below:

Date	Q Measured	40% - 250%	Flow meeting two criteria
3/26/2014	5.16 cfs	2.1 - 12.9 cfs	all values out of range
7/10/2014	2.88 cfs	1.2 - 7.2 cfs	1.3 cfs

Due to the higher elevation snowmelt driven hydrology of Boxelder Creek's hydrology and the nature of the natural environment present (a cold water fishery), CPW is of the opinion that it is not appropriate to recommend a single year-round instream flow amount of 1.3 cfs as this would not be sufficient to preserve the existing and future potential natural environment to a reasonable degree. Therefore, pending site specific water availability data collected by CWCB staff and further consultation with CPW, we recommend a base flow winter low flow season instream flow of 1.3 cfs and a summer, high flow season instream flow of 7.2 cfs (the lowest in-range flow prediction from the R2CROSS model). At 7.2 cfs, the average depth and velocity criteria are met and wetted perimeter is maintained at about 44% of the bank full value (only 6% short of the wetted perimeter criterion).

Red Mountain Open Space
Larimer County, Colorado

Overview of Natural Environment/Resources on Sand & Boxelder Creeks

General

There are two perennial creeks that flow through Red Mountain Open Space – Boxelder and Sand creeks. The headwaters of both watersheds are on primarily private lands and flow into the open space. Both riparian corridors primarily consist of native vegetation and contain examples of rare plant communities. The presence of flood debris away from the stream channel, including large logs, indicates intense flooding episodes that occur through the canyons.

Boxelder Creek originates partially in Colorado and partially in Wyoming and flows through Boxelder Canyon before entering Red Mountain Open Space. An approximately 4.5 mile reach of Boxelder Creek flows through the open space. is dominated by large cottonwoods and willows and a diverse mesic herbaceous understory above Boxelder Dam No. 5. At the dam face, there is a shallow wetland most of the year. Below the dam, the creek flows through an agricultural field and then natural habitat again before it's confluence with Sand Creek at the southern boundary of Red Mountain Open Space.

Sand Creek originates in Wyoming, partially on private lands and partially on City of Cheyenne Open Space property. Once the creek crosses into Red Mountain Open Space, it flows through Haygood Canyon, before it comes to the valley floor and Boxelder Dam No. 6 (built in 1977). Sand Creek is dominated by mature cottonwoods and willow with a diverse mesic herbaceous understory above the dam. Below the dam the released water cuts through an anticline creating a unique canyon, still dominated by native riparian vegetation. Once the creek emerges from this canyon it enters a relatively broad, sandy wash and at times runs belowground. Sand Creek flows into Boxelder Creek at the southern boundary of the open space.

Vegetation

Over and understory vegetation on large portions of both Sand and Boxelder creeks include the following species. Narrowleaf cottonwood (*Populus angustifolia*) is the dominant riparian tree forming a canopy over diverse shrub species including rocky mountain maple (*Acer glabrum*), wild plum *(Prunus americana)*, sandbar willow (*Salix exigua*), plains cottonwood (*Populus deltoides*), chokecherry (*Prunus virginiana*), bluestem willow (*Salix irrorata*), skunkbush, snowberry (*Symphoricarpos oreophilus*) and cottonwood (*Populus acuminata*). The herbaceous understory in the riparian areas includes Kentucky bluegrass, needle-and-thread, western wheatgrass, lupine (*Lupinus argenteus*), sticky geranium (*Geranium caespitosum*), water sedge (*Carex aquatilus*), field horsetail (*Equisetum arvense*), poison ivy (*Toxicodendron rydbergii*) and field mint (*Mentha arvensis*).

- Haygood Canyon supports a rare narrowleaf cottonwood/chokecherry (*Populus angustifolia/Prunus virginiana*) community which is a late seral community and maintained by regular flooding. CNHP Rank of G1Q/S1
- Boxelder Canyon supports a rare narrowleaf cottonwood/bluestem willow (*Populus angustifolia/Salix irrorata*) community. This early seral community has a dense cover of willow that would indicate frequent flooding. CNHP Rank of G2/S2

Wildlife

Due to its location, the Laramie Foothills likely served as an important connection between the mountains and the plains for historic seasonal animal migration and dispersal. Red Mountain Open Space supports a variety of large-ranging mammals including mountain lion (*Felis concolor*), coyote (*Canis latrans*)

(including dens), mule deer (*Odocoileus hemion*us), white-tail deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), American elk (*Cervus elaphus*) and pronghorn (*Antilocapra americana*). Red Mountain Open Space is included in a large regional mule deer migration and winter concentration area that extends from Wyoming south into Boulder County and potential elk calving areas exist on-site but need to be confirmed (Natural Diversity Information Source, 2007). In general, winter concentration periods correspond to the months of December through March and elk calving occurs in June.

Small and medium-sized mammal and bat surveys were completed in spring and summer 2005 by the Colorado Natural Heritage Program (CNHP). Netted or observed species included striped skunk (*Mephitis mephitis*), long-tailed vole (*Microtus longicaudus*), deer mouse (*Peromyscus maniculatus*), western harvest mouse (*Reithrodontomys megalotis*), northern pocket gopher (*Thomomys talpoides*), meadow vole (*Microtus pennsylvanicus*), black-tailed prairie dogs (*Cynomys ludovicianus*) (there is an approximately 5-acre population at the southeast corner of the property), long-legged myotis (*Myotis volans*), long-eared myotis (*Myotis evotis*), hoary bat (*Lasiurus cinereus*), big brown bat (*Eptesicus fuscus*) and western small-footed myotis (*Myotis ciliolabrum*). There are no rare or imperiled bat species of conservation concern known on the property.

Aquatic Species

Sand and Boxelder creeks, were sampled by the Colorado Division of Wildlife for fish composition. Fish species trapped were mixed age class, small brook trout (*Salvelinus fontinalis)* with evidence of recruitment and reproduction. The water quality and temperature and native aquatic insect assemblage in both creeks are very good and both have the potential to support introduction of the native state and federally threatened greenback cutthroat trout (*Oncorhynchus clarki stomias).*

In March 2007 and again in 2012 an aquatic insect survey was completed by Colorado State University (Boris Kondratieff, and others) on both creeks with excellent results showing that the assemblage of native aquatic insects is intact. During the sampling, over 128 total macroinvertebrate taxa were identified from both qualitative samples and quantitative benthic samples. Of these, 53 mayfly/stonefly/caddisfly taxa were collected from Sand Creek, a remarkable biodiversity and number for any known Front Range stream. An average of 22-25 EPT taxa being more typical for Front Range streams (B. C. Kondratieff, personal observation). Species recorded include stoneflies such as the rare snowfly (*Capnura wanica*), mayfly (*Baetis magnus),* Gunnison snowfly (*Utacapnia poda*), Angulate snowfly (*Paracapnia angulata*), blue-winged olive (*Baetis tricaudatus*), stoneflies (*Sweltsa* sp.), Oregon forestfly (*Zapada oregonensis*)) and alderflies (*Sialis* sp.). The alder fly *Sialis hamata* Ross was a relatively common species in Sand Creek, representing a new state record for Colorado (Ross 1937, Penny et al. 1997). Uncommon insect species found in the gypsum karst formations include a variety of mayflies, an albino millipede (new species and genus) and cave webworms (possibly the first documented occurrence in Colorado, although adults collected in the spring or summer are needed for an exact species determination).

Water Rights

There are four adjudicated springs on the Ranch that provide livestock water, as well as rights to the spring water from Wyoming flowing into the tank on the northern property boundary:

- Belvoir 19S Spring Well (SW1/4SE1/4 Sec. 19-T12N-R69W)
- Belvoir 30 Spring Well (SW1/4SW1/4 Sec. 30-T12N-R69W)
- Belvoir 36 Spring Well (NW 1/4NW1/4 Sec. 36-T12N-R70W)
- Quonset Spring (SE1/4SE1/4 Sec. 13-T11N-R70W)

Sturdevant Ditch No. 1, No. 2 and No. 3 are adjudicated water rights diverted from Boxelder Creek for irrigation:

- Sturdevant Ditch No. 1 (Sec. 13-T11N-R70W)
- Sturdevant Ditch No. 2 (Sec. 13-T11N-R70W)
- Sturdevant Ditch No. 3 (Sec. 19-T11N-R70W)

No. 1 diversion is washed out and not currently carrying water. No. 2 supplies water for the hay fields just north of the Southwest Place on the west side of Boxelder Creek. These ditches have a combined decree of 10.67 cfs, which is more than typically available. Appropriation dates are 8/15/1873 and 8/20/1873, which are No. 64 and No. 65 priority for the Poudre Drainage. No. 3 is diverted further down stream, supplying water for the hay fields at the Southeast Place.

COLORADO WATER CONSERVATION BOARD
INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM
STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME:	Boxelder Creek
XS LOCATION:	Ab lower NRCS Dam
XS NUMBER:	0
DATE:	3.26.14
OBSERVERS:	0
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	0
WATERSHED:	0
DIVISION:	0
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

*** NOTE ***
Leave TAPE WT and TENSION at defaults for data collected with a survey level and rod

TAPE WT:	0.0106
TENSION:	99999

CHANNEL PROFILE DATA

SLOPE:	0.009

INPUT DATA CHECKED BY: .....DATE.....

ASSIGNED TO: ….....……..…….....DATE.....

STREAM NAME: Boxelder Creek
XS LOCATION: Ab lower NRCS Dam
XS NUMBER: 0

DATA POINTS= 24

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1	gl	0.00	3.92			0.00		0.00	0.00	0.0%
		3.60	6.35			0.00		0.00	0.00	0.0%
		5.00	6.76			0.00		0.00	0.00	0.0%
	wl	6.70	7.04	0.00	0.00	0.00		0.00	0.00	0.0%
		7.10	7.35	0.30	2.20	0.51	0.30	0.12	0.26	5.1%
		7.50	7.35	0.35	1.70	0.40	0.35	0.14	0.24	4.6%
		7.90	7.45	0.40	1.60	0.41	0.40	0.16	0.26	5.0%
		8.30	7.45	0.45	1.80	0.40	0.45	0.18	0.32	6.3%
		8.70	7.35	0.45	2.40	0.41	0.45	0.18	0.43	8.4%
		9.10	7.50	0.40	2.10	0.43	0.40	0.16	0.34	6.5%
		9.50	7.50	0.50	2.60	0.40	0.50	0.20	0.52	10.1%
		9.90	7.55	0.50	2.70	0.40	0.50	0.20	0.54	10.5%
		10.30	7.50	0.45	2.70	0.40	0.45	0.18	0.49	9.4%
		10.70	7.55	0.40	2.60	0.40	0.40	0.16	0.42	8.1%
		11.10	7.60	0.50	2.00	0.40	0.50	0.20	0.40	7.8%
		11.50	7.40	0.30	2.90	0.45	0.30	0.12	0.35	6.7%
		11.90	7.40	0.30	2.80	0.40	0.30	0.12	0.34	6.5%
		12.30	7.40	0.30	2.50	0.40	0.30	0.11	0.26	5.1%
	wl	12.60	7.04	0.00	0.00	0.47		0.00	0.00	0.0%
		13.60	6.71			0.00		0.00	0.00	0.0%
		17.80	5.74			0.00		0.00	0.00	0.0%
		20.50	5.72			0.00		0.00	0.00	0.0%
1	gl	23.00	5.27			0.00		0.00	0.00	0.0%
		25.00	5.09			0.00		0.00	0.00	0.0%
	TOTALS ----------					6.29	0.5 (Max.)	2.23	5.16	100.0%

Manning's n = 0.0304
Hydraulic Radius= 0.35395191

STREAM NAME: Boxelder Creek
XS LOCATION: Ab lower NRCS Dam
XS NUMBER: 0

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.23	2.30	3.3%
6.79	2.23	4.06	82.4%
6.81	2.23	3.90	75.1%
6.83	2.23	3.74	68.0%
6.85	2.23	3.58	61.0%
6.87	2.23	3.43	54.3%
6.89	2.23	3.29	47.7%
6.91	2.23	3.14	41.2%
6.93	2.23	3.00	34.9%
6.95	2.23	2.87	28.8%
6.97	2.23	2.73	22.8%
6.99	2.23	2.60	17.1%
7.00	2.23	2.54	14.2%
7.01	2.23	2.48	11.4%
7.02	2.23	2.42	8.7%
7.03	2.23	2.36	6.0%
7.04	2.23	2.30	3.3%
7.05	2.23	2.24	0.6%
7.06	2.23	2.18	-2.0%
7.07	2.23	2.12	-4.6%
7.08	2.23	2.06	-7.2%
7.09	2.23	2.01	-9.9%
7.11	2.23	1.89	-15.0%
7.13	2.23	1.78	-20.2%
7.15	2.23	1.66	-25.3%
7.17	2.23	1.55	-30.4%
7.19	2.23	1.44	-35.4%
7.21	2.23	1.33	-40.4%
7.23	2.23	1.22	-45.4%
7.25	2.23	1.11	-50.3%
7.27	2.23	1.00	-55.2%
7.29	2.23	0.89	-60.0%

WATERLINE AT ZERO
AREA ERROR = 7.052

STREAM NAME: Boxelder Creek
XS LOCATION: Ab lower NRCS Dam
XS NUMBER: 0

Constant Manning's n

GL = lowest Grassline elevation corrected for sag

STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.27	21.00	1.22	2.33	25.60	22.00	100.0%	1.16	131.18	5.13
	6.05	13.29	0.91	1.55	12.09	13.98	63.5%	0.87	50.89	4.21
	6.10	13.00	0.88	1.50	11.44	13.66	62.1%	0.84	47.06	4.12
	6.15	12.71	0.85	1.45	10.79	13.35	60.7%	0.81	43.40	4.02
	6.20	12.42	0.82	1.40	10.17	13.04	59.3%	0.78	39.90	3.92
	6.25	12.13	0.79	1.35	9.55	12.73	57.9%	0.75	36.55	3.83
	6.30	11.84	0.76	1.30	8.95	12.42	56.4%	0.72	33.36	3.73
	6.35	11.54	0.73	1.25	8.37	12.10	55.0%	0.69	30.32	3.62
	6.40	11.15	0.70	1.20	7.80	11.70	53.2%	0.67	27.59	3.54
	6.45	10.77	0.67	1.15	7.25	11.30	51.4%	0.64	25.01	3.45
	6.50	10.38	0.65	1.10	6.72	10.90	49.5%	0.62	22.58	3.36
	6.55	9.99	0.62	1.05	6.22	10.50	47.7%	0.59	20.30	3.27
	6.60	9.60	0.60	1.00	5.73	10.10	45.9%	0.57	18.17	3.17
	6.65	9.22	0.57	0.95	5.26	9.70	44.1%	0.54	16.18	3.08
	6.70	8.83	0.54	0.90	4.80	9.30	42.3%	0.52	14.33	2.98
	6.75	8.50	0.51	0.85	4.37	8.95	40.7%	0.49	12.56	2.87
	6.80	8.06	0.49	0.80	3.96	8.51	38.7%	0.47	11.01	2.78
	6.85	7.61	0.47	0.75	3.56	8.04	36.5%	0.44	9.61	2.69
	6.90	7.15	0.45	0.70	3.20	7.57	34.4%	0.42	8.33	2.61
	6.95	6.70	0.43	0.65	2.85	7.10	32.3%	0.40	7.18	2.52
	7.00	6.24	0.40	0.60	2.53	6.64	30.2%	0.38	6.15	2.43
WL	7.05	5.87	0.38	0.55	2.22	6.25	28.4%	0.36	5.18	2.33
	7.10	5.77	0.34	0.50	1.93	6.10	27.7%	0.32	4.16	2.15
	7.15	5.66	0.29	0.45	1.65	5.96	27.1%	0.28	3.24	1.97
	7.20	5.56	0.25	0.40	1.37	5.81	26.4%	0.24	2.42	1.77
	7.25	5.45	0.20	0.35	1.09	5.66	25.7%	0.19	1.69	1.55
	7.30	5.34	0.15	0.30	0.82	5.52	25.1%	0.15	1.07	1.30
	7.35	4.81	0.12	0.25	0.56	4.95	22.5%	0.11	0.61	1.08
	7.40	3.44	0.10	0.20	0.34	3.52	16.0%	0.10	0.32	0.96
	7.45	2.42	0.07	0.15	0.18	2.48	11.3%	0.07	0.15	0.81
	7.50	1.74	0.04	0.10	0.07	1.77	8.1%	0.04	0.03	0.52
	7.55	0.48	0.02	0.05	0.01	0.49	2.2%	0.02	0.00	0.38

STREAM NAME: Boxelder Creek
XS LOCATION: Ab lower NRCS Dam
XS NUMBER: 0

SUMMARY SHEET

MEASURED FLOW (Qm)=	5.16	cfs
CALCULATED FLOW (Qc)=	5.18	cfs
(Qm-Qc)/Qm * 100 =	-0.4	%
MEASURED WATERLINE (WLm)=	7.04	ft
CALCULATED WATERLINE (WLc)=	7.05	ft
(WLm-WLc)/WLm * 100 =	-0.2	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.55	ft
(Dm-Dc)/Dm * 100	-9.5	%
MEAN VELOCITY=	2.33	ft/sec
MANNING'S N=	0.030	
SLOPE=	0.009	ft/ft
.4 * Qm =	2.1	cfs
2.5 * Qm=	12.9	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
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____________________	____________________
____________________	____________________
____________________	____________________

RATIONALE FOR RECOMMENDATION:
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RECOMMENDATION BY: ………………....……….…….............................. AGENCY...……………………......…....…....……...... DATE:.......…...…......……………

CWCB REVIEW BY: ..……………………….....……………………………………………...…............. DATE:..................…………….....

STREAM NAME: Boxelder Creek
XS LOCATION: Ab lower NRCS Dam
XS NUMBER: 0 Jarrett Variable Manning's n Correction Applied

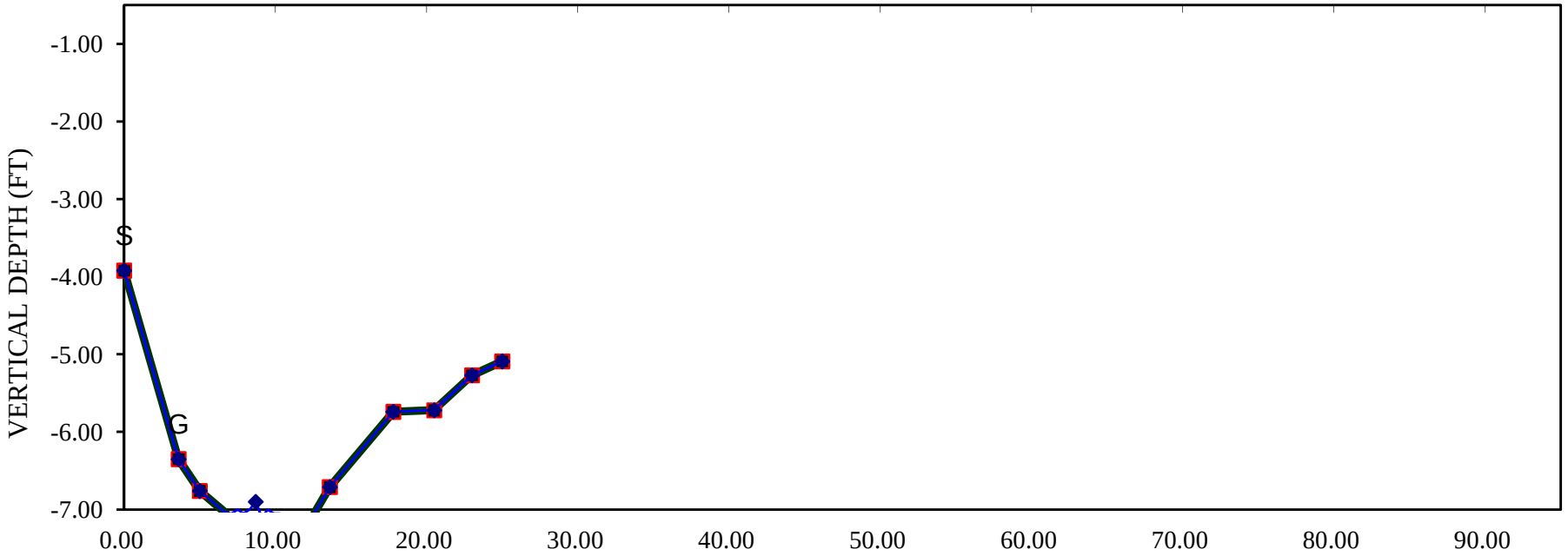
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

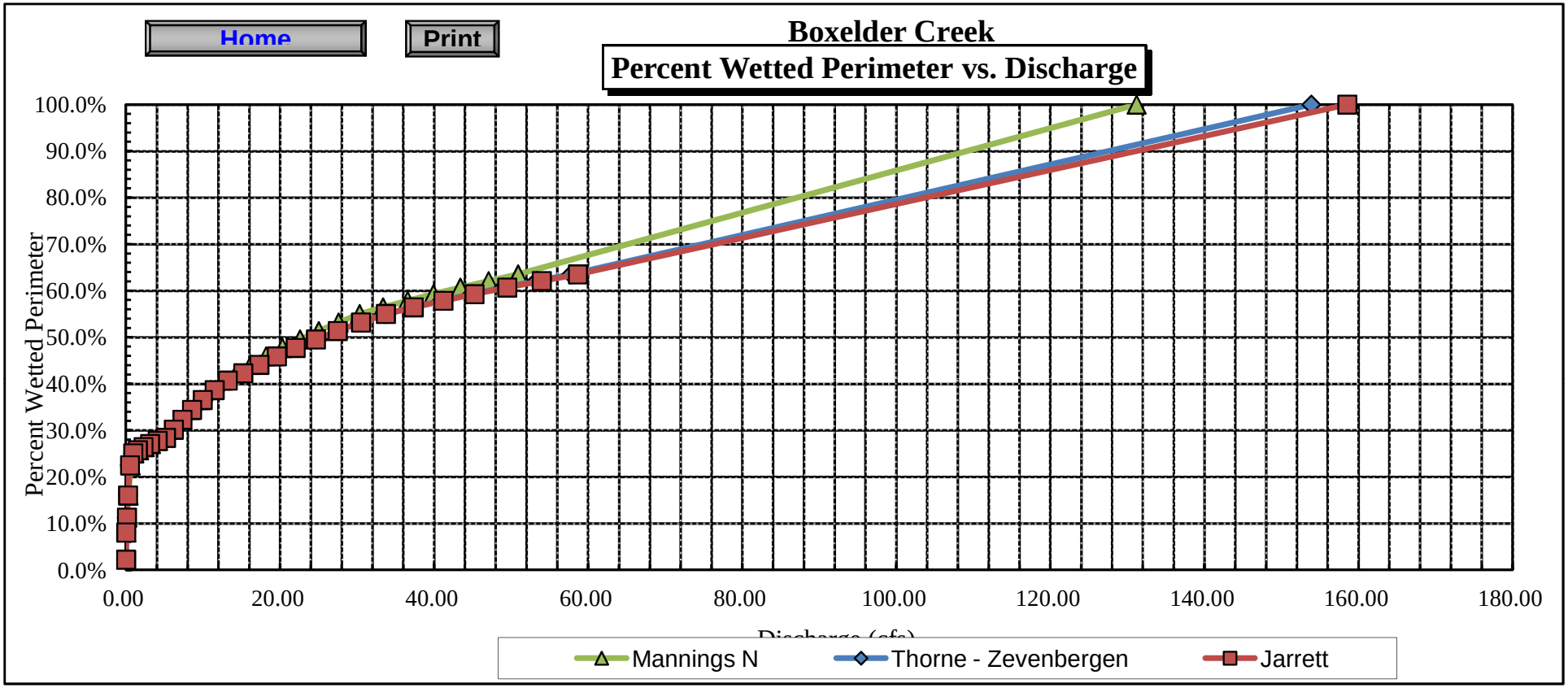
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.27	21.00	1.22	2.33	25.60	22.00	100.0%	1.16	158.55	6.19
	6.05	13.29	0.91	1.55	12.09	13.98	63.5%	0.87	58.66	4.85
	6.10	13.00	0.88	1.50	11.44	13.66	62.1%	0.84	53.96	4.72
	6.15	12.71	0.85	1.45	10.79	13.35	60.7%	0.81	49.49	4.58
	6.20	12.42	0.82	1.40	10.17	13.04	59.3%	0.78	45.23	4.45
	6.25	12.13	0.79	1.35	9.55	12.73	57.9%	0.75	41.18	4.31
	6.30	11.84	0.76	1.30	8.95	12.42	56.4%	0.72	37.35	4.17
	6.35	11.54	0.73	1.25	8.37	12.10	55.0%	0.69	33.72	4.03
	6.40	11.15	0.70	1.20	7.80	11.70	53.2%	0.67	30.50	3.91
	6.45	10.77	0.67	1.15	7.25	11.30	51.4%	0.64	27.48	3.79
	6.50	10.38	0.65	1.10	6.72	10.90	49.5%	0.62	24.66	3.67
	6.55	9.99	0.62	1.05	6.22	10.50	47.7%	0.59	22.02	3.54
	6.60	9.60	0.60	1.00	5.73	10.10	45.9%	0.57	19.58	3.42
	6.65	9.22	0.57	0.95	5.26	9.70	44.1%	0.54	17.31	3.29
	6.70	8.83	0.54	0.90	4.80	9.30	42.3%	0.52	15.21	3.17
	6.75	8.50	0.51	0.85	4.37	8.95	40.7%	0.49	13.21	3.02
	6.80	8.06	0.49	0.80	3.96	8.51	38.7%	0.47	11.49	2.90
	6.85	7.61	0.47	0.75	3.56	8.04	36.5%	0.44	9.95	2.79
	6.90	7.15	0.45	0.70	3.20	7.57	34.4%	0.42	8.56	2.68
	6.95	6.70	0.43	0.65	2.85	7.10	32.3%	0.40	7.32	2.57
	7.00	6.24	0.40	0.60	2.53	6.64	30.2%	0.38	6.21	2.46
WL	7.05	5.87	0.38	0.55	2.22	6.25	28.4%	0.36	5.18	2.33
	7.10	5.77	0.34	0.50	1.93	6.10	27.7%	0.32	4.09	2.11
	7.15	5.66	0.29	0.45	1.65	5.96	27.1%	0.28	3.11	1.89
	7.20	5.56	0.25	0.40	1.37	5.81	26.4%	0.24	2.26	1.65
	7.25	5.45	0.20	0.35	1.09	5.66	25.7%	0.19	1.53	1.40
	7.30	5.34	0.15	0.30	0.82	5.52	25.1%	0.15	0.93	1.13
	7.35	4.81	0.12	0.25	0.56	4.95	22.5%	0.11	0.50	0.90
	7.40	3.44	0.10	0.20	0.34	3.52	16.0%	0.10	0.26	0.78
	7.45	2.42	0.07	0.15	0.18	2.48	11.3%	0.07	0.11	0.63
	7.50	1.74	0.04	0.10	0.07	1.77	8.1%	0.04	0.02	0.36
	7.55	0.48	0.02	0.05	0.01	0.49	2.2%	0.02	0.00	0.24

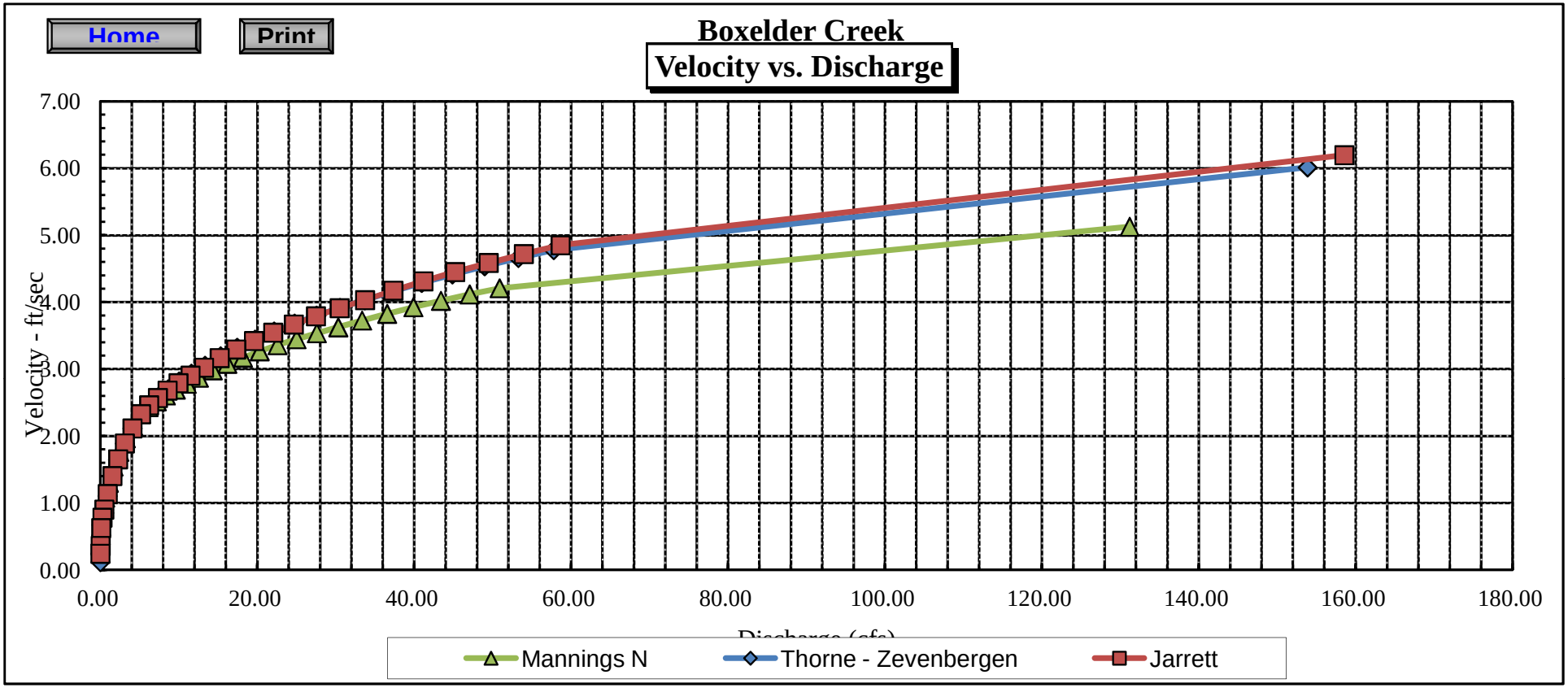
Home Print

Boxelder Creek

CROSS SECTION DATA ANALYSIS



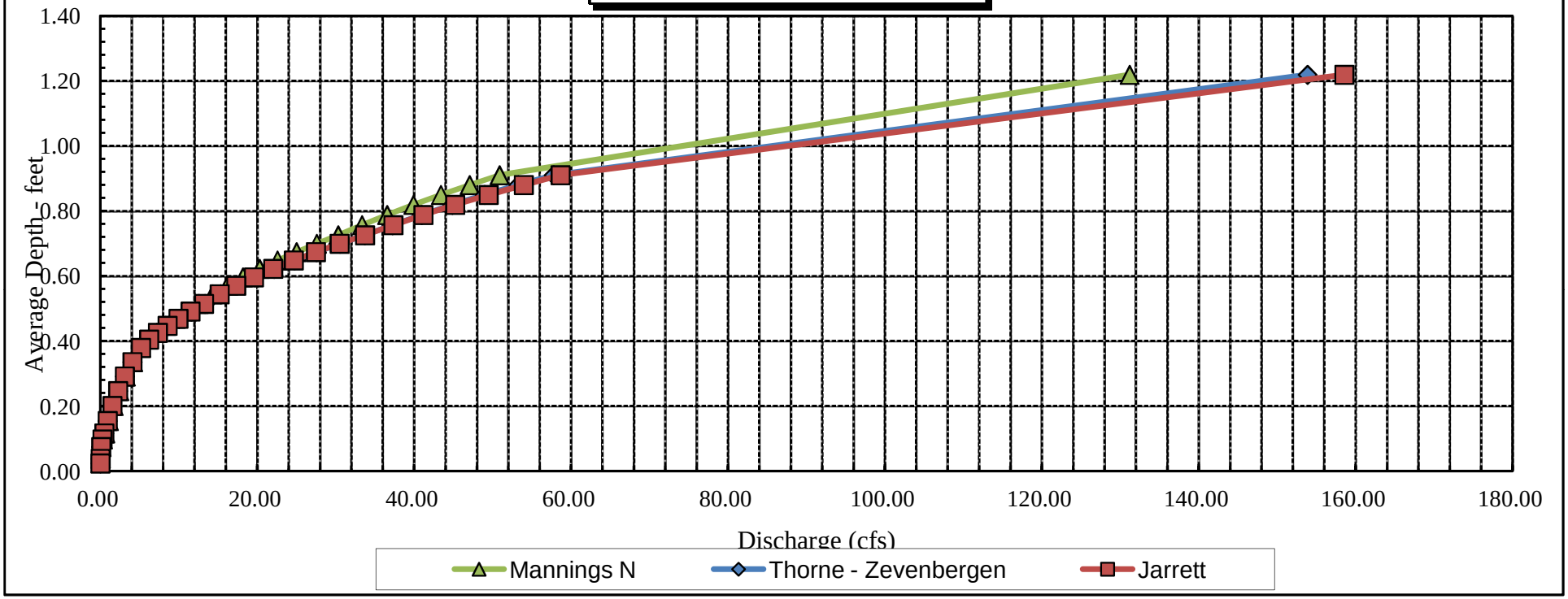

Home
Print
Boxelder Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
Mannings N
Thorne - Zevenbergen
Jarrett

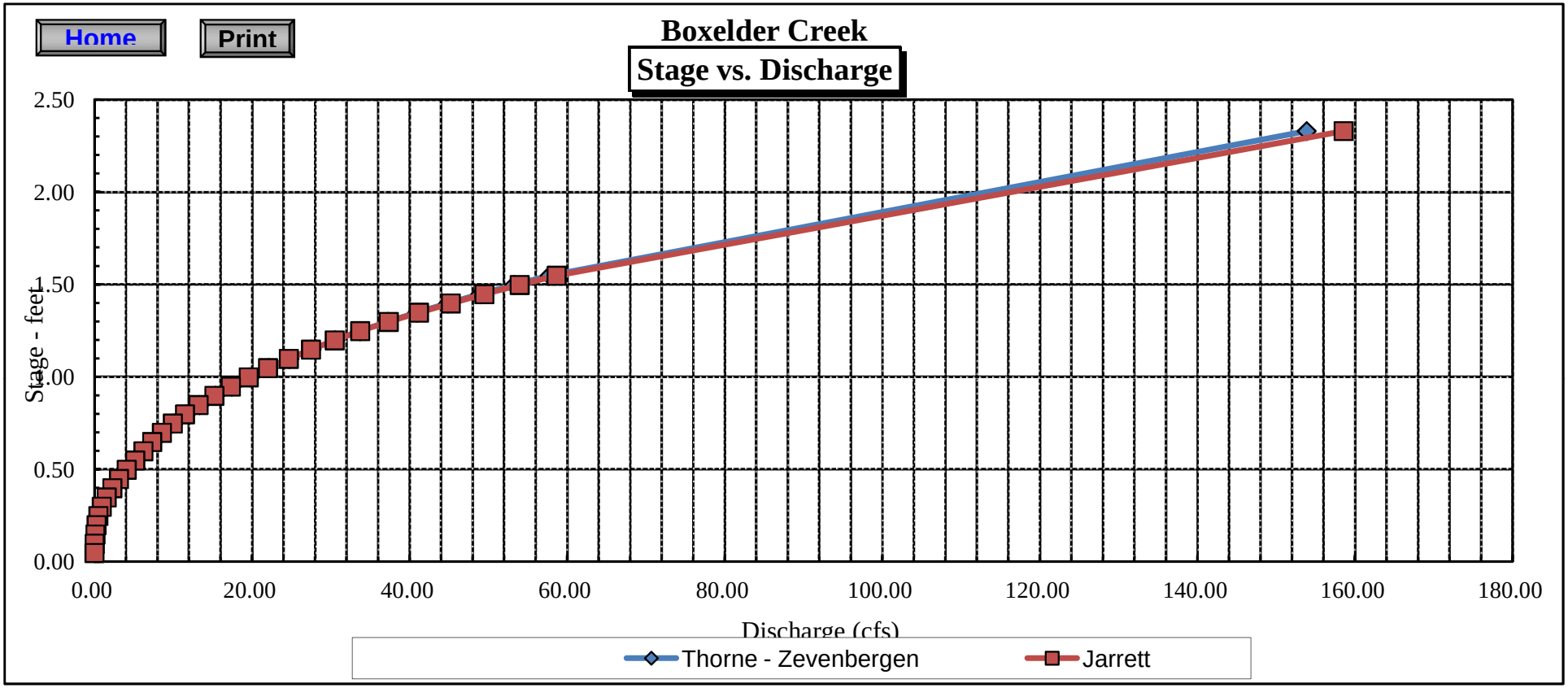

Home
Print
Boxelder Creek
Velocity vs. Discharge
Velocity - ft/sec
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
Mannings N
Thorne - Zevenbergen
Jarrett

Home Print

Boxelder Creek

Average Depth vs. Discharge




Home
Print
Boxelder Creek
Stage vs. Discharge
2.50
2.00
1.50
1.00
0.50
0.00
Stage - feet
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD
INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM
STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME:	Boxelder Creek
XS LOCATION:	0
XS NUMBER:	0
DATE:	7.10.14
OBSERVERS:	CPW CWCB LLS
1/4 SEC:	0
SECTION:	0
TWP:	0
RANGE:	0
PM:	0
COUNTY:	0
WATERSHED:	0
DIVISION:	0
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

*** NOTE ***
Leave TAPE WT and TENSION at defaults for data collected with a survey level and rod

TAPE WT:	0.0106
TENSION:	99999

CHANNEL PROFILE DATA

SLOPE:	0.004

INPUT DATA CHECKED BY: .....DATE.....

ASSIGNED TO: ….....……..…….....DATE.....

STREAM NAME: Boxelder Creek
XS LOCATION: 0
XS NUMBER: 0

DATA POINTS= 18

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 gl	2.00	4.70			0.00		0.00	0.00	0.0%
	3.00	5.00			0.00		0.00	0.00	0.0%
wl	4.10	5.49	0.00	0.00	0.00		0.00	0.00	0.0%
	4.80	5.95	0.45	0.83	0.84	0.45	0.27	0.22	7.8%
	5.30	5.95	0.40	2.03	0.50	0.40	0.20	0.41	14.1%
	5.80	6.00	0.40	1.91	0.50	0.40	0.20	0.38	13.3%
	6.30	5.95	0.50	1.77	0.50	0.50	0.25	0.44	15.4%
	6.80	6.00	0.50	1.54	0.50	0.50	0.25	0.39	13.4%
	7.30	6.05	0.55	1.28	0.50	0.55	0.28	0.35	12.2%
	7.80	6.10	0.50	1.05	0.50	0.50	0.25	0.26	9.1%
	8.30	6.00	0.47	1.20	0.51	0.47	0.24	0.28	9.8%
	8.80	5.95	0.40	0.51	0.50	0.40	0.28	0.14	5.0%
wl	9.70	5.51	0.00	0.00	1.00		0.00	0.00	0.0%
	10.50	5.40			0.00		0.00	0.00	0.0%
	13.00	5.05			0.00		0.00	0.00	0.0%
	16.00	4.70			0.00		0.00	0.00	0.0%
	19.50	4.95			0.00		0.00	0.00	0.0%
1 gl	23.00	4.50			0.00		0.00	0.00	0.0%
TOTALS ----------					5.86	0.55 (Max.)	2.21	2.88	100.0%

Manning's n = 0.0376
Hydraulic Radius= 0.37685794

STREAM NAME: Boxelder Creek
XS LOCATION: 0
XS NUMBER: 0

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.21	2.36	6.9%
5.25	2.21	4.07	84.2%
5.27	2.21	3.91	77.0%
5.29	2.21	3.76	70.0%
5.31	2.21	3.61	63.2%
5.33	2.21	3.46	56.5%
5.35	2.21	3.32	50.0%
5.37	2.21	3.18	43.7%
5.39	2.21	3.04	37.6%
5.41	2.21	2.91	31.6%
5.43	2.21	2.78	25.8%
5.45	2.21	2.66	20.2%
5.46	2.21	2.60	17.4%
5.47	2.21	2.54	14.7%
5.48	2.21	2.48	12.1%
5.49	2.21	2.42	9.4%
5.50	2.21	2.36	6.9%
5.51	2.21	2.31	4.3%
5.52	2.21	2.25	1.8%
5.53	2.21	2.19	-0.7%
5.54	2.21	2.14	-3.2%
5.55	2.21	2.09	-5.6%
5.57	2.21	1.98	-10.5%
5.59	2.21	1.87	-15.3%
5.61	2.21	1.77	-20.1%
5.63	2.21	1.66	-24.8%
5.65	2.21	1.56	-29.4%
5.67	2.21	1.46	-33.9%
5.69	2.21	1.36	-38.4%
5.71	2.21	1.26	-42.9%
5.73	2.21	1.17	-47.2%
5.75	2.21	1.07	-51.5%

WATERLINE AT ZERO
AREA ERROR = 5.527

STREAM NAME: Boxelder Creek
XS LOCATION: 0
XS NUMBER: 0

Constant Manning's n

GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.70	19.44	0.55	1.40	10.71	19.93	100.0%	0.54	17.68	1.65
	4.73	18.53	0.55	1.37	10.20	19.01	95.4%	0.54	16.81	1.65
	4.78	16.84	0.55	1.32	9.31	17.31	86.8%	0.54	15.38	1.65
	4.83	15.16	0.56	1.27	8.51	15.61	78.3%	0.55	14.18	1.67
	4.88	13.48	0.58	1.22	7.80	13.91	69.8%	0.56	13.23	1.70
	4.93	11.79	0.61	1.17	7.16	12.21	61.3%	0.59	12.54	1.75
	4.98	10.70	0.62	1.12	6.61	11.11	55.7%	0.59	11.67	1.77
	5.03	10.13	0.60	1.07	6.09	10.53	52.8%	0.58	10.55	1.73
	5.08	9.63	0.58	1.02	5.59	10.01	50.2%	0.56	9.47	1.69
	5.13	9.16	0.56	0.97	5.12	9.53	47.8%	0.54	8.46	1.65
	5.18	8.69	0.54	0.92	4.68	9.05	45.4%	0.52	7.52	1.61
	5.23	8.22	0.52	0.87	4.25	8.56	43.0%	0.50	6.66	1.57
	5.28	7.75	0.50	0.82	3.86	8.08	40.5%	0.48	5.88	1.52
	5.33	7.29	0.48	0.77	3.48	7.60	38.1%	0.46	5.16	1.48
	5.38	6.82	0.46	0.72	3.13	7.11	35.7%	0.44	4.51	1.44
	5.43	6.34	0.44	0.67	2.80	6.63	33.2%	0.42	3.93	1.41
	5.48	5.87	0.42	0.62	2.49	6.14	30.8%	0.41	3.41	1.37
WL	5.53	5.51	0.40	0.57	2.21	5.76	28.9%	0.38	2.91	1.32
	5.58	5.33	0.36	0.52	1.94	5.55	27.9%	0.35	2.40	1.24
	5.63	5.15	0.33	0.47	1.68	5.35	26.8%	0.31	1.93	1.15
	5.68	4.97	0.29	0.42	1.42	5.14	25.8%	0.28	1.51	1.06
	5.73	4.79	0.25	0.37	1.18	4.94	24.8%	0.24	1.13	0.96
	5.78	4.62	0.20	0.32	0.94	4.73	23.7%	0.20	0.81	0.85
	5.83	4.44	0.16	0.27	0.72	4.53	22.7%	0.16	0.53	0.73
	5.88	4.26	0.12	0.22	0.50	4.32	21.7%	0.12	0.30	0.59
	5.93	4.08	0.07	0.17	0.29	4.12	20.7%	0.07	0.12	0.43
	5.98	2.41	0.05	0.12	0.12	2.43	12.2%	0.05	0.04	0.34
	6.03	1.09	0.04	0.07	0.04	1.10	5.5%	0.04	0.01	0.27
	6.08	0.34	0.01	0.02	0.00	0.35	1.7%	0.01	0.00	0.13

STREAM NAME: Boxelder Creek
XS LOCATION: 0
XS NUMBER: 0

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.88	cfs
CALCULATED FLOW (Qc)=	2.91	cfs
(Qm-Qc)/Qm * 100 =	-1.2	%
MEASURED WATERLINE (WLm)=	5.50	ft
CALCULATED WATERLINE (WLc)=	5.53	ft
(WLm-WLc)/WLm * 100 =	-0.5	%
MAX MEASURED DEPTH (Dm)=	0.55	ft
MAX CALCULATED DEPTH (Dc)=	0.57	ft
(Dm-Dc)/Dm * 100	-4.1	%
MEAN VELOCITY=	1.32	ft/sec
MANNING'S N=	0.038	
SLOPE=	0.004	ft/ft
.4 * Qm =	1.2	cfs
2.5 * Qm=	7.2	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
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RATIONALE FOR RECOMMENDATION:
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RECOMMENDATION BY: .... AGENCY.. DATE:..............................

CWCB REVIEW BY: .... DATE:..............................

STREAM NAME: Boxelder Creek
XS LOCATION: 0
XS NUMBER: 0

Jarrett Variable Manning's n Correction Applied

GL = lowest Grassline elevation corrected for sag

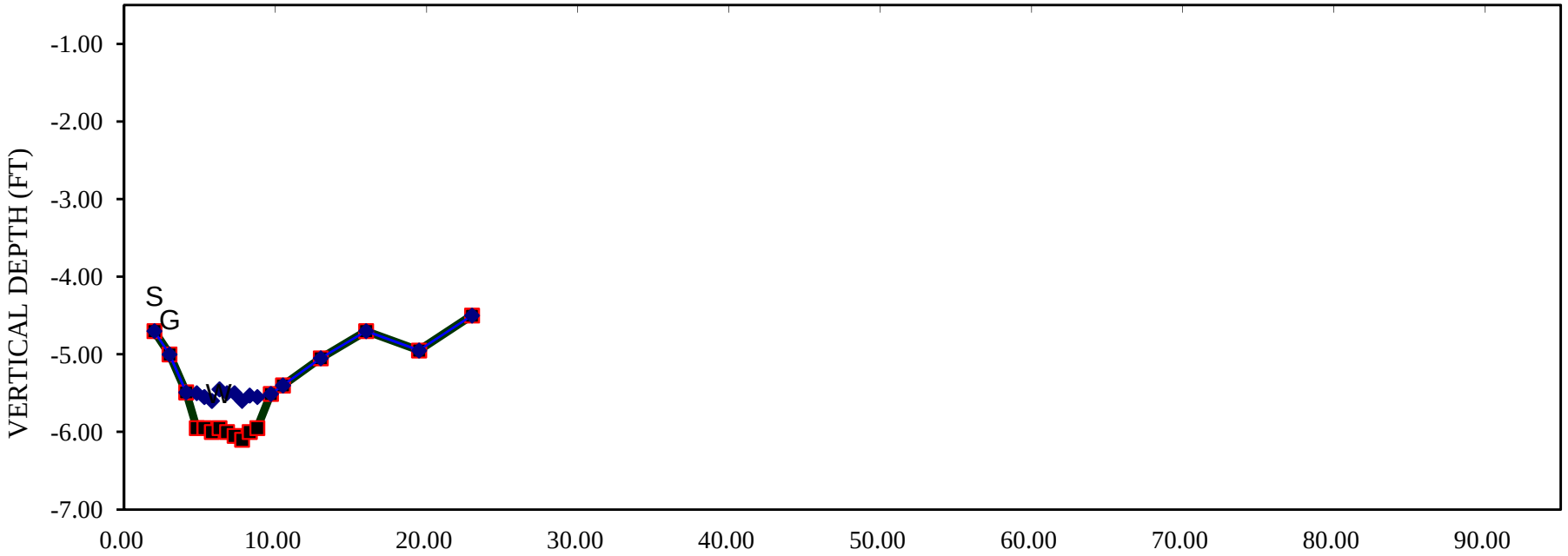
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

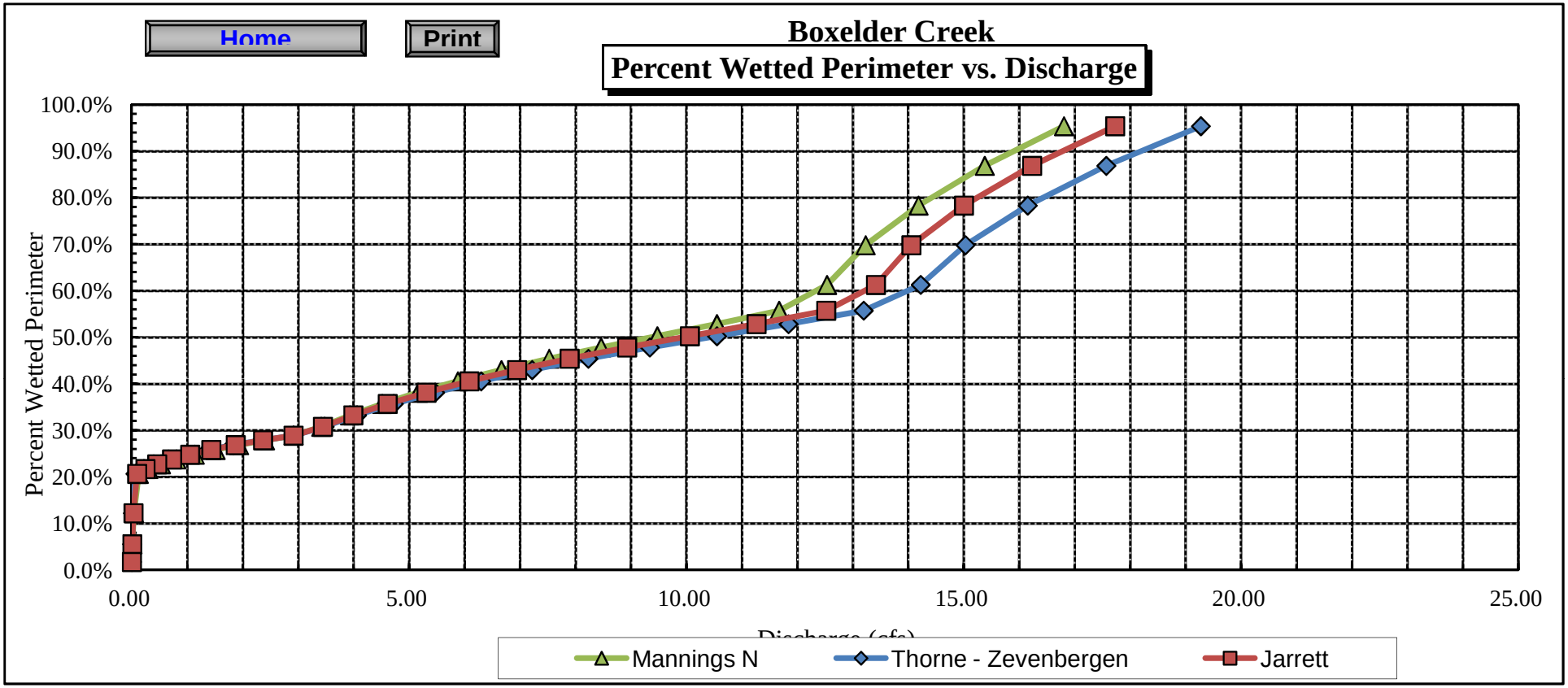
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.70	19.44	0.55	1.40	10.71	19.93	100.0%	0.54	18.66	1.74
	4.73	18.53	0.55	1.37	10.20	19.01	95.4%	0.54	17.73	1.74
	4.78	16.84	0.55	1.32	9.31	17.31	86.8%	0.54	16.23	1.74
	4.83	15.16	0.56	1.27	8.51	15.61	78.3%	0.55	15.00	1.76
	4.88	13.48	0.58	1.22	7.80	13.91	69.8%	0.56	14.06	1.80
	4.93	11.79	0.61	1.17	7.16	12.21	61.3%	0.59	13.42	1.87
	4.98	10.70	0.62	1.12	6.61	11.11	55.7%	0.59	12.52	1.89
	5.03	10.13	0.60	1.07	6.09	10.53	52.8%	0.58	11.26	1.85
	5.08	9.63	0.58	1.02	5.59	10.01	50.2%	0.56	10.06	1.80
	5.13	9.16	0.56	0.97	5.12	9.53	47.8%	0.54	8.93	1.74
	5.18	8.69	0.54	0.92	4.68	9.05	45.4%	0.52	7.89	1.69
	5.23	8.22	0.52	0.87	4.25	8.56	43.0%	0.50	6.95	1.63
	5.28	7.75	0.50	0.82	3.86	8.08	40.5%	0.48	6.09	1.58
	5.33	7.29	0.48	0.77	3.48	7.60	38.1%	0.46	5.31	1.53
	5.38	6.82	0.46	0.72	3.13	7.11	35.7%	0.44	4.61	1.48
	5.43	6.34	0.44	0.67	2.80	6.63	33.2%	0.42	3.99	1.43
	5.48	5.87	0.42	0.62	2.49	6.14	30.8%	0.41	3.44	1.38
WL	5.53	5.51	0.40	0.57	2.21	5.76	28.9%	0.38	2.91	1.32
	5.58	5.33	0.36	0.52	1.94	5.55	27.9%	0.35	2.36	1.22
	5.63	5.15	0.33	0.47	1.68	5.35	26.8%	0.31	1.87	1.12
	5.68	4.97	0.29	0.42	1.42	5.14	25.8%	0.28	1.43	1.01
	5.73	4.79	0.25	0.37	1.18	4.94	24.8%	0.24	1.05	0.89
	5.78	4.62	0.20	0.32	0.94	4.73	23.7%	0.20	0.73	0.77
	5.83	4.44	0.16	0.27	0.72	4.53	22.7%	0.16	0.46	0.63
	5.88	4.26	0.12	0.22	0.50	4.32	21.7%	0.12	0.25	0.49
	5.93	4.08	0.07	0.17	0.29	4.12	20.7%	0.07	0.10	0.33
	5.98	2.41	0.05	0.12	0.12	2.43	12.2%	0.05	0.03	0.24
	6.03	1.09	0.04	0.07	0.04	1.10	5.5%	0.04	0.01	0.19
	6.08	0.34	0.01	0.02	0.00	0.35	1.7%	0.01	0.00	0.07

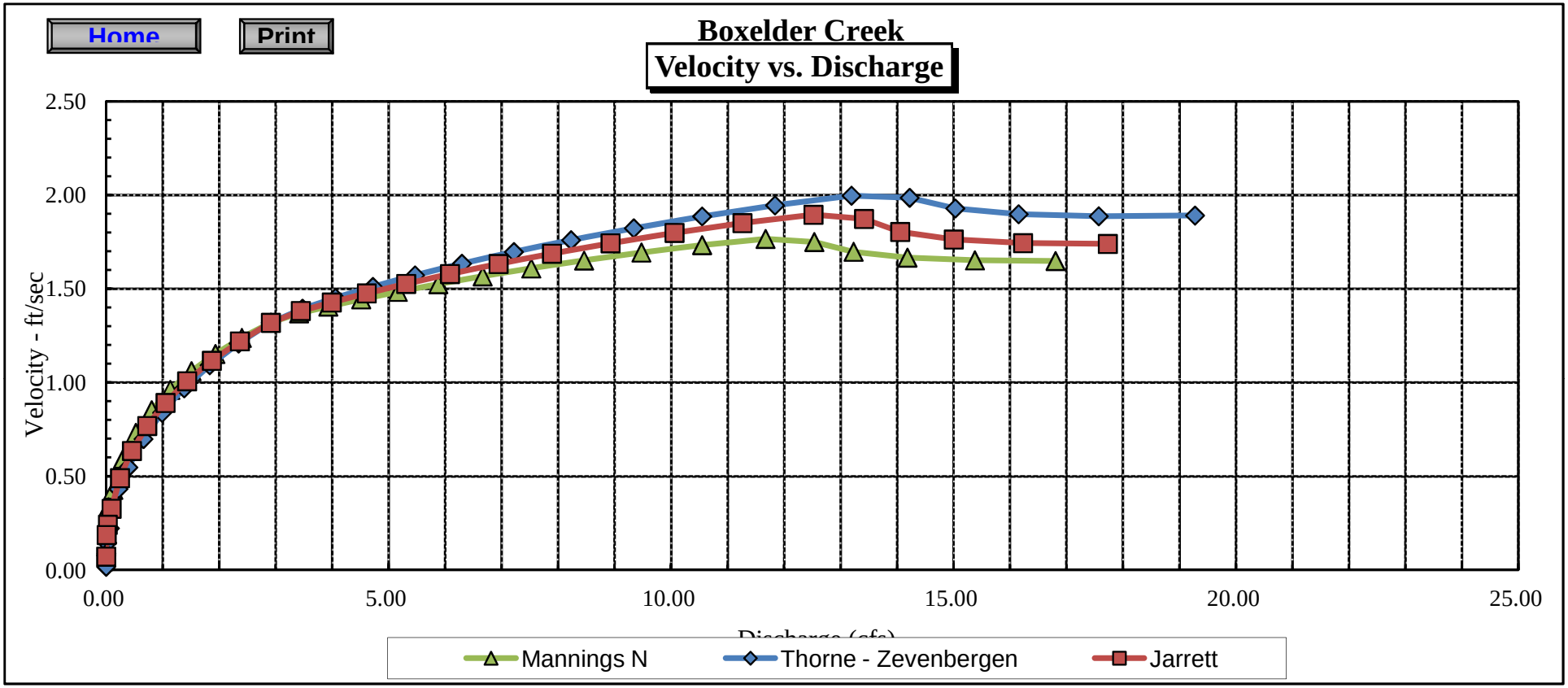
Home Print

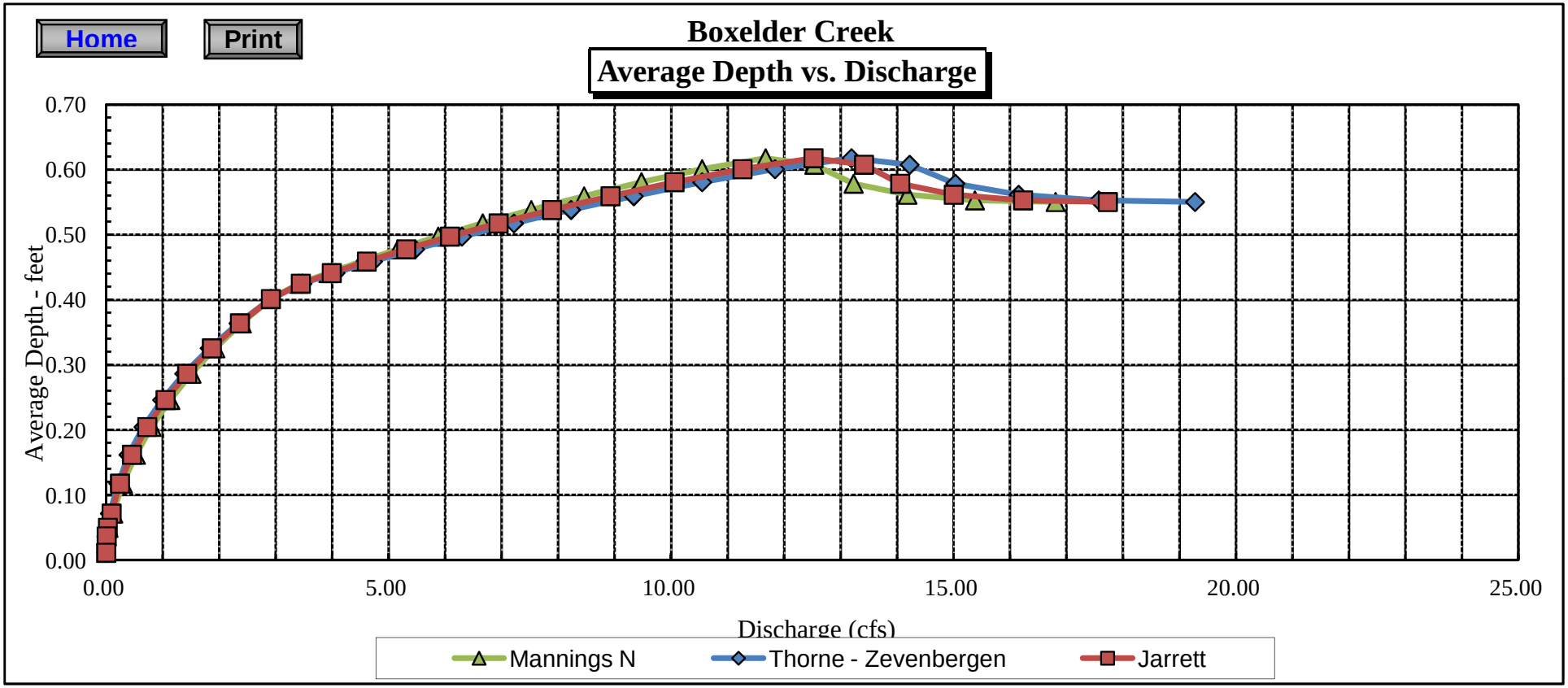
Boxelder Creek

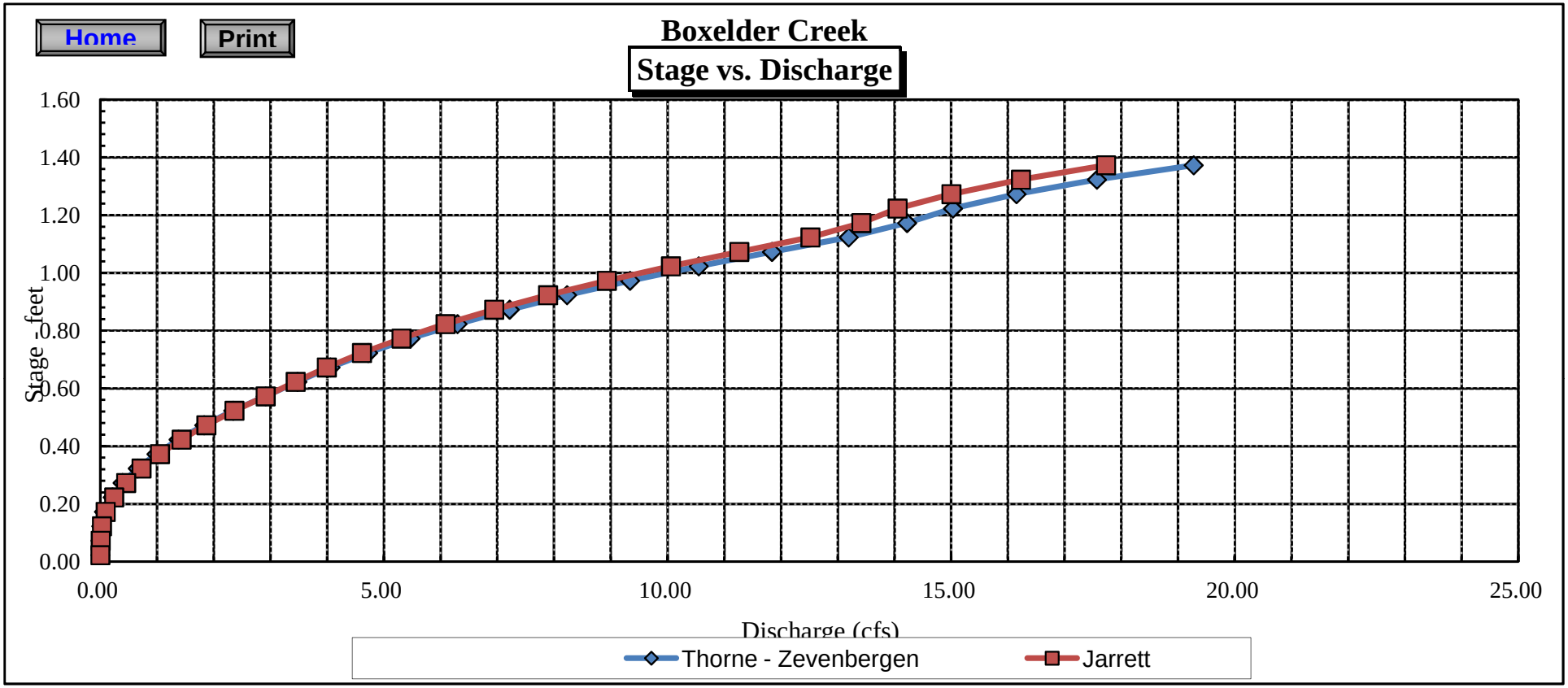
CROSS SECTION DATA ANALYSIS




Home
Print
Boxelder Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
5.00
10.00
15.00
20.00
25.00
Mannings N
Thorne - Zevenbergen
Jarrett


Home
Print
Boxelder Creek
Velocity vs. Discharge
Velocity - ft/sec
2.50
2.00
1.50
1.00
0.50
0.00
0.00
5.00
10.00
15.00
20.00
25.00
Mannings N
Thorne - Zevenbergen
Jarrett


Home
Print
Boxelder Creek
Average Depth vs. Discharge
Average Depth - feet
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
5.00
10.00
15.00
20.00
25.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Home
Print
Boxelder Creek
Stage vs. Discharge
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Stage - feet
0.00
5.00
10.00
15.00
20.00
25.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Tue Dec 8 2015

File Information

File Name	BECACWTG.009.WAD
Start Date and Time	2015/12/07 13:19:32

Site Details

Site Name	BOXELDER AT TEMP G
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.4%	2.6%
Velocity	0.9%	1.6%
Width	0.1%	0.1%
Method	2.1%	-
# Stations	3.0%	-
Overall	**3.9%**	**3.2%**

Summary

Averaging Int.	40	# Stations	18
Start Edge	REW	Total Width	5.000
Mean SNR	30.2 dB	Total Area	1.782
Mean Temp	36.73 °F	Mean Depth	0.356
Disch. Equation	Mid-Section	Mean Velocity	1.6002
		Total Discharge	**2.8515**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	13:19	0.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	13:19	1.40	0.6	0.510	0.6	0.204	2.1535	1.00	2.1535	0.178	0.3844	13.5
2	13:20	1.60	0.6	0.510	0.6	0.204	2.8333	1.00	2.8333	0.102	0.2891	10.1
3	13:21	1.80	0.6	0.500	0.6	0.200	2.9035	1.00	2.9035	0.100	0.2905	10.2
4	13:22	2.00	0.6	0.390	0.6	0.156	2.9222	1.00	2.9222	0.078	0.2281	8.0
5	13:25	2.20	0.6	0.390	0.6	0.156	2.7146	1.00	2.7146	0.078	0.2119	7.4
6	13:26	2.40	0.6	0.440	0.6	0.176	2.4491	1.00	2.4491	0.088	0.2156	7.6
7	13:27	2.60	0.6	0.330	0.6	0.132	2.2057	1.00	2.2057	0.066	0.1457	5.1
8	13:28	2.80	0.6	0.420	0.6	0.168	1.9852	1.00	1.9852	0.084	0.1668	5.9
9	13:29	3.00	0.6	0.400	0.6	0.160	1.7434	1.00	1.7434	0.080	0.1395	4.9
10	13:33	3.20	0.6	0.460	0.6	0.184	1.4537	1.00	1.4537	0.115	0.1668	5.9
11	13:35	3.50	0.6	0.420	0.6	0.168	1.5003	1.00	1.5003	0.126	0.1883	6.6
12	13:36	3.80	0.6	0.430	0.6	0.172	1.3146	1.00	1.3146	0.151	0.1979	6.9
13	13:38	4.20	0.6	0.370	0.6	0.148	0.9501	1.00	0.9501	0.148	0.1411	4.9
14	13:39	4.60	0.6	0.370	0.6	0.148	0.3875	1.00	0.3875	0.148	0.0575	2.0
15	*13:41*	*5.00*	*0.6*	*0.350*	*0.6*	*0.140*	*0.1991*	*1.00*	*0.1991*	*0.140*	*0.0280*	*1.0*
16	*13:45*	*5.40*	*Input V*	*0.220*	*0.0*	*0.000*	*0.0000*	*1.00*	*0.0000*	*0.099*	*0.0000*	*0.0*
17	13:45	5.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

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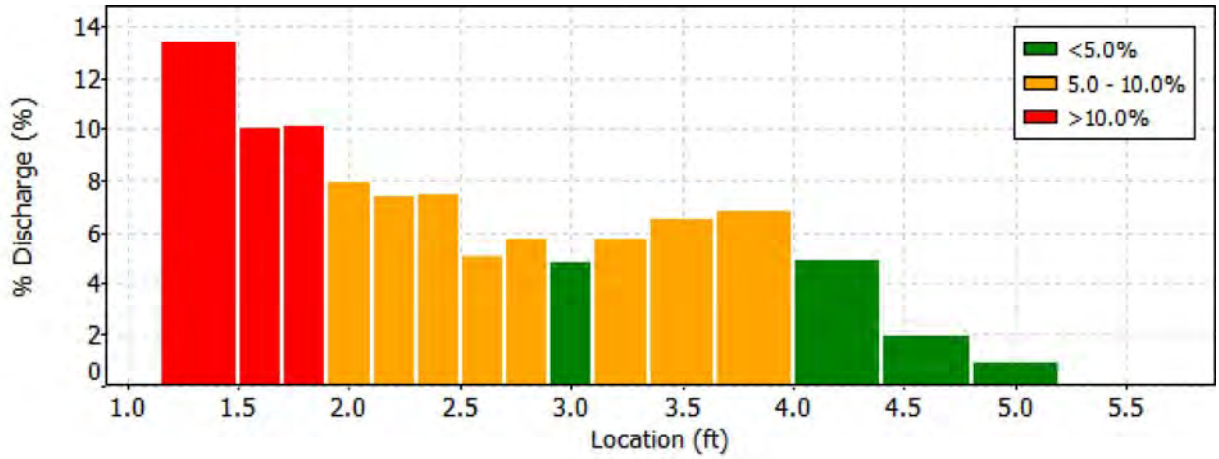
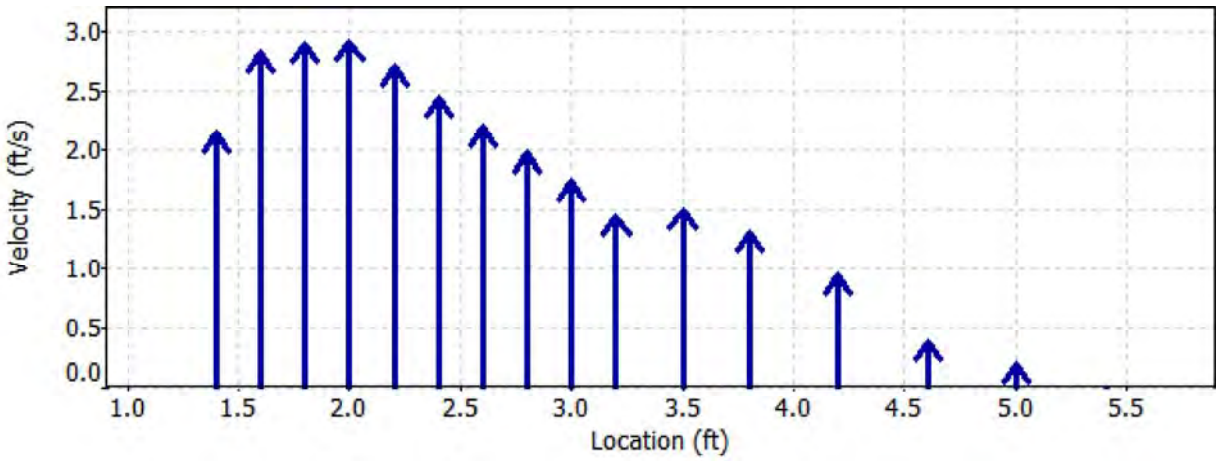
Colorado Water Conservation Board
Department of Natural Resources

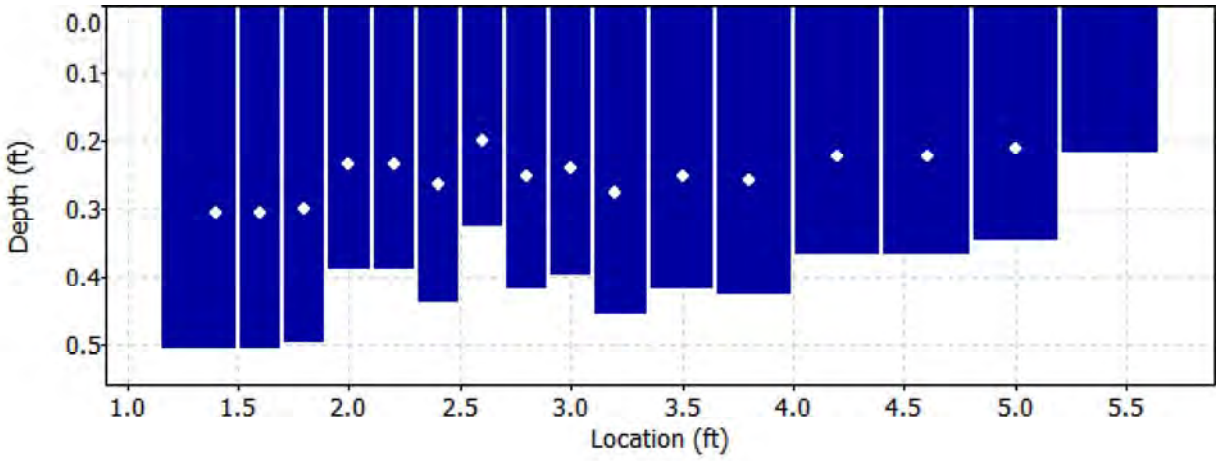
Discharge Measurement Summary

Date Generated: Tue Dec 8 2015

File Information		Site Details	
File Name	BECACWTG.009.WAD	Site Name	BOXELDER AT TEMP G
Start Date and Time	2015/12/07 13:19:32	Operator(s)	BRIAN EPSTEIN







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Discharge Measurement Summary

Date Generated: Tue Dec 8 2015

File Information

File Name	BECACWTG.009.WAD
Start Date and Time	2015/12/07 13:19:32

Site Details

Site Name	BOXELDER AT TEMP G
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
15	5.00	0.6	High angle: 31
16	5.40	0.0	Low SNR: 0.0,0.0
		0.0	SNR (0.0) is different from typical SNR (32.2)
		0.0	High standard error: 0.000

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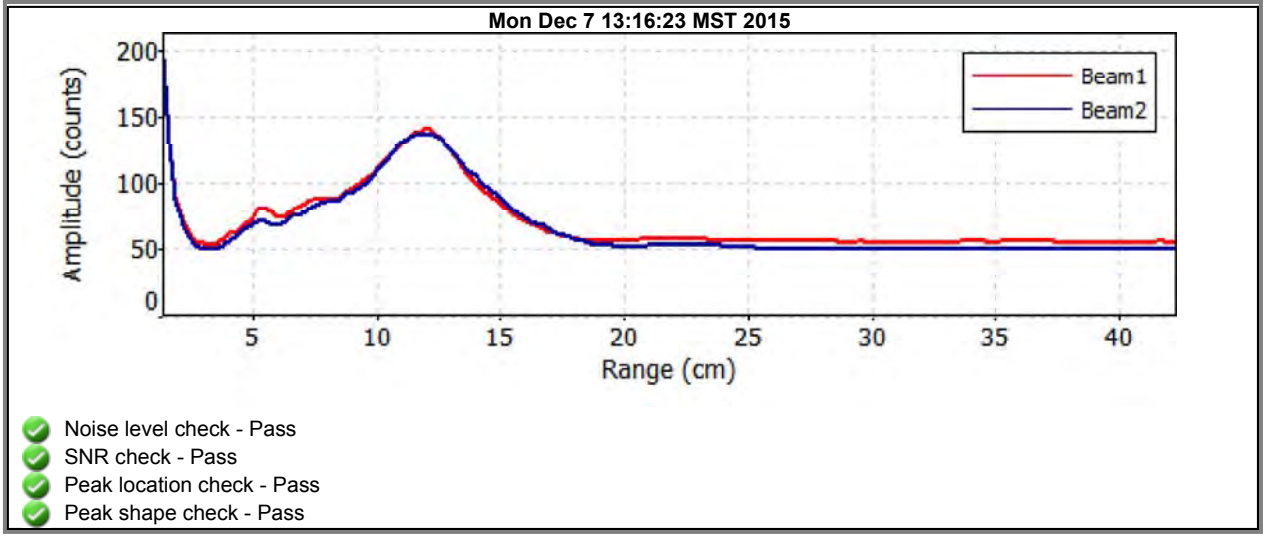
Discharge Measurement Summary

Date Generated: Tue Dec 8 2015

File Information		Site Details	
File Name	BECACWTG.009.WAD	Site Name	BOXELDER AT TEMP G
Start Date and Time	2015/12/07 13:19:32	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

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Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Tue Dec 1 2015

File Information

File Name	BECACWTG.008.WAD
Start Date and Time	2015/10/26 14:25:07

Site Details

Site Name	BOXELDER CR AT GAGE
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.4%	1.6%
Velocity	0.9%	1.0%
Width	0.1%	0.1%
Method	1.9%	-
# Stations	2.4%	-
Overall	**3.3%**	**2.1%**

Summary

Averaging Int.	40	# Stations	21
Start Edge	REW	Total Width	5.800
Mean SNR	34.4 dB	Total Area	2.963
Mean Temp	49.12 °F	Mean Depth	0.511
Disch. Equation	Mid-Section	Mean Velocity	0.9857
		Total Discharge	**2.9210**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	14:25	2.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	14:25	3.00	0.6	0.310	0.6	0.124	1.0663	1.00	1.0663	0.093	0.0991	3.4
2	14:26	3.30	0.6	0.290	0.6	0.116	1.1109	1.00	1.1109	0.087	0.0966	3.3
3	14:27	3.60	0.6	0.370	0.6	0.148	1.2008	1.00	1.2008	0.111	0.1333	4.6
4	14:28	3.90	0.6	0.430	0.6	0.172	1.1854	1.00	1.1854	0.129	0.1529	5.2
5	14:29	4.20	0.6	0.430	0.6	0.172	1.2356	1.00	1.2356	0.129	0.1594	5.5
6	14:30	4.50	0.6	0.420	0.6	0.168	1.2116	1.00	1.2116	0.126	0.1526	5.2
7	14:31	4.80	0.6	0.420	0.6	0.168	1.2031	1.00	1.2031	0.126	0.1515	5.2
8	14:32	5.10	0.6	0.510	0.6	0.204	1.2123	1.00	1.2123	0.153	0.1853	6.3
9	14:33	5.40	0.6	0.570	0.6	0.228	1.2789	1.00	1.2789	0.171	0.2185	7.5
10	14:36	5.70	0.6	0.570	0.6	0.228	1.3560	1.00	1.3560	0.171	0.2317	7.9
11	14:39	6.00	0.6	0.500	0.6	0.200	1.4390	1.00	1.4390	0.150	0.2158	7.4
12	14:41	6.30	0.6	0.640	0.6	0.256	1.3609	1.00	1.3609	0.192	0.2612	8.9
13	14:42	6.60	0.6	0.670	0.6	0.268	1.1946	1.00	1.1946	0.201	0.2400	8.2
14	14:43	6.90	0.6	0.700	0.6	0.280	0.9459	1.00	0.9459	0.210	0.1986	6.8
15	*14:45*	*7.20*	*0.6*	*0.700*	*0.6*	*0.280*	*0.7559*	*1.00*	*0.7559*	*0.210*	*0.1587*	*5.4*
16	*14:46*	*7.50*	*0.6*	*0.730*	*0.6*	*0.292*	*0.5686*	*1.00*	*0.5686*	*0.219*	*0.1245*	*4.3*
17	14:47	7.80	0.6	0.720	0.6	0.288	0.5364	1.00	0.5364	0.181	0.0970	3.3
18	*14:49*	*8.00*	*0.6*	*0.650*	*0.6*	*0.260*	*0.3409*	*1.00*	*0.3409*	*0.131*	*0.0446*	*1.5*
19	14:52	8.20	0.6	0.700	0.6	0.280	-0.0007	1.00	-0.0007	0.175	-0.0001	0.0
20	14:52	8.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

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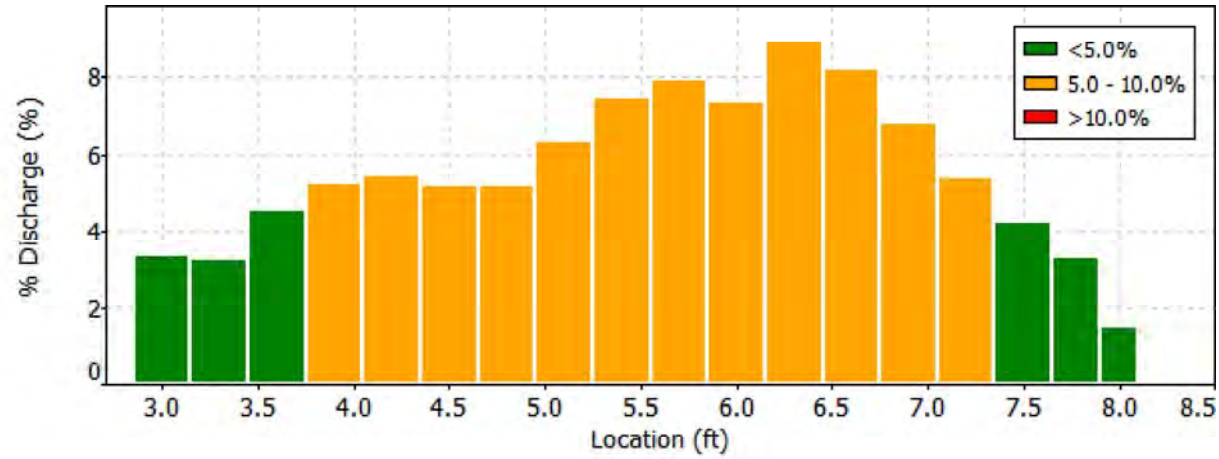
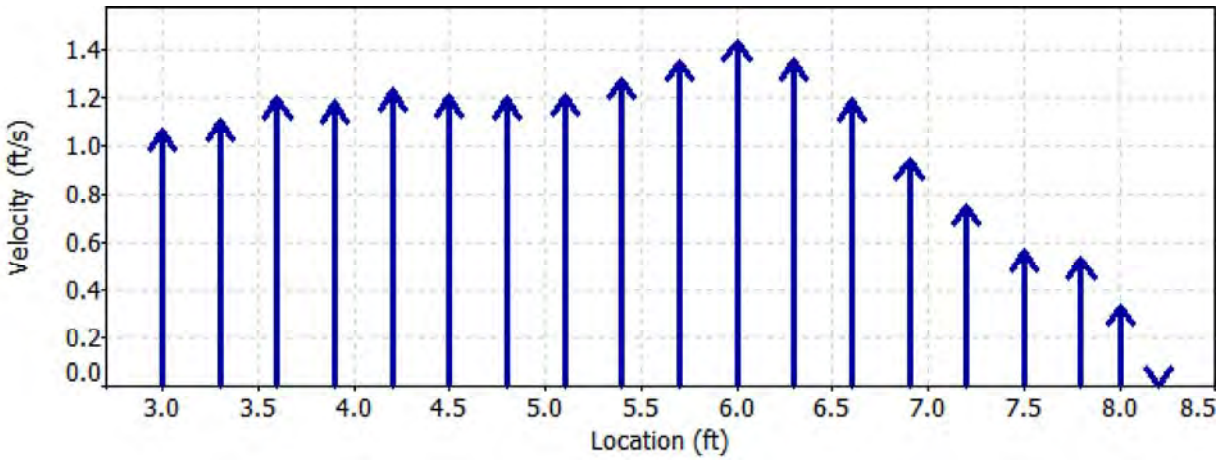
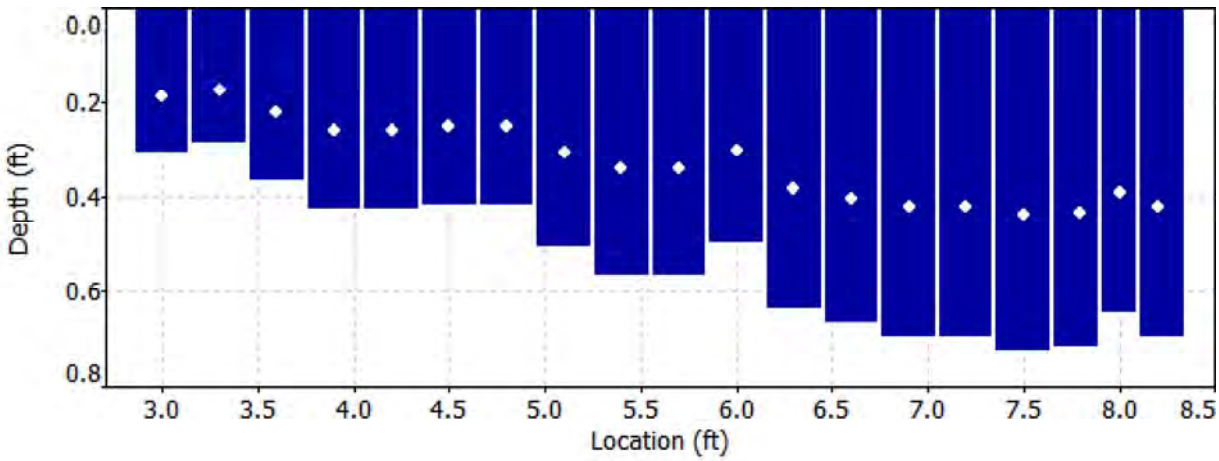
Discharge Measurement Summary

Date Generated: Tue Dec 1 2015

File Information		Site Details	
File Name	BECACWTG.008.WAD	Site Name	BOXELDER CR AT GAGE
Start Date and Time	2015/10/26 14:25:07	Operator(s)	BRIAN EPSTEIN







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Discharge Measurement Summary

Date Generated: Tue Dec 1 2015

File Information

File Name	BECACWTG.008.WAD
Start Date and Time	2015/10/26 14:25:07

Site Details

Site Name	BOXELDER CR AT GAGE
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
15	7.20	0.6	High standard error: 0.053
16	7.50	0.6	High standard error: 0.036
18	8.00	0.6	High standard error: 0.046

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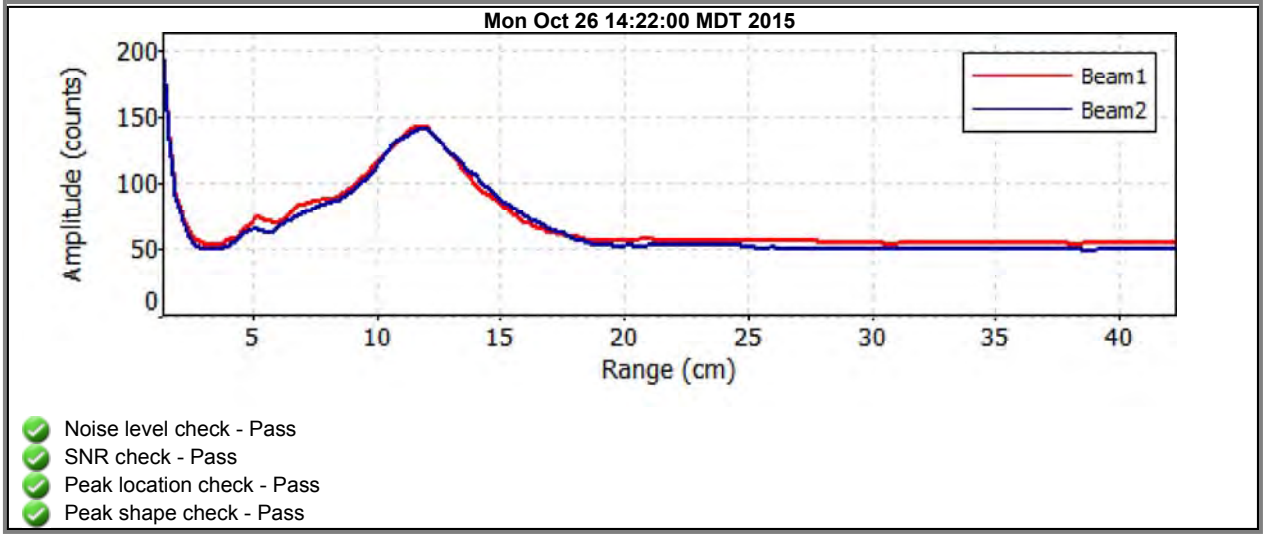
Discharge Measurement Summary

Date Generated: Tue Dec 1 2015

File Information		Site Details	
File Name	BECACWTG.008.WAD	Site Name	BOXELDER CR AT GAGE
Start Date and Time	2015/10/26 14:25:07	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Tue Dec 1 2015

File Information

File Name	BECACWTG.007.WAD
Start Date and Time	2015/07/15 15:36:31

Site Details

Site Name	BOXELDER CR TMP GAGE
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.3%	2.6%
Velocity	0.6%	2.4%
Width	0.1%	0.1%
Method	1.5%	-
# Stations	1.8%	-
Overall	**2.6%**	**3.6%**

Summary

Averaging Int.	40	# Stations	29
Start Edge	REW	Total Width	5.604
Mean SNR	37.0 dB	Total Area	2.948
Mean Temp	62.04 °F	Mean Depth	0.526
Disch. Equation	Mid-Section	Mean Velocity	1.8229
		Total Discharge	**5.3738**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	15:36	3.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	15:36	4.10	0.6	0.220	0.6	0.088	2.1401	1.00	2.1401	0.044	0.0943	1.8
2	15:38	4.30	0.6	0.220	0.6	0.088	2.0056	1.00	2.0056	0.044	0.0884	1.6
3	15:40	4.50	0.6	0.500	0.6	0.200	1.4442	1.00	1.4442	0.100	0.1445	2.7
4	15:41	4.70	0.6	0.650	0.6	0.260	1.7415	1.00	1.7415	0.130	0.2265	4.2
5	15:42	4.90	0.6	0.620	0.6	0.248	1.9199	1.00	1.9199	0.124	0.2383	4.4
6	15:44	5.10	0.6	0.480	0.6	0.192	2.1230	1.00	2.1230	0.096	0.2039	3.8
7	15:45	5.30	0.6	0.520	0.6	0.208	2.0899	1.00	2.0899	0.104	0.2175	4.0
8	15:46	5.50	0.6	0.700	0.6	0.280	2.0328	1.00	2.0328	0.140	0.2848	5.3
9	15:47	5.70	0.6	0.700	0.6	0.280	2.0554	1.00	2.0554	0.140	0.2880	5.4
10	15:48	5.90	0.6	0.400	0.6	0.160	2.1900	1.00	2.1900	0.080	0.1753	3.3
11	15:49	6.10	0.6	0.400	0.6	0.160	2.2156	1.00	2.2156	0.080	0.1773	3.3
12	15:50	6.30	0.6	0.410	0.6	0.164	2.2684	1.00	2.2684	0.082	0.1862	3.5
13	15:51	6.50	0.6	0.410	0.6	0.164	2.4446	1.00	2.4446	0.082	0.2006	3.7
14	15:52	6.70	0.6	0.420	0.6	0.168	2.3865	1.00	2.3865	0.084	0.2006	3.7
15	15:54	6.90	0.6	0.420	0.6	0.168	2.5801	1.00	2.5801	0.084	0.2168	4.0
16	15:55	7.10	0.6	0.460	0.6	0.184	2.4941	1.00	2.4941	0.092	0.2296	4.3
17	15:56	7.30	0.6	0.460	0.6	0.184	2.4298	1.00	2.4298	0.092	0.2237	4.2
18	15:57	7.50	0.6	0.690	0.6	0.276	2.1598	1.00	2.1598	0.138	0.2982	5.5
19	15:59	7.70	0.6	0.650	0.6	0.260	1.9869	1.00	1.9869	0.130	0.2584	4.8
20	16:00	7.90	0.6	0.620	0.6	0.248	1.7621	1.00	1.7621	0.124	0.2187	4.1
21	16:02	8.10	0.6	0.630	0.6	0.252	1.7867	1.00	1.7867	0.126	0.2252	4.2
22	16:03	8.30	0.6	0.590	0.6	0.236	1.5909	1.00	1.5909	0.118	0.1878	3.5
23	16:04	8.50	0.6	0.730	0.6	0.292	1.5801	1.00	1.5801	0.146	0.2308	4.3
24	*16:06*	*8.70*	*0.6*	*0.700*	*0.6*	*0.280*	*1.0761*	*1.00*	*1.0761*	*0.140*	*0.1508*	*2.8*
25	*16:07*	*8.90*	*0.6*	*0.720*	*0.6*	*0.288*	*0.2339*	*1.00*	*0.2339*	*0.144*	*0.0337*	*0.6*
26	*16:09*	*9.10*	*0.6*	*0.800*	*0.6*	*0.320*	*-1.3448*	*-1.00*	*1.3448*	*0.160*	*0.2153*	*4.0*
27	*16:10*	*9.30*	*0.6*	*0.610*	*0.6*	*0.244*	*-1.2982*	*-1.00*	*1.2982*	*0.122*	*0.1585*	*2.9*
28	16:10	9.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

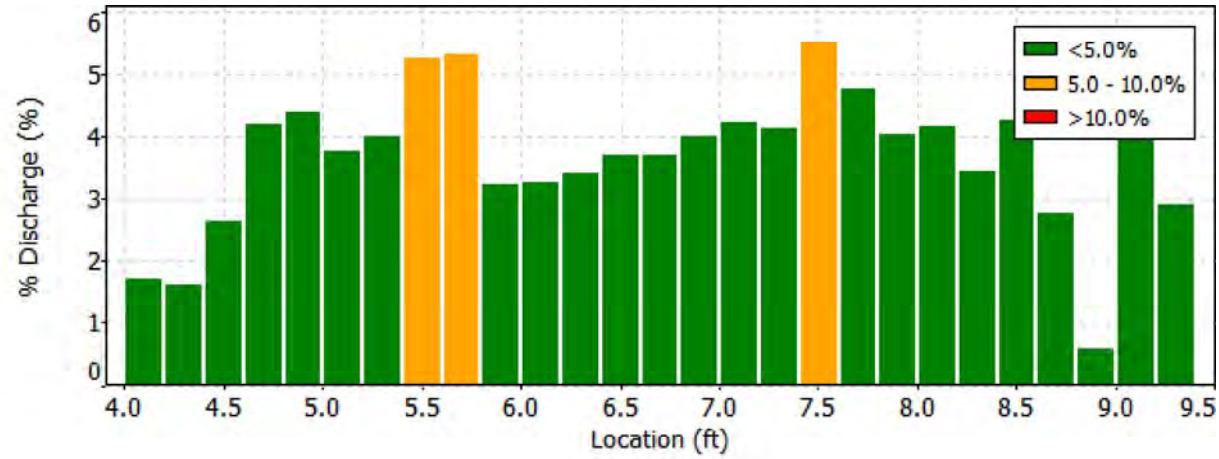
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

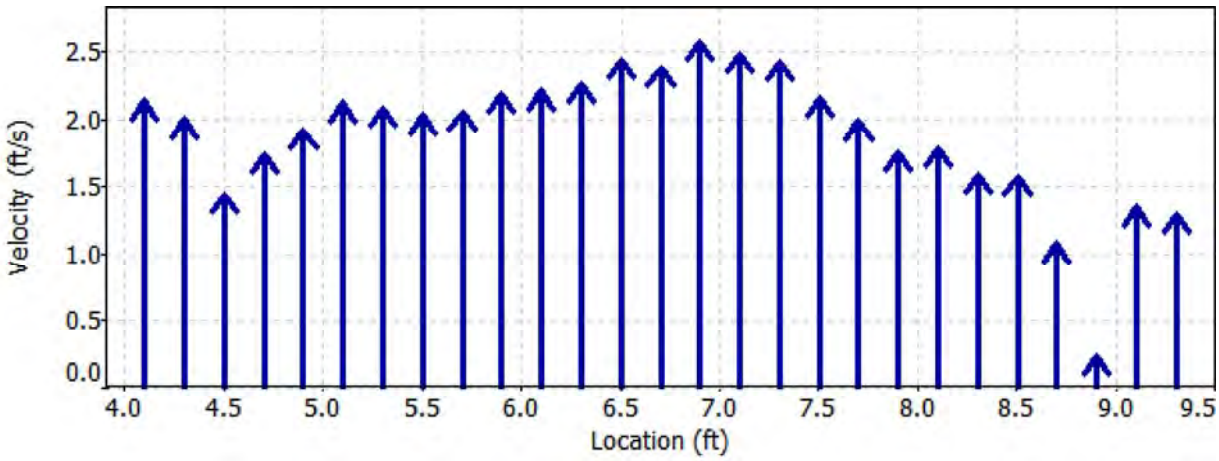
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

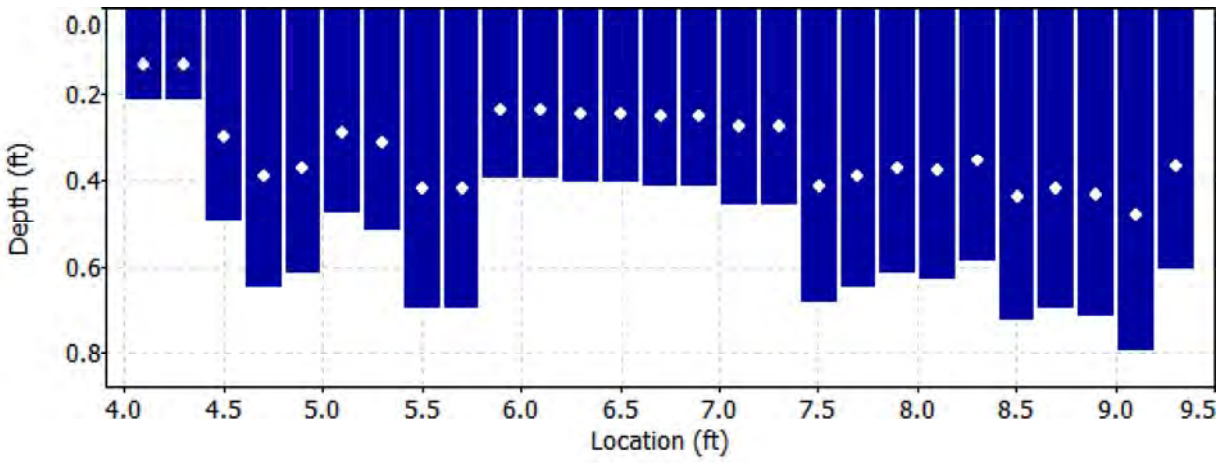
Discharge Measurement Summary

Date Generated: Tue Dec 1 2015

File Information		Site Details	
File Name	BECACWTG.007.WAD	Site Name	BOXELDER CR TMP GAGE
Start Date and Time	2015/07/15 15:36:31	Operator(s)	BRIAN EPSTEIN







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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Tue Dec 1 2015

File Information

File Name	BECACWTG.007.WAD
Start Date and Time	2015/07/15 15:36:31

Site Details

Site Name	BOXELDER CR TMP GAGE
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
24	8.70	0.6	High standard error: 0.101
25	8.90	0.6	High standard error: 0.102
26	9.10	0.6	High angle: 179
27	9.30	0.6	High angle: -176
		0.6	High standard error: 0.115

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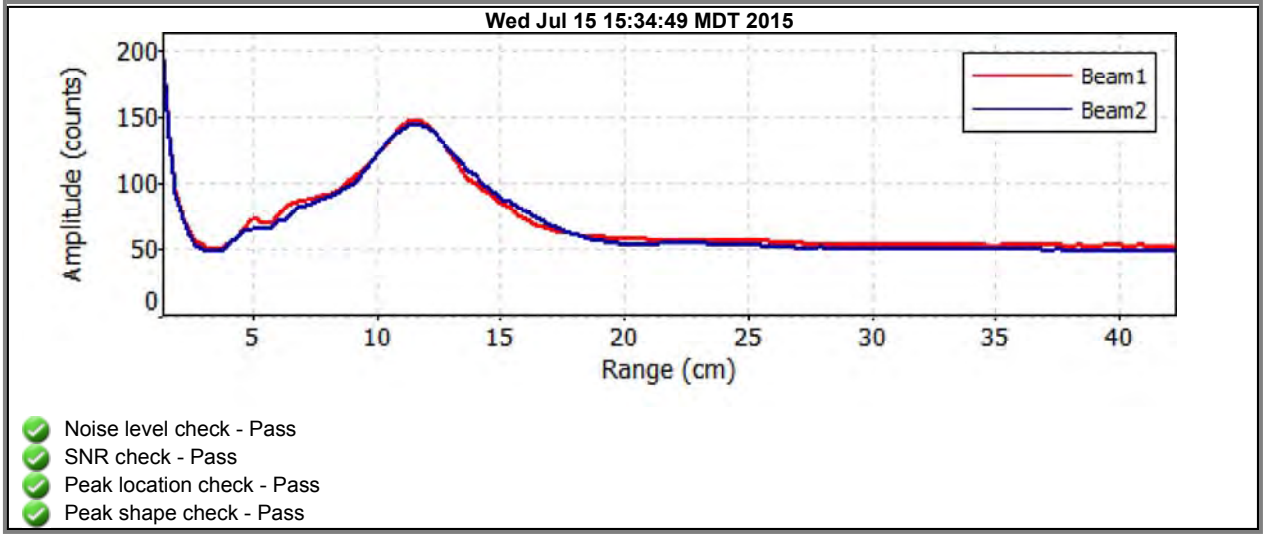
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Tue Dec 1 2015

File Information		Site Details	
File Name	BECACWTG.007.WAD	Site Name	BOXELDER CR TMP GAGE
Start Date and Time	2015/07/15 15:36:31	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Wed Jun 3 2015

File Information

File Name	BECACMTG.006.WAD
Start Date and Time	2015/05/12 16:18:13

Site Details

Site Name	BOXELDER TEMP GAGE
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.4%	5.0%
Velocity	0.9%	3.9%
Width	0.1%	0.1%
Method	2.1%	-
# Stations	3.3%	-
Overall	**4.2%**	**6.4%**

Summary

Averaging Int.	40	# Stations	15
Start Edge	REW	Total Width	7.000
Mean SNR	41.2 dB	Total Area	4.044
Mean Temp	51.22 °F	Mean Depth	0.578
Disch. Equation	Mid-Section	Mean Velocity	2.1985
		Total Discharge	**8.8902**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	16:18	1.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	16:18	2.00	0.6	0.550	0.6	0.220	1.8176	1.00	1.8176	0.302	0.5497	6.2
2	16:20	2.50	0.6	0.570	0.6	0.228	2.2087	1.00	2.2087	0.285	0.6293	7.1
3	16:21	3.00	0.6	0.640	0.6	0.256	2.0981	1.00	2.0981	0.320	0.6715	7.6
4	16:22	3.50	0.6	0.650	0.6	0.260	2.0115	1.00	2.0115	0.325	0.6537	7.4
5	16:23	4.00	0.6	0.680	0.6	0.272	2.0568	1.00	2.0568	0.340	0.6994	7.9
6	16:26	4.50	0.6	0.670	0.6	0.268	2.2474	1.00	2.2474	0.335	0.7528	8.5
7	16:28	5.00	0.6	0.700	0.6	0.280	2.7641	1.00	2.7641	0.350	0.9676	10.9
8	16:29	5.50	0.6	0.480	0.6	0.192	2.8077	1.00	2.8077	0.240	0.6738	7.6
9	16:30	6.00	0.6	0.590	0.6	0.236	2.8068	1.00	2.8068	0.295	0.8278	9.3
10	16:32	6.50	0.6	0.730	0.6	0.292	2.3353	1.00	2.3353	0.365	0.8524	9.6
11	16:33	7.00	0.6	0.500	0.6	0.200	3.0046	1.00	3.0046	0.250	0.7511	8.4
12	*16:39*	*7.50*	*0.6*	*0.760*	*0.6*	*0.304*	*1.7142*	*1.00*	*1.7142*	*0.380*	*0.6513*	*7.3*
13	16:40	8.00	0.6	0.570	0.6	0.228	0.8176	1.00	0.8176	0.256	0.2097	2.4
14	16:40	8.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

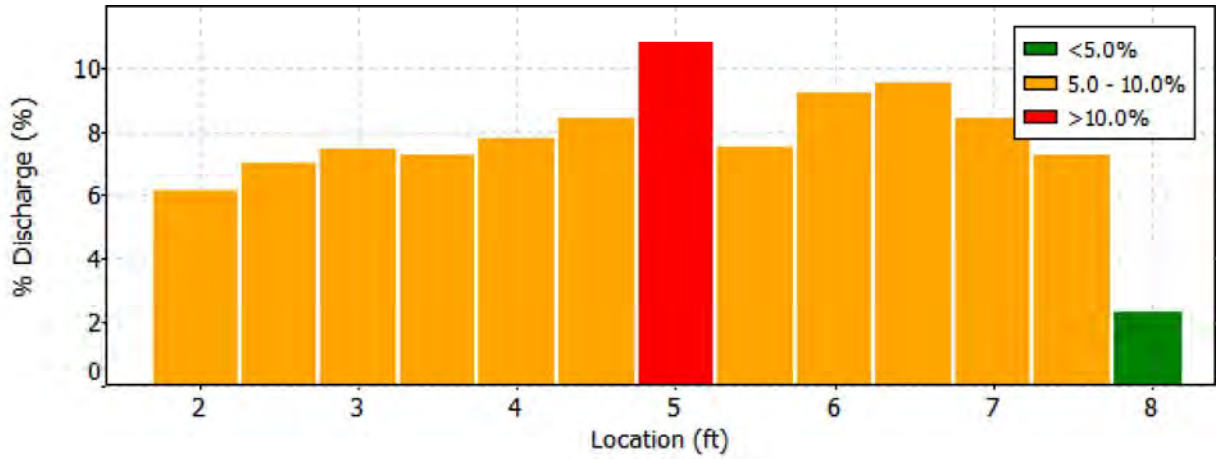
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

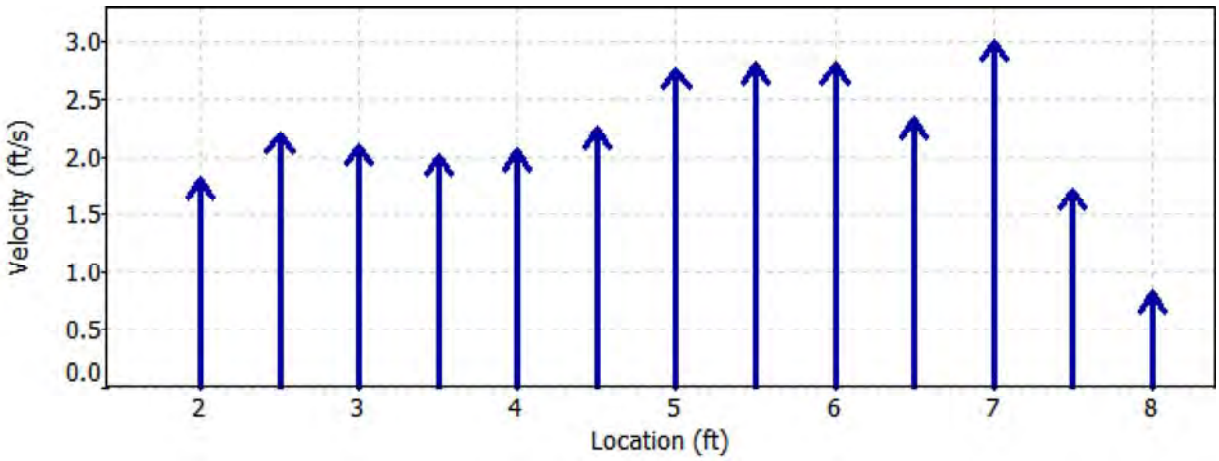
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

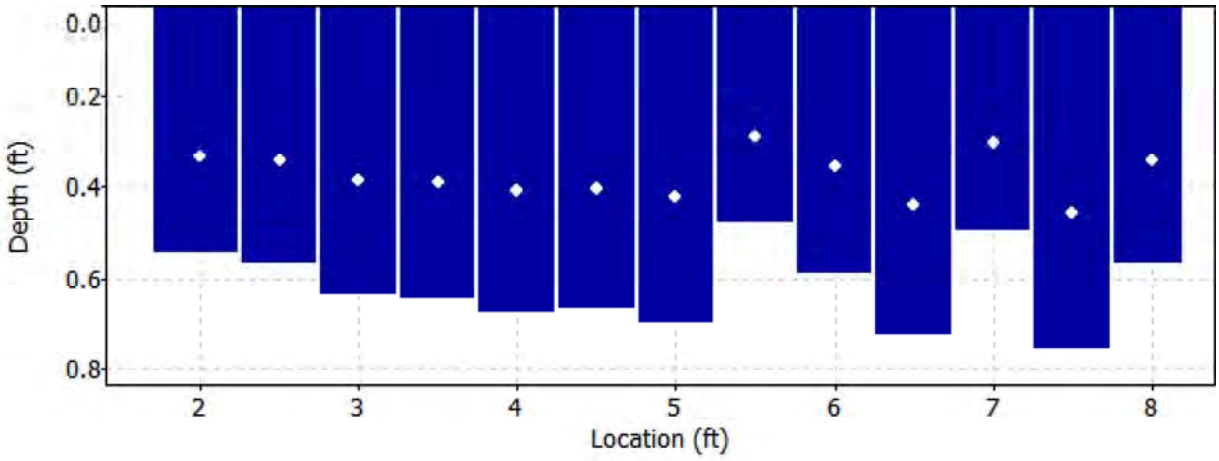
Discharge Measurement Summary

Date Generated: Wed Jun 3 2015

File Information		Site Details	
File Name	BECACMTG.006.WAD	Site Name	BOXELDER TEMP GAGE
Start Date and Time	2015/05/12 16:18:13	Operator(s)	BRIAN EPSTEIN







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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Wed Jun 3 2015

File Information

File Name	BECACMTG.006.WAD
Start Date and Time	2015/05/12 16:18:13

Site Details

Site Name	BOXELDER TEMP GAGE
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
12	7.50	0.6	High standard error: 0.100

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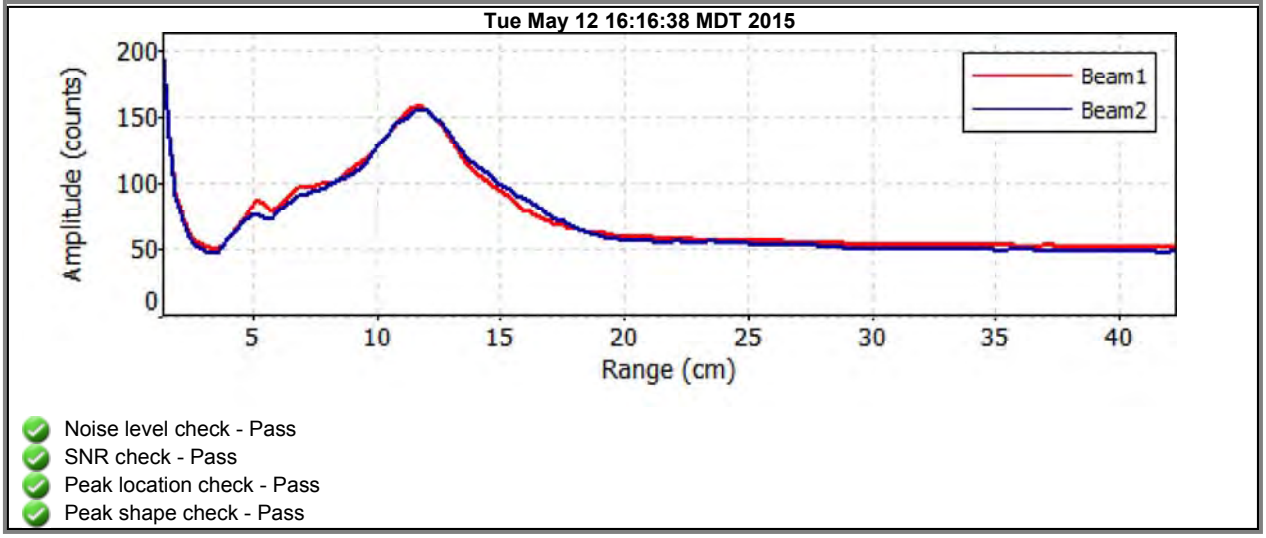
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Wed Jun 3 2015

File Information		Site Details	
File Name	BECACMTG.006.WAD	Site Name	BOXELDER TEMP GAGE
Start Date and Time	2015/05/12 16:18:13	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Thu Feb 12 2015

File Information

File Name	BECACWTG.005.WAD
Start Date and Time	2015/02/06 16:16:41

Site Details

Site Name	BOXELDER CR TMP GAGE
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.5%	2.0%
Velocity	1.2%	2.9%
Width	0.2%	0.2%
Method	2.3%	-
# Stations	3.9%	-
Overall	**4.8%**	**3.7%**

Summary

Averaging Int.	40	# Stations	13
Start Edge	REW	Total Width	4.700
Mean SNR	31.4 dB	Total Area	2.475
Mean Temp	38.23 °F	Mean Depth	0.527
Disch. Equation	Mid-Section	Mean Velocity	0.8012
		Total Discharge	**1.9831**

Supplemental Data

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Fri Feb 6 16:32:18 MST 2015	8.000			REV MTR COR NEG 1

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	16:16	3.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	16:16	3.80	0.6	0.360	0.6	0.144	0.9715	1.00	0.9715	0.144	0.1398	7.1
2	16:17	4.20	0.6	0.400	0.6	0.160	0.8990	1.00	0.8990	0.160	0.1438	7.3
3	16:19	4.60	0.6	0.350	0.6	0.140	0.9508	1.00	0.9508	0.140	0.1331	6.7
4	16:21	5.00	0.6	0.400	0.6	0.160	0.9600	1.00	0.9600	0.160	0.1535	7.7
5	16:22	5.40	0.6	0.550	0.6	0.220	0.9613	1.00	0.9613	0.220	0.2114	10.7
6	16:23	5.80	0.6	0.570	0.6	0.228	1.0256	1.00	1.0256	0.228	0.2337	11.8
7	16:25	6.20	0.6	0.680	0.6	0.272	0.9012	1.00	0.9012	0.272	0.2451	12.4
8	16:26	6.60	0.6	0.720	0.6	0.288	0.9170	1.00	0.9170	0.288	0.2641	13.3
9	*16:28*	*7.00*	*0.6*	*0.750*	*0.6*	*0.300*	*0.5709*	*1.00*	*0.5709*	*0.300*	*0.1712*	*8.6*
10	*16:29*	*7.40*	*0.6*	*0.720*	*0.6*	*0.288*	*0.4944*	*1.00*	*0.4944*	*0.360*	*0.1781*	*9.0*
11	*16:33*	*8.00*	*0.6*	*0.580*	*0.6*	*0.232*	*-0.5364*	*-1.00*	*0.5364*	*0.203*	*0.1090*	*5.5*
12	16:33	8.10	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

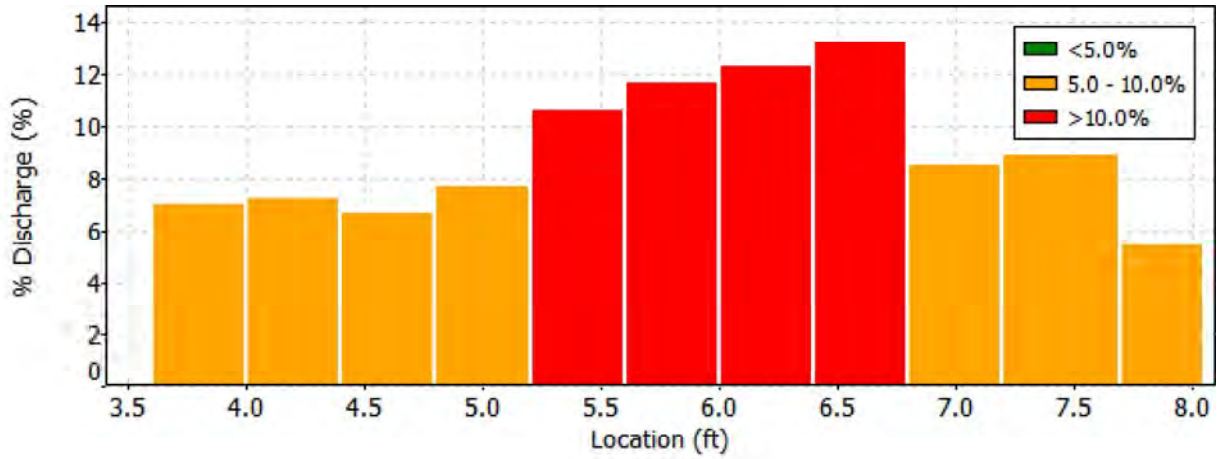
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

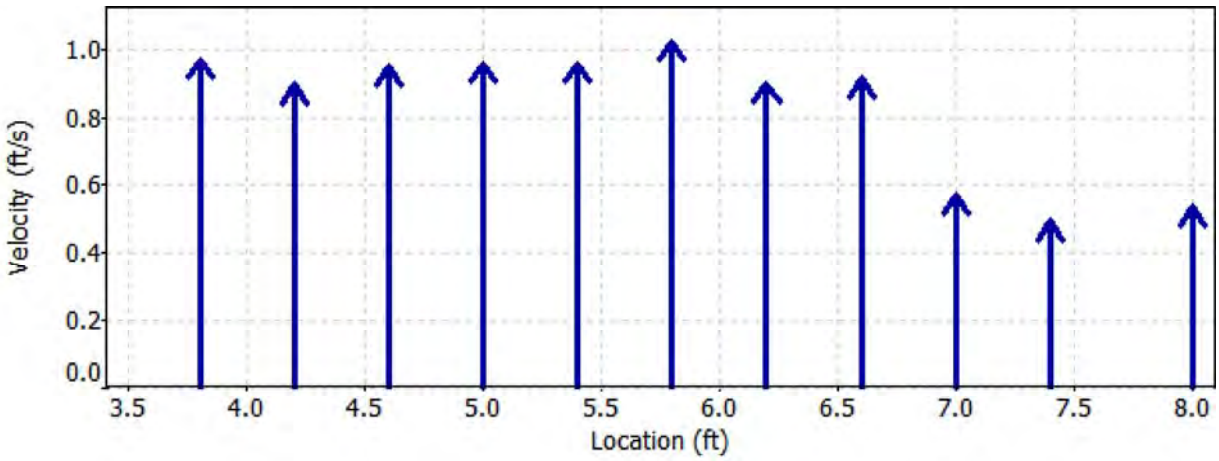
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

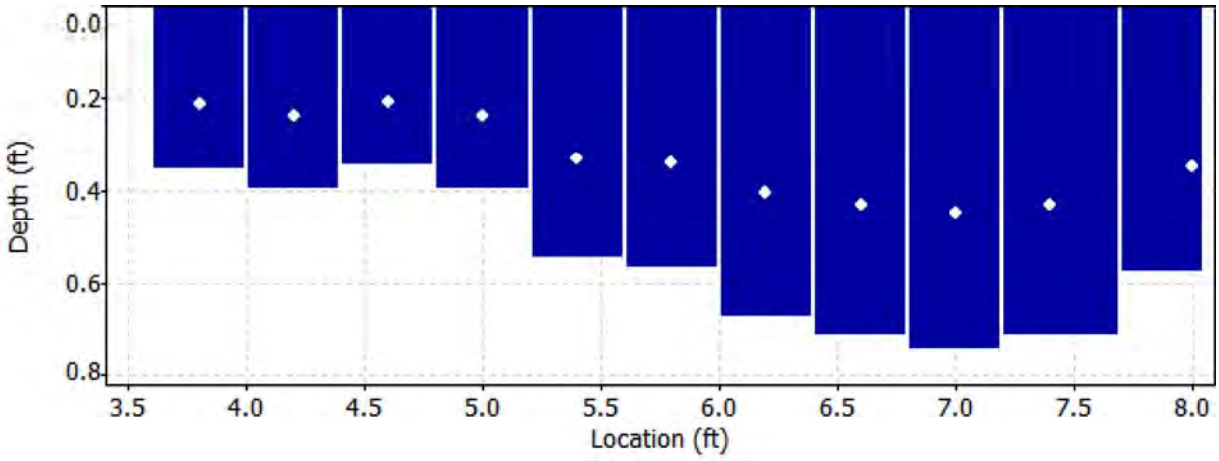
Discharge Measurement Summary

Date Generated: Thu Feb 12 2015

File Information		Site Details	
File Name	BECACWTG.005.WAD	Site Name	BOXELDER CR TMP GAGE
Start Date and Time	2015/02/06 16:16:41	Operator(s)	BRIAN EPSTEIN







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Discharge Measurement Summary

Date Generated: Thu Feb 12 2015

File Information

File Name	BECACWTG.005.WAD
Start Date and Time	2015/02/06 16:16:41

Site Details

Site Name	BOXELDER CR TMP GAGE
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
9	7.00	0.6	High standard error: 0.038
10	7.40	0.6	High standard error: 0.031
11	8.00	0.6	High angle: 176

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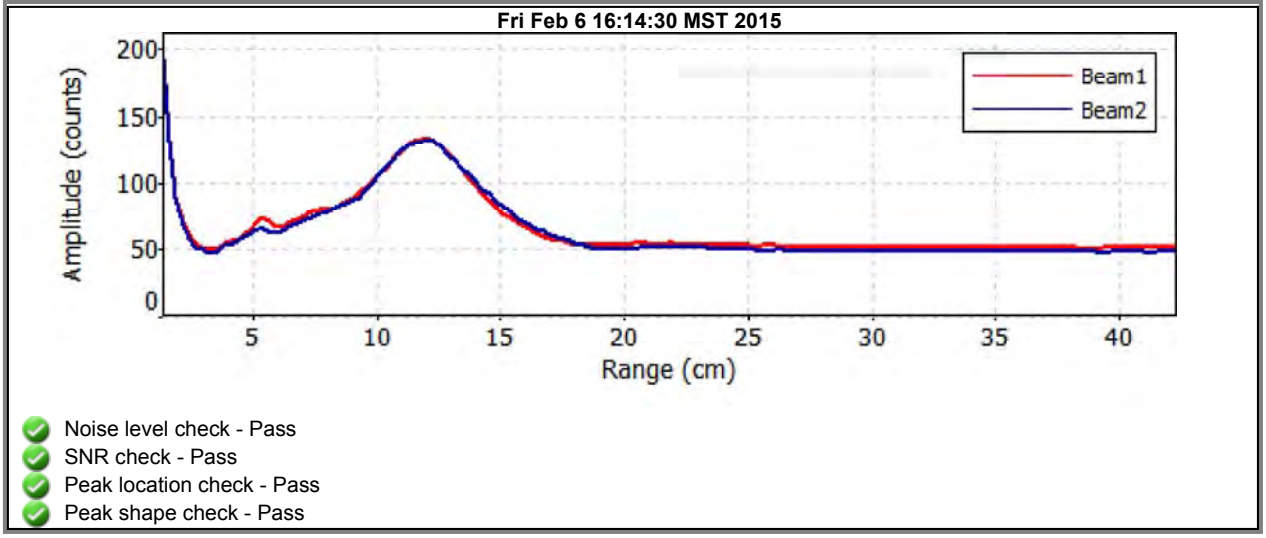
Discharge Measurement Summary

Date Generated: Thu Feb 12 2015

File Information		Site Details	
File Name	BECACWTG.005.WAD	Site Name	BOXELDER CR TMP GAGE
Start Date and Time	2015/02/06 16:16:41	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Dec 15 2014

File Information

File Name	BECACWTG.004.WAD
Start Date and Time	2014/11/06 09:57:02

Site Details

Site Name	BOXELDER CR TEMP GAG
Operator(s)	BJE

System Information

Sensor Type	FlowTracker
Serial #	P2355
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.4%	0.7%
Velocity	1.4%	1.5%
Width	0.1%	0.1%
Method	2.1%	-
# Stations	2.8%	-
Overall	**3.9%**	**2.0%**

Summary

Averaging Int.	40	# Stations	18
Start Edge	REW	Total Width	5.500
Mean SNR	30.4 dB	Total Area	3.212
Mean Temp	39.84 °F	Mean Depth	0.584
Disch. Equation	Mid-Section	Mean Velocity	0.6592
		Total Discharge	**2.1170**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	09:57	5.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	09:57	5.50	0.6	0.410	0.6	0.164	1.0282	1.00	1.0282	0.123	0.1264	6.0
2	09:58	5.80	0.6	0.440	0.6	0.176	0.9662	1.00	0.9662	0.132	0.1275	6.0
3	09:59	6.10	0.6	0.450	0.6	0.180	0.9249	1.00	0.9249	0.135	0.1248	5.9
4	10:00	6.40	0.6	0.490	0.6	0.196	0.8967	1.00	0.8967	0.147	0.1318	6.2
5	10:04	6.70	0.6	0.520	0.6	0.208	0.9003	1.00	0.9003	0.156	0.1404	6.6
6	10:05	7.00	0.6	0.540	0.6	0.216	0.9839	1.00	0.9839	0.162	0.1593	7.5
7	10:07	7.30	0.6	0.620	0.6	0.248	1.0738	1.00	1.0738	0.186	0.1997	9.4
8	10:08	7.60	0.6	0.710	0.6	0.284	1.0138	1.00	1.0138	0.213	0.2158	10.2
9	10:11	7.90	0.6	0.750	0.6	0.300	0.9390	1.00	0.9390	0.225	0.2112	10.0
10	10:13	8.20	0.6	0.750	0.6	0.300	0.8825	1.00	0.8825	0.225	0.1985	9.4
11	10:15	8.50	0.6	0.780	0.6	0.312	0.8392	1.00	0.8392	0.234	0.1963	9.3
12	10:16	8.80	0.6	0.800	0.6	0.320	0.6273	1.00	0.6273	0.240	0.1505	7.1
13	10:17	9.10	0.6	0.780	0.6	0.312	0.3855	1.00	0.3855	0.234	0.0902	4.3
14	10:19	9.40	0.6	0.750	0.6	0.300	0.1686	1.00	0.1686	0.225	0.0379	1.8
15	*10:20*	*9.70*	*0.6*	*0.700*	*0.6*	*0.280*	*-0.0276*	*1.00*	*-0.0276*	*0.210*	*-0.0058*	*-0.3*
16	*10:21*	*10.00*	*0.6*	*0.730*	*0.6*	*0.292*	*0.0344*	*1.00*	*0.0344*	*0.366*	*0.0126*	*0.6*
17	10:21	10.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

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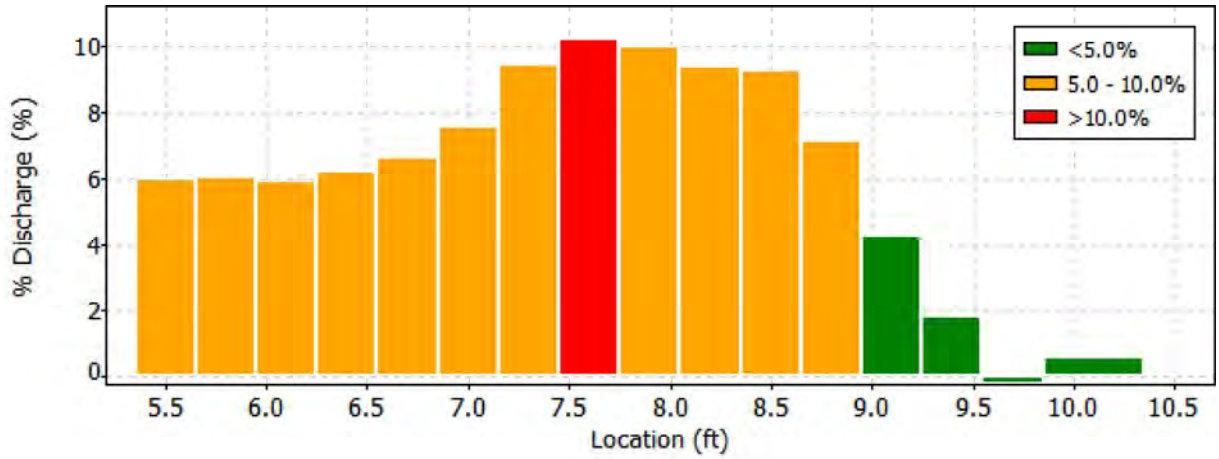
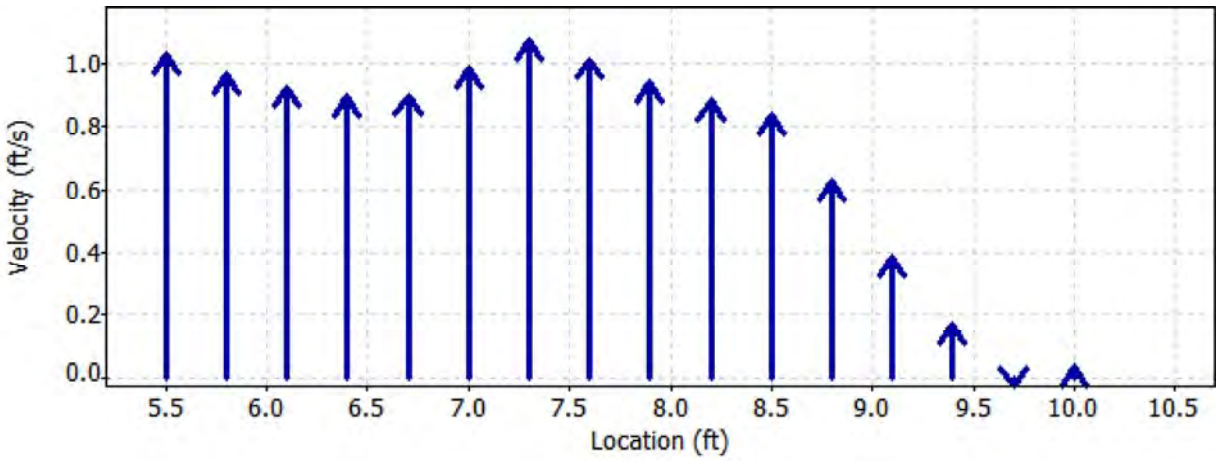
Colorado Water Conservation Board
Department of Natural Resources

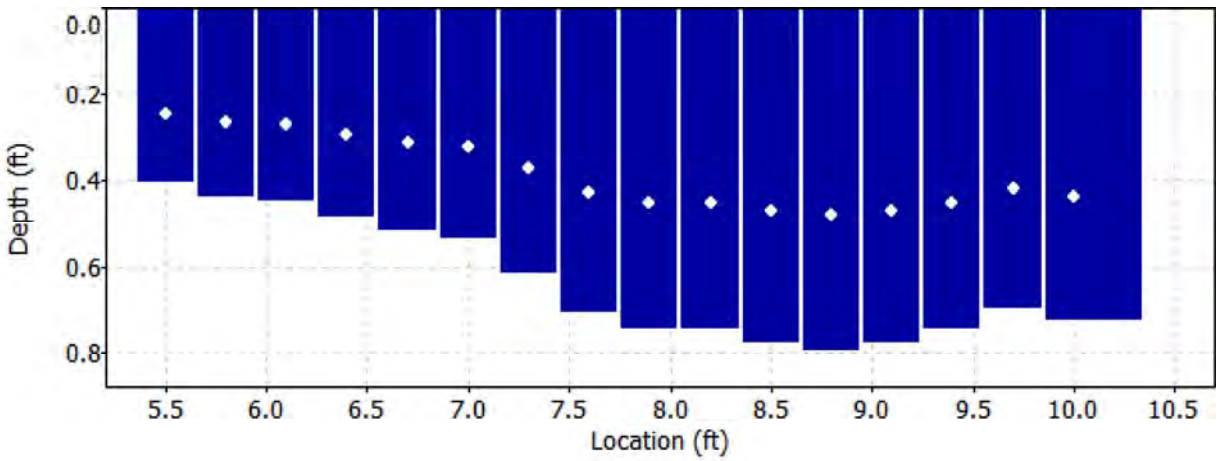
Discharge Measurement Summary

Date Generated: Mon Dec 15 2014

File Information		Site Details	
File Name	BECACWTG.004.WAD	Site Name	BOXELDER CR TEMP GAG
Start Date and Time	2014/11/06 09:57:02	Operator(s)	BJE







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Discharge Measurement Summary

Date Generated: Mon Dec 15 2014

File Information

File Name	BECACWTG.004.WAD
Start Date and Time	2014/11/06 09:57:02

Site Details

Site Name	BOXELDER CR TEMP GAG
Operator(s)	BJE

Quality Control

St	Loc	%Dep	Message
15	9.70	0.6	High angle: -162
16	10.00	0.6	High angle: -69

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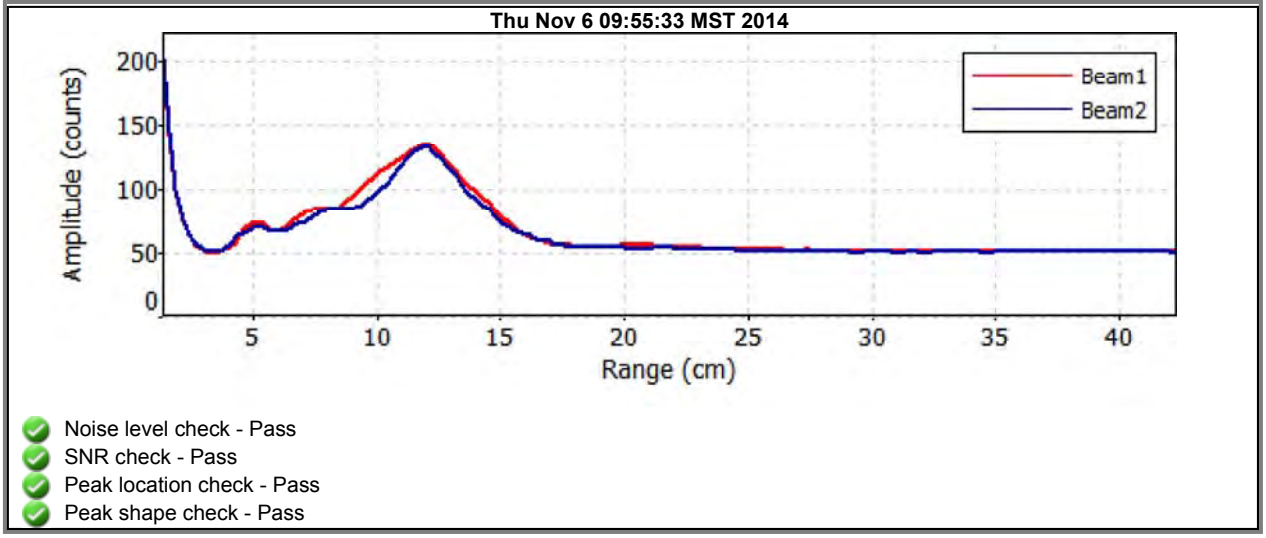
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Dec 15 2014

File Information		Site Details	
File Name	BECACWTG.004.WAD	Site Name	BOXELDER CR TEMP GAG
Start Date and Time	2014/11/06 09:57:02	Operator(s)	BJE

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

Discharge Measurement Summary

Date Generated: Tue Nov 4 2014

File Information

File Name	BECACWTG.003.WAD
Start Date and Time	2014/09/29 11:32:08

Site Details

Site Name	BOXELDER TEMP GAGE
Operator(s)	BJE

System Information

Sensor Type	FlowTracker
Serial #	P2355
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.3%	2.3%
Velocity	0.9%	0.7%
Width	0.1%	0.1%
Method	2.2%	-
# Stations	3.6%	-
Overall	**4.4%**	**2.6%**

Summary

Averaging Int.	40	# Stations	14
Start Edge	REW	Total Width	4.300
Mean SNR	31.6 dB	Total Area	3.053
Mean Temp	54.60 °F	Mean Depth	0.710
Disch. Equation	Mid-Section	Mean Velocity	1.2029
		Total Discharge	**3.6720**

Measurement Results

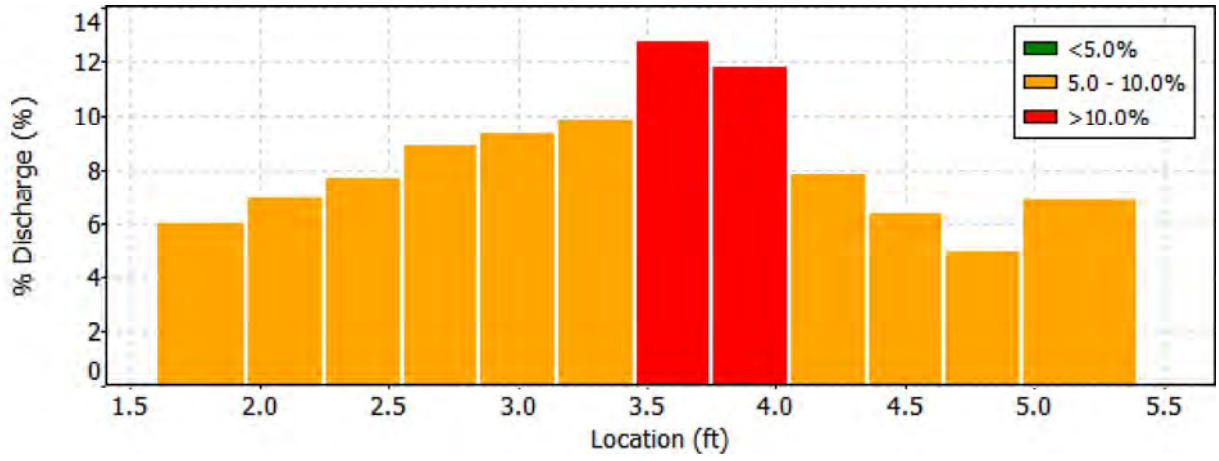
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	11:32	1.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	11:32	1.80	0.6	0.750	0.6	0.300	0.8448	1.00	0.8448	0.263	0.2218	6.0
2	11:33	2.10	0.6	0.860	0.6	0.344	1.0010	1.00	1.0010	0.258	0.2584	7.0
3	11:34	2.40	0.6	0.860	0.6	0.344	1.1070	1.00	1.1070	0.258	0.2858	7.8
4	11:35	2.70	0.6	0.970	0.6	0.388	1.1306	1.00	1.1306	0.291	0.3293	9.0
5	11:37	3.00	0.6	0.990	0.6	0.396	1.1598	1.00	1.1598	0.297	0.3447	9.4
6	11:37	3.30	0.6	0.990	0.6	0.396	1.2224	1.00	1.2224	0.297	0.3634	9.9
7	11:40	3.60	0.6	1.140	0.6	0.456	1.3743	1.00	1.3743	0.342	0.4704	12.8
8	11:41	3.90	0.6	1.030	0.6	0.412	1.4045	1.00	1.4045	0.309	0.4342	11.8
9	11:46	4.20	0.6	0.700	0.6	0.280	1.3842	1.00	1.3842	0.210	0.2909	7.9
10	11:48	4.50	0.6	0.600	0.6	0.240	1.3035	1.00	1.3035	0.180	0.2348	6.4
11	11:50	4.80	0.6	0.480	0.6	0.192	1.2756	1.00	1.2756	0.144	0.1838	5.0
12	11:51	5.10	0.6	0.450	0.6	0.180	1.2592	1.00	1.2592	0.202	0.2546	6.9
13	11:51	5.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

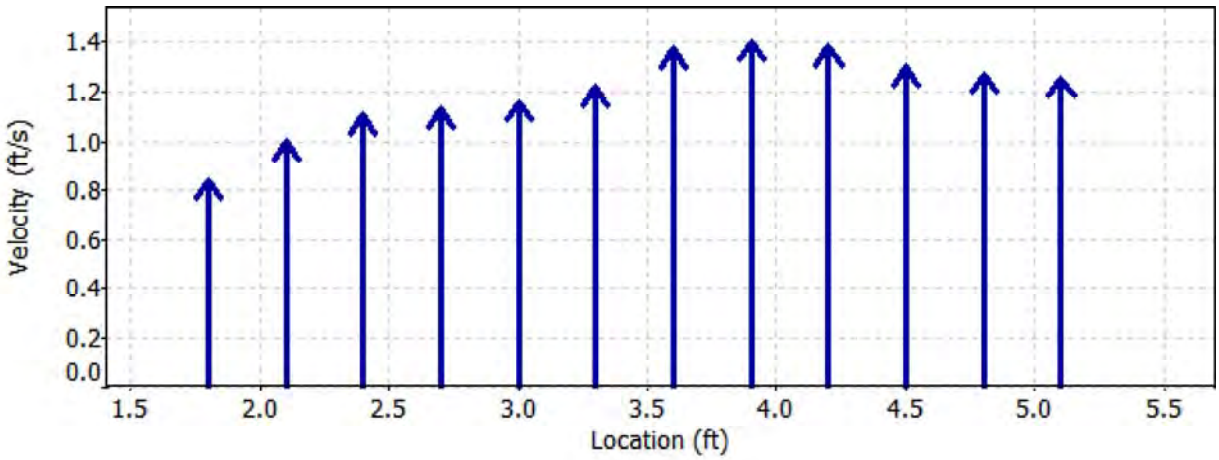
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

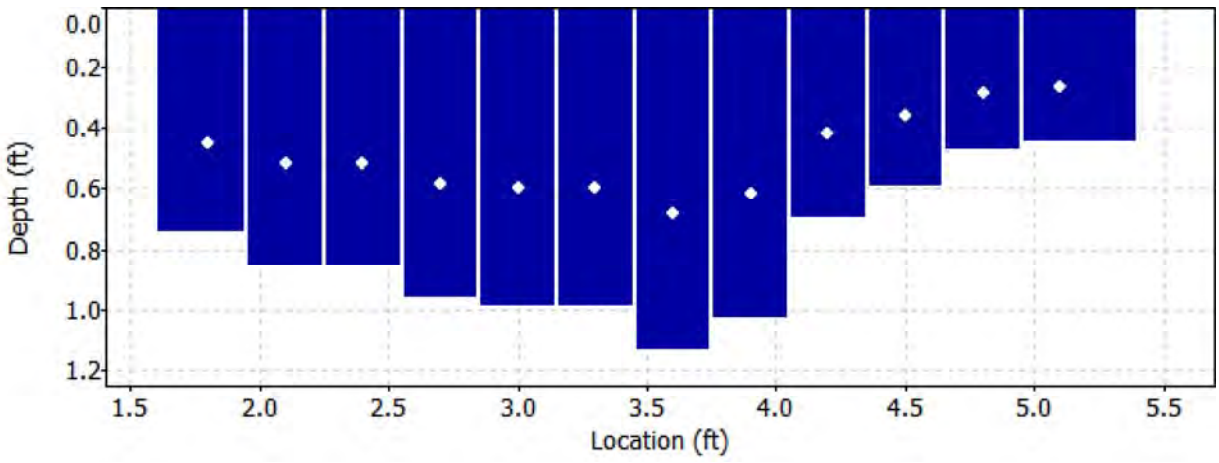
Discharge Measurement Summary

Date Generated: Tue Nov 4 2014

File Information		Site Details	
File Name	BECACWTG.003.WAD	Site Name	BOXELDER TEMP GAGE
Start Date and Time	2014/09/29 11:32:08	Operator(s)	BJE







Discharge Measurement Summary

Date Generated: Tue Nov 4 2014

File Information		Site Details	
File Name	BECACWTG.003.WAD	Site Name	BOXELDER TEMP GAGE
Start Date and Time	2014/09/29 11:32:08	Operator(s)	BJE

Quality Control

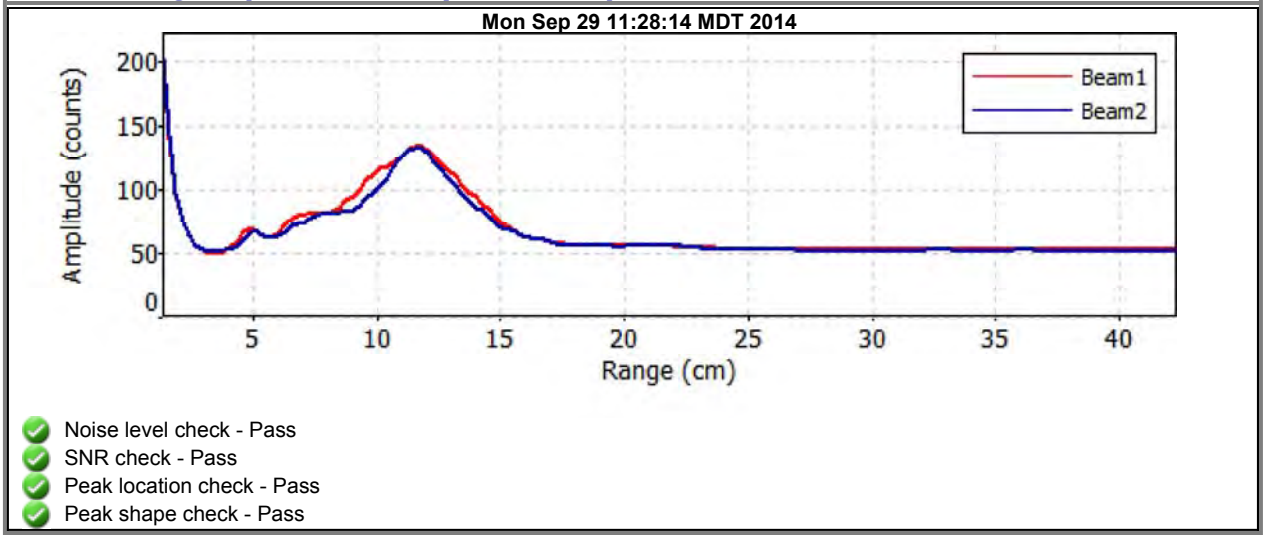
No Quality Control warnings

Discharge Measurement Summary

Date Generated: Tue Nov 4 2014

File Information		Site Details	
File Name	BECACWTG.003.WAD	Site Name	BOXELDER TEMP GAGE
Start Date and Time	2014/09/29 11:32:08	Operator(s)	BJE

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

Discharge Measurement Summary

Date Generated: Tue Nov 4 2014

File Information		Site Details	
File Name	BECACWTG.002.WAD	Site Name	BOXELDER CR TEMP G
Start Date and Time		Operator(s)	BJE

System Information		Units	(English Units)
Sensor Type	FlowTracker	Distance	ft
Serial #	P2355	Velocity	ft/s
CPU Firmware Version	3.9	Area	ft^2
Software Ver	2.30	Discharge	cfs
Mounting Correction	0.0%		

Summary

Averaging Int.	40	# Stations	0
Mean SNR	0.0 dB	Mean Velocity Vx	0.0000
Mean Temp	0.00 °F	Mean Velocity Vy	0.0000

Supplemental Data

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Mon Sep 29 11:25:26 MDT 2014	0.000			ABORT FT SET GENERAL

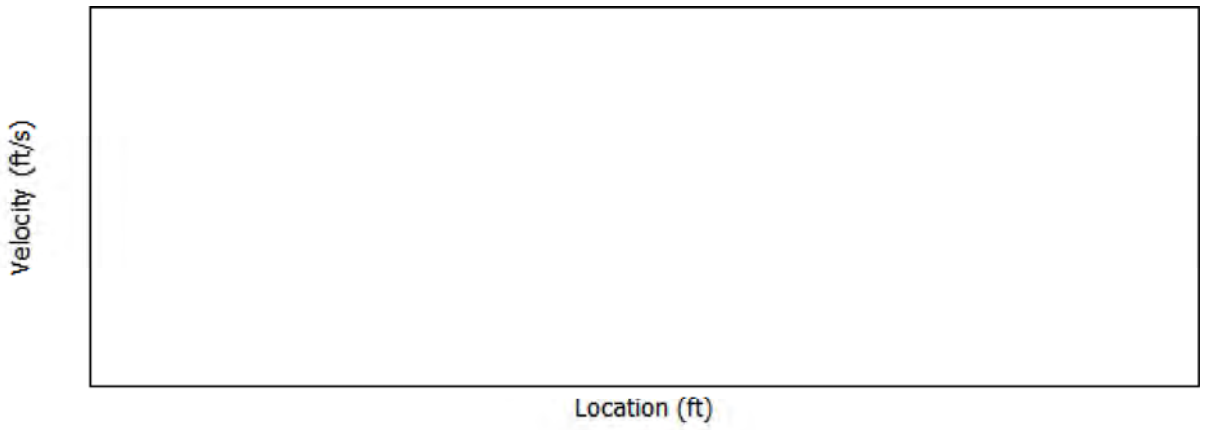
Measurement Results

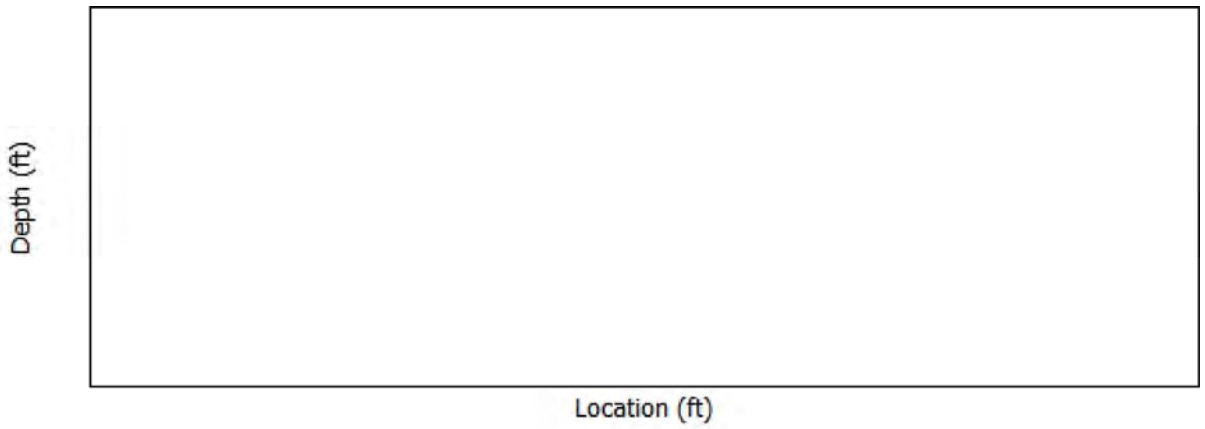
St	Loc1	Loc2	Depth	MeasD	Clock	Npts	Spike	VelX	VelY	VelZ	SNR1	SNR2	SNR3	VxErr	VyErr	VzErr	Bnd	Temp

Discharge Measurement Summary

Date Generated: Tue Nov 4 2014

File Information		Site Details	
File Name	BECACWTG.002.WAD	Site Name	BOXELDER CR TEMP G
Start Date and Time		Operator(s)	BJE





Discharge Measurement Summary

Date Generated: Tue Nov 4 2014

File Information		Site Details	
File Name	BECACWTG.002.WAD	Site Name	BOXELDER CR TEMP G
Start Date and Time		Operator(s)	BJE

Quality Control

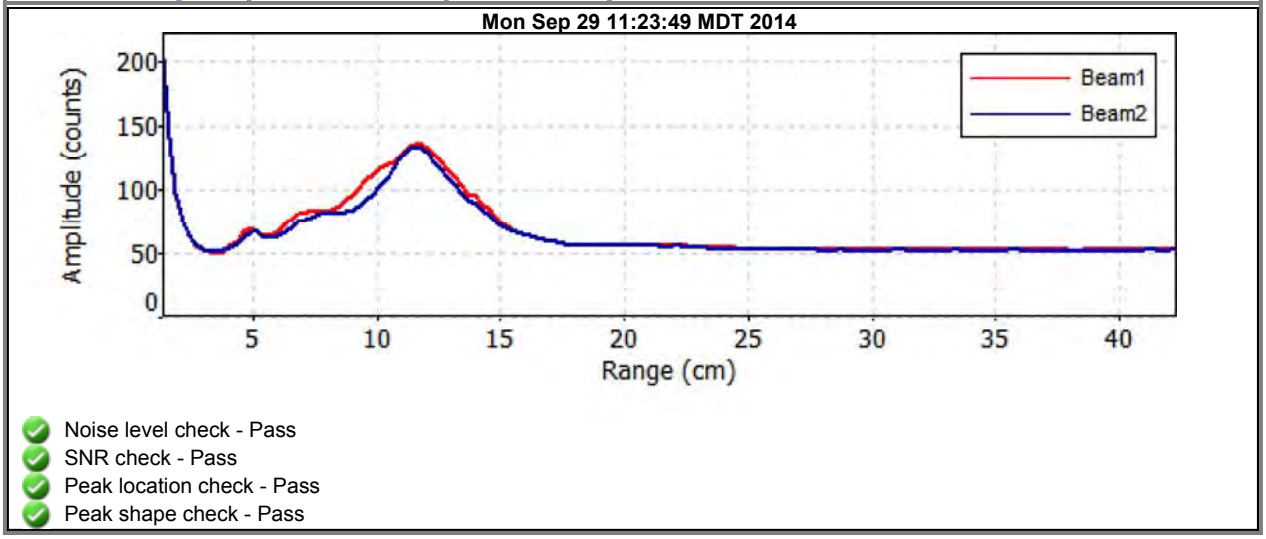
No Quality Control warnings

Discharge Measurement Summary

Date Generated: Tue Nov 4 2014

File Information		Site Details	
File Name	BECACWTG.002.WAD	Site Name	BOXELDER CR TEMP G
Start Date and Time		Operator(s)	BJE

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information

File Name	BECACWTG.001.WAD
Start Date and Time	2014/09/04 19:39:16

Site Details

Site Name	BOXELDER CR AB COW
Operator(s)	BJE

System Information

Sensor Type	FlowTracker
Serial #	P2355
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.5%	5.8%
Velocity	1.2%	2.2%
Width	0.2%	0.2%
Method	2.7%	-
# Stations	4.6%	-
Overall	**5.6%**	**6.3%**

Summary

Averaging Int.	40	# Stations	11
Start Edge	REW	Total Width	5.600
Mean SNR	29.5 dB	Total Area	2.335
Mean Temp	56.20 °F	Mean Depth	0.417
Disch. Equation	Mid-Section	Mean Velocity	0.8996
		Total Discharge	**2.1007**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	19:39	4.80	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	19:39	5.80	0.6	0.250	0.6	0.100	0.9528	1.00	0.9528	0.200	0.1906	9.1
2	19:40	6.40	0.6	0.370	0.6	0.148	0.9944	1.00	0.9944	0.222	0.2208	10.5
3	19:41	7.00	0.6	0.360	0.6	0.144	1.1293	1.00	1.1293	0.198	0.2236	10.6
4	19:42	7.50	0.6	0.550	0.6	0.220	1.1568	1.00	1.1568	0.275	0.3181	15.1
5	19:44	8.00	0.6	0.470	0.6	0.188	1.2336	1.00	1.2336	0.235	0.2900	13.8
6	19:46	8.50	0.6	0.650	0.6	0.260	1.0502	1.00	1.0502	0.325	0.3413	16.2
7	19:47	9.00	0.6	0.680	0.6	0.272	0.8461	1.00	0.8461	0.340	0.2877	13.7
8	19:48	9.50	0.6	0.600	0.6	0.240	0.6178	1.00	0.6178	0.270	0.1668	7.9
9	*19:49*	*9.90*	*0.6*	*0.600*	*0.6*	*0.240*	*0.2293*	*1.00*	*0.2293*	*0.270*	*0.0619*	*2.9*
10	19:49	10.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

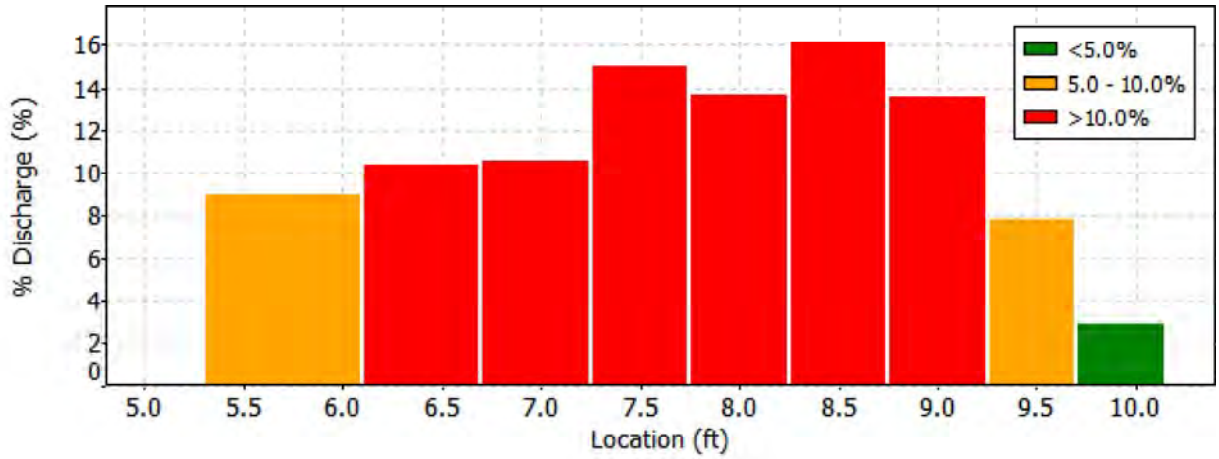
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

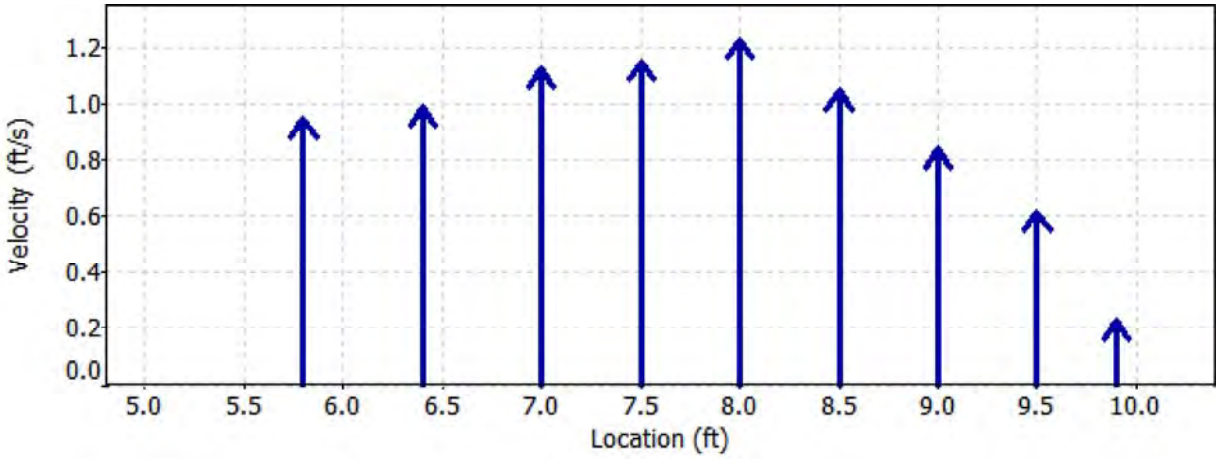
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

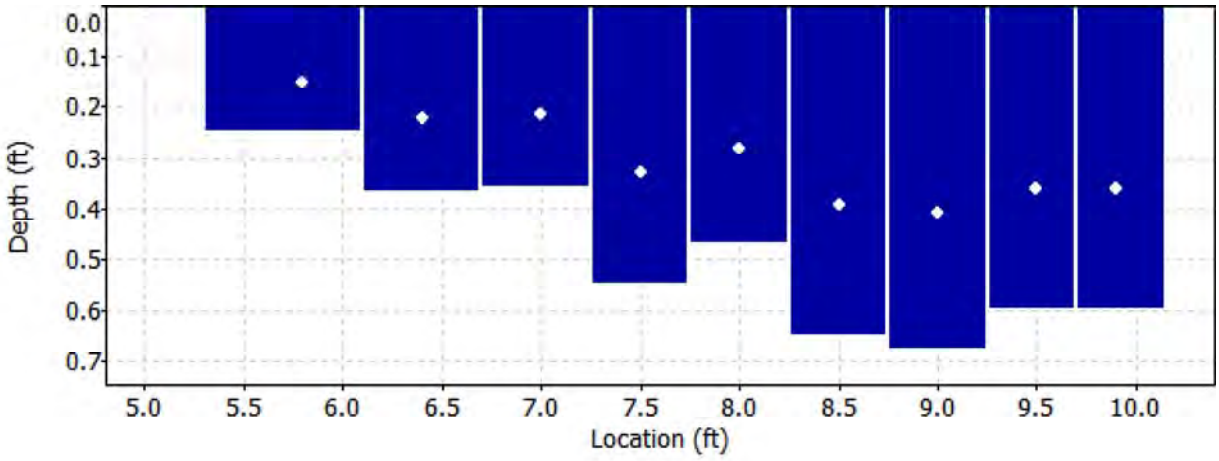
Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information		Site Details	
File Name	BECACWTG.001.WAD	Site Name	BOXELDER CR AB COW
Start Date and Time	2014/09/04 19:39:16	Operator(s)	BJE







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Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information

File Name	BECACWTG.001.WAD
Start Date and Time	2014/09/04 19:39:16

Site Details

Site Name	BOXELDER CR AB COW
Operator(s)	BJE

Quality Control

St	Loc	%Dep	Message
9	9.90	0.6	High standard error: 0.036

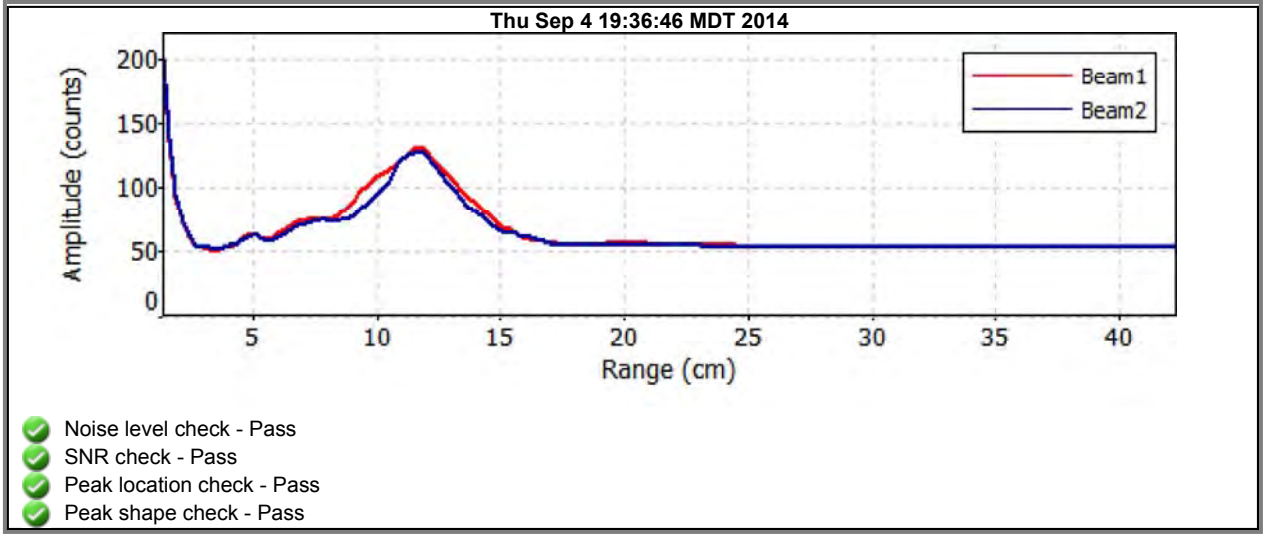
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information		Site Details	
File Name	BECACWTG.001.WAD	Site Name	BOXELDER CR AB COW
Start Date and Time	2014/09/04 19:39:16	Operator(s)	BJE

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information

File Name	BXEBCR2X.002.WAD
Start Date and Time	2014/07/10 14:49:14

Site Details

Site Name	BOXELDER CR BL CNY
Operator(s)	BJE

System Information

Sensor Type	FlowTracker
Serial #	P2355
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.5%	2.0%
Velocity	1.0%	6.4%
Width	0.2%	0.2%
Method	2.6%	-
# Stations	4.6%	-
Overall	**5.5%**	**6.8%**

Summary

Averaging Int.	40	# Stations	11
Start Edge	REW	Total Width	5.400
Mean SNR	34.8 dB	Total Area	2.207
Mean Temp	62.36 °F	Mean Depth	0.409
Disch. Equation	Mid-Section	Mean Velocity	1.3135
		Total Discharge	**2.8990**

Measurement Results

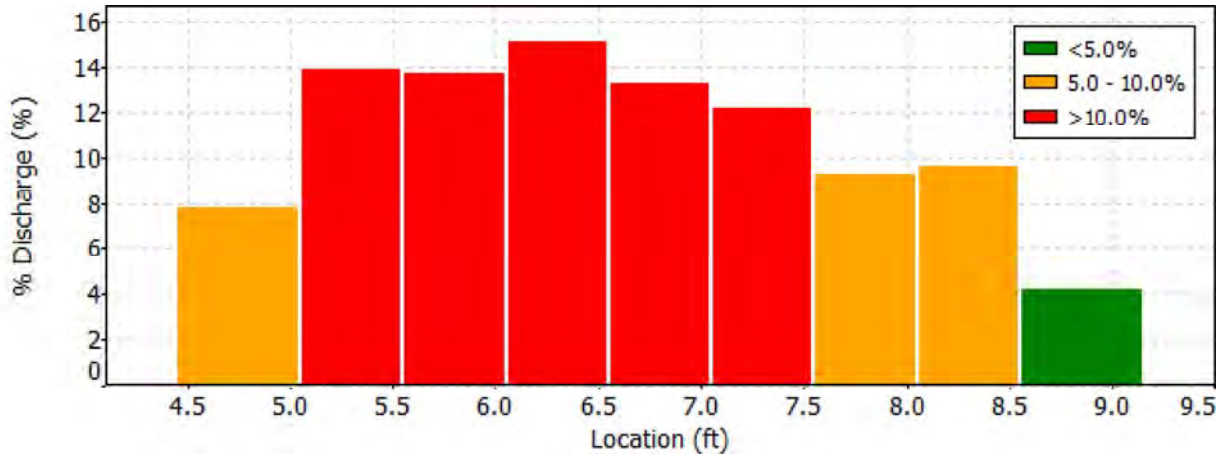
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	14:49	4.10	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	14:52	4.80	0.6	0.460	0.6	0.184	0.8271	1.00	0.8271	0.276	0.2282	7.9
2	14:54	5.30	0.6	0.400	0.6	0.160	2.0279	1.00	2.0279	0.200	0.4055	14.0
3	14:55	5.80	0.6	0.420	0.6	0.168	1.9098	1.00	1.9098	0.210	0.4010	13.8
4	14:57	6.30	0.6	0.500	0.6	0.200	1.7664	1.00	1.7664	0.250	0.4416	15.2
5	14:58	6.80	0.6	0.500	0.6	0.200	1.5449	1.00	1.5449	0.250	0.3862	13.3
6	15:00	7.30	0.6	0.560	0.6	0.224	1.2753	1.00	1.2753	0.280	0.3571	12.3
7	15:01	7.80	0.6	0.520	0.6	0.208	1.0463	1.00	1.0463	0.260	0.2720	9.4
8	15:03	8.30	0.6	0.470	0.6	0.188	1.2031	1.00	1.2031	0.235	0.2828	9.8
9	15:05	8.80	0.6	0.410	0.6	0.164	0.5059	1.00	0.5059	0.246	0.1245	4.3
10	15:05	9.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

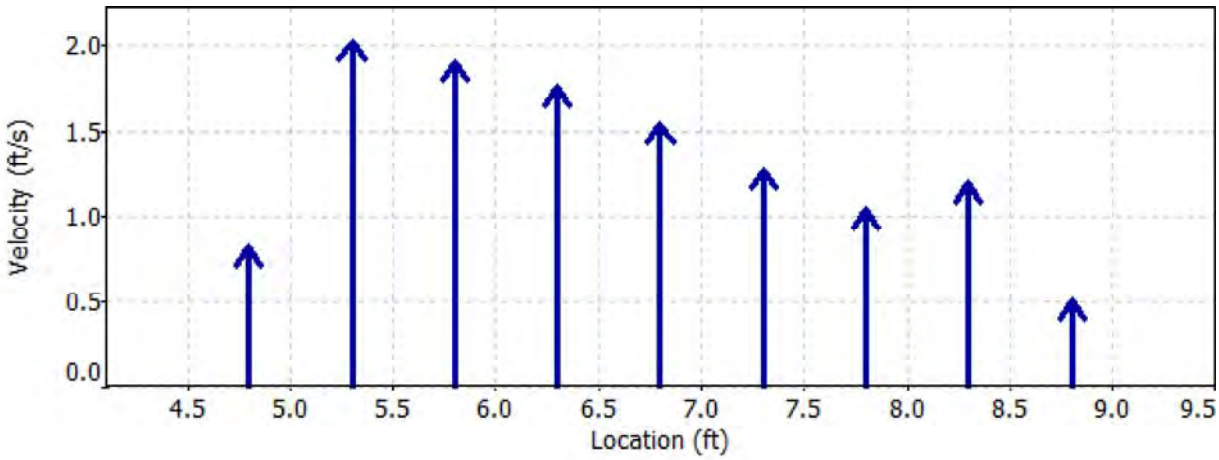
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

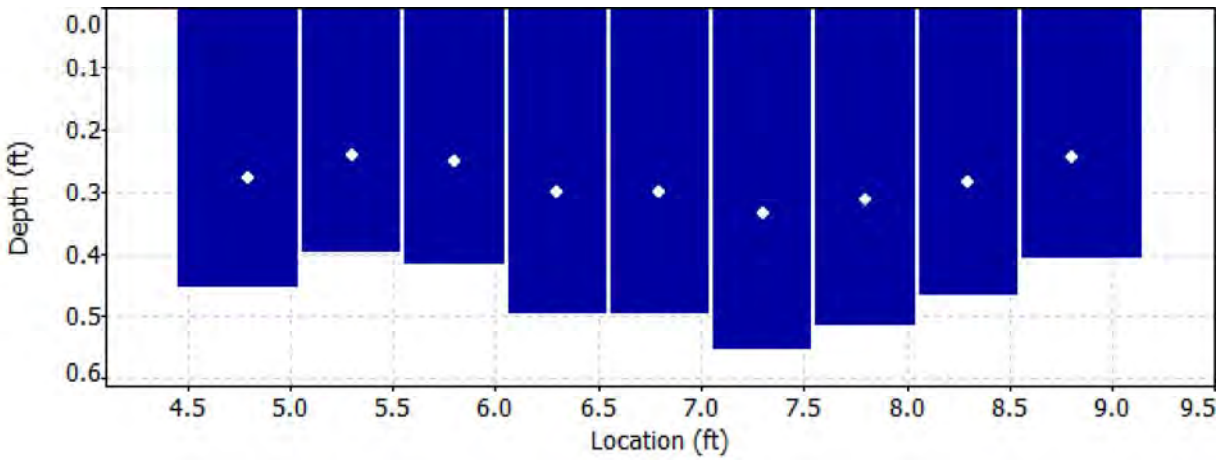
Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information		Site Details	
File Name	BXEBCR2X.002.WAD	Site Name	BOXELDER CR BL CNY
Start Date and Time	2014/07/10 14:49:14	Operator(s)	BJE







Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information		Site Details	
File Name	BXEBCR2X.002.WAD	Site Name	BOXELDER CR BL CNY
Start Date and Time	2014/07/10 14:49:14	Operator(s)	BJE

Quality Control

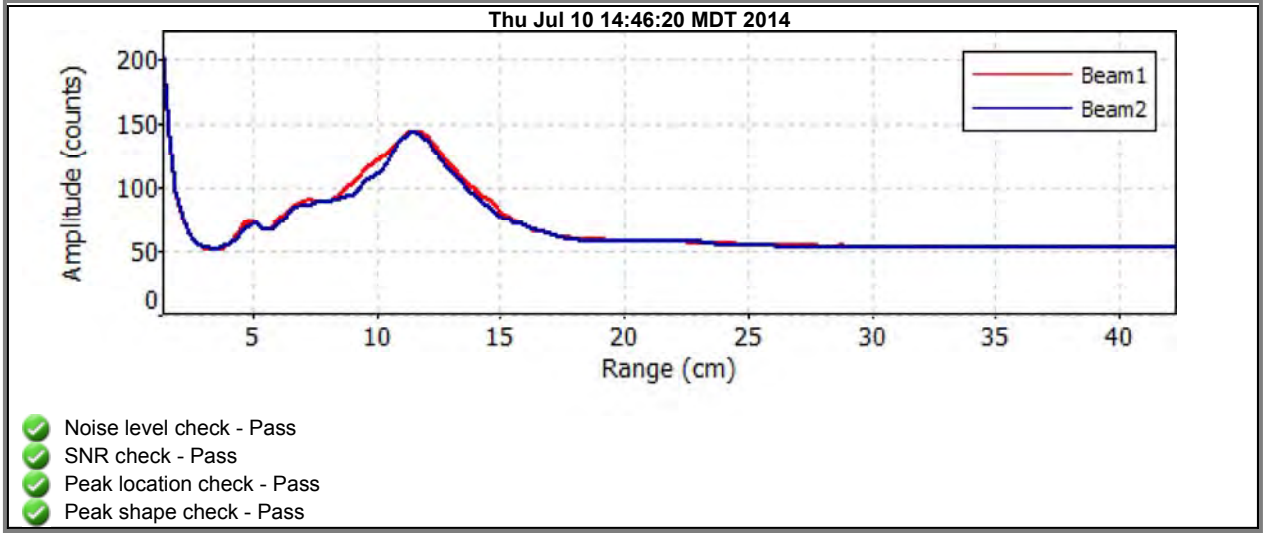
No Quality Control warnings

Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information		Site Details	
File Name	BXEBCR2X.002.WAD	Site Name	BOXELDER CR BL CNY
Start Date and Time	2014/07/10 14:49:14	Operator(s)	BJE

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

Discharge Measurement Summary

Date Generated: Fri Apr 11 2014

File Information

File Name	BXELDR2X.001.WAD
Start Date and Time	2014/03/26 10:45:14

Site Details

Site Name	BOXELDER CR BL CANY
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.4%	3.0%
Velocity	0.8%	3.3%
Width	0.1%	0.1%
Method	2.1%	-
# Stations	3.1%	-
Overall	**4.0%**	**4.6%**

Summary

Averaging Int.	40	# Stations	16
Start Edge	LEW	Total Width	5.900
Mean SNR	30.4 dB	Total Area	2.212
Mean Temp	39.40 °F	Mean Depth	0.375
Disch. Equation	Mid-Section	Mean Velocity	2.3423
		Total Discharge	**5.1820**

Measurement Results

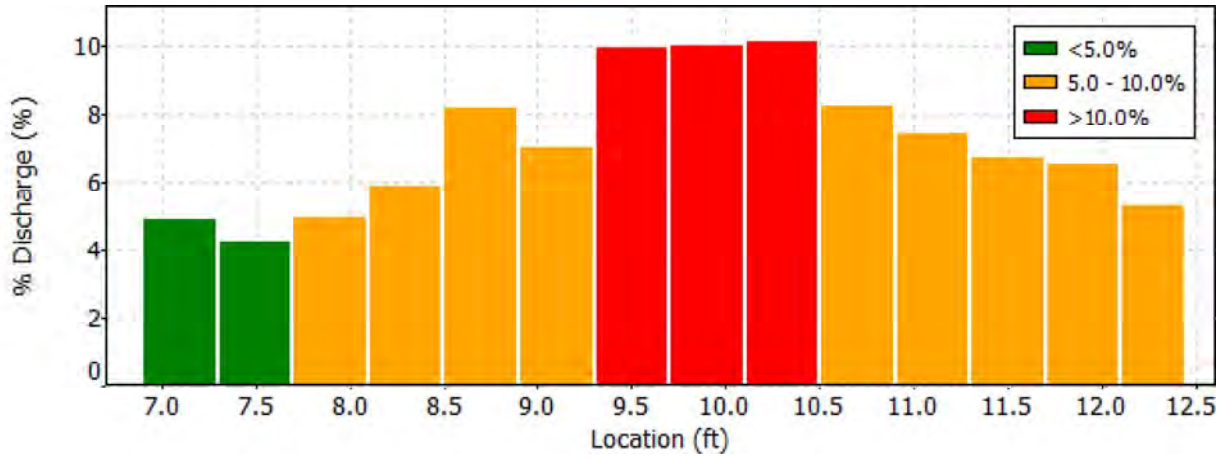
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	10:45	6.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*10:46*	*7.10*	*0.6*	*0.290*	*0.6*	*0.116*	*-2.2083*	*-1.00*	*2.2083*	*0.116*	*0.2561*	*4.9*
2	*10:47*	*7.50*	*0.6*	*0.320*	*0.6*	*0.128*	*1.7359*	*1.00*	*1.7359*	*0.128*	*0.2221*	*4.3*
3	*10:50*	*7.90*	*0.6*	*0.410*	*0.6*	*0.164*	*1.5814*	*1.00*	*1.5814*	*0.164*	*0.2594*	*5.0*
4	10:51	8.30	0.6	0.430	0.6	0.172	1.7753	1.00	1.7753	0.172	0.3054	5.9
5	10:52	8.70	0.6	0.440	0.6	0.176	2.4144	1.00	2.4144	0.176	0.4248	8.2
6	10:53	9.10	0.6	0.430	0.6	0.172	2.1224	1.00	2.1224	0.172	0.3651	7.0
7	10:55	9.50	0.6	0.490	0.6	0.196	2.6473	1.00	2.6473	0.196	0.5190	10.0
8	10:56	9.90	0.6	0.480	0.6	0.192	2.7188	1.00	2.7188	0.192	0.5219	10.1
9	10:57	10.30	0.6	0.480	0.6	0.192	2.7477	1.00	2.7477	0.192	0.5275	10.2
10	10:59	10.70	0.6	0.410	0.6	0.164	2.6217	1.00	2.6217	0.164	0.4300	8.3
11	11:00	11.10	0.6	0.480	0.6	0.192	2.0062	1.00	2.0062	0.192	0.3851	7.4
12	11:01	11.50	0.6	0.300	0.6	0.120	2.9137	1.00	2.9137	0.120	0.3494	6.7
13	11:02	11.90	0.6	0.300	0.6	0.120	2.8320	1.00	2.8320	0.120	0.3396	6.6
14	11:04	12.30	0.6	0.310	0.6	0.124	2.5459	1.00	2.5459	0.109	0.2766	5.3
15	11:04	12.60	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

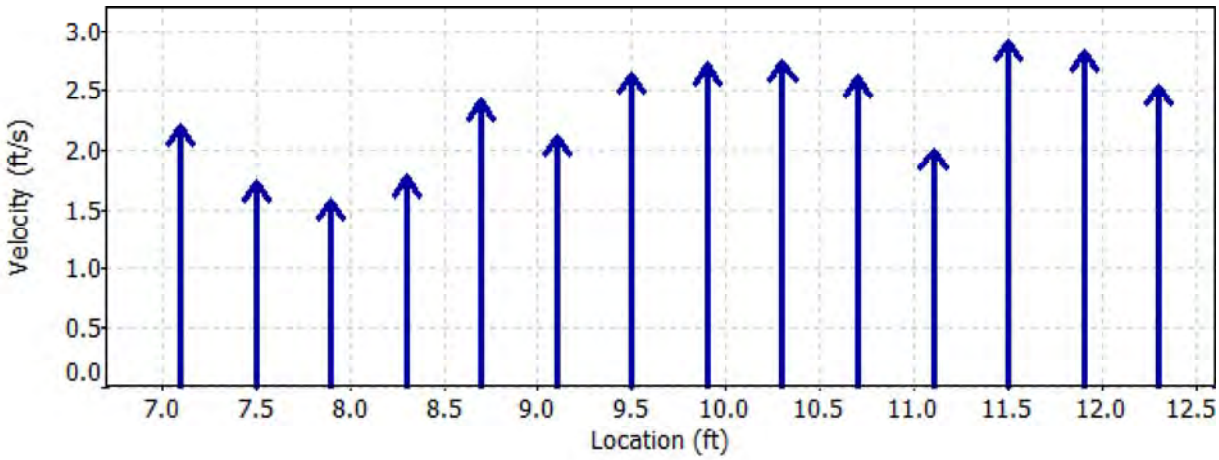
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

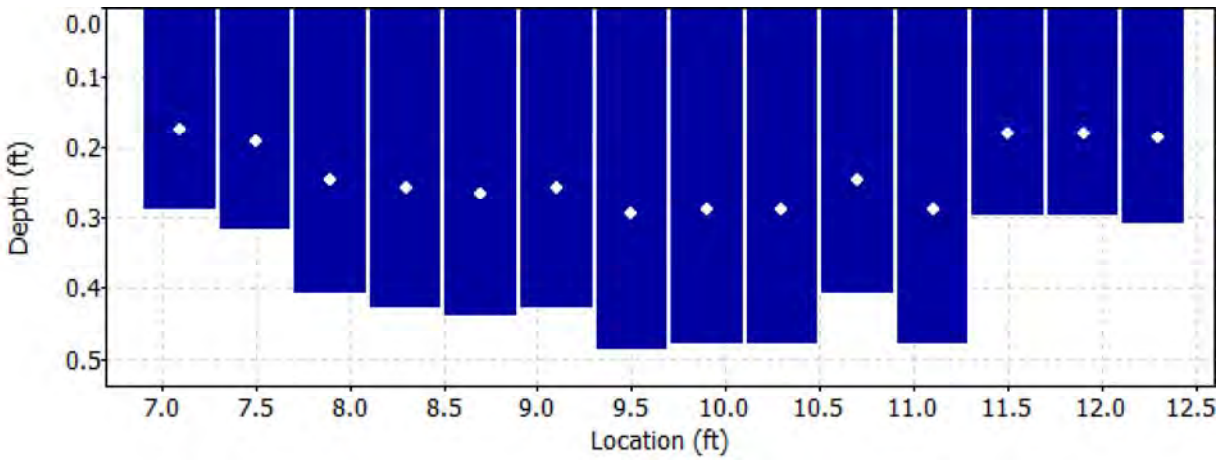
Discharge Measurement Summary

Date Generated: Fri Apr 11 2014

File Information		Site Details	
File Name	BXELDR2X.001.WAD	Site Name	BOXELDER CR BL CANY
Start Date and Time	2014/03/26 10:45:14	Operator(s)	BRIAN EPSTEIN







Discharge Measurement Summary

Date Generated: Fri Apr 11 2014

File Information		Site Details	
File Name	BXELDR2X.001.WAD	Site Name	BOXELDER CR BL CANY
Start Date and Time	2014/03/26 10:45:14	Operator(s)	BRIAN EPSTEIN

Quality Control

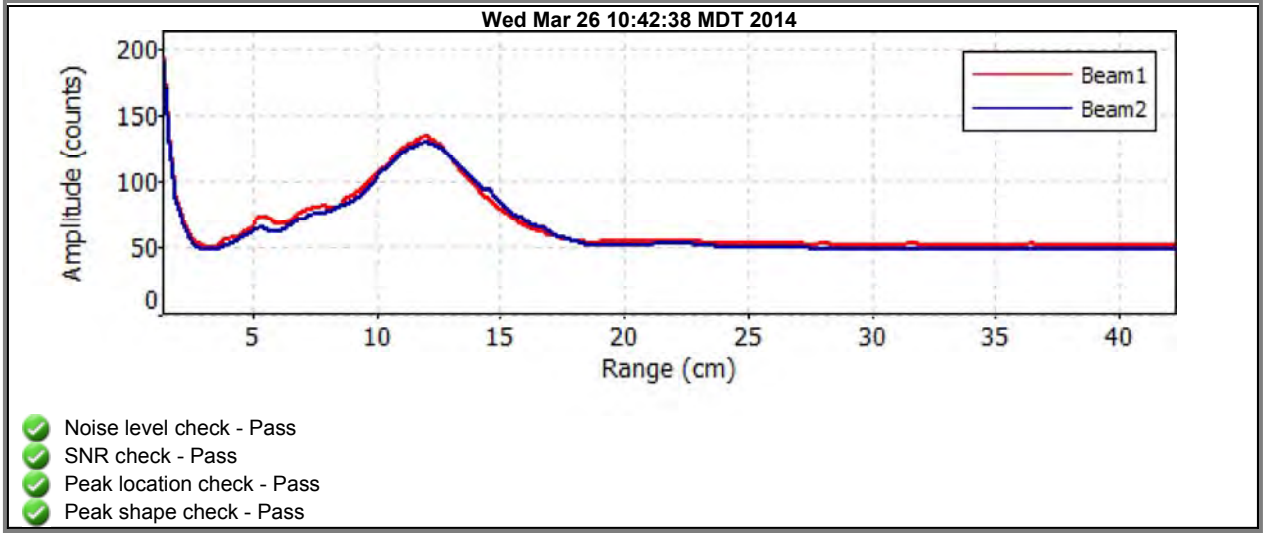
St	Loc	%Dep	Message
1	7.10	0.6	High angle: 180
		0.6	High standard error: 0.094
2	7.50	0.6	High number of spikes: 6
		0.6	High SNR variation during measurement: 3.9,5.2
3	7.90	0.6	High SNR variation during measurement: 4.7,9.9
		0.6	High standard error: 0.124

Discharge Measurement Summary

Date Generated: Fri Apr 11 2014

File Information		Site Details	
File Name	BXELDR2X.001.WAD	Site Name	BOXELDER CR BL CANY
Start Date and Time	2014/03/26 10:45:14	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

State of Colorado

Colorado Water Conservation Board

Field Notes

Boxelder Creek
Temporary Gage

10:50 arrive at temp gage site
- Condition of control upon arrival
  - leafy and woody debris built up on the right side of the channel
- Condition of the staff
  - leafy and woody debris on staff below water surface

10:56 synchronized camera time to iPhone & Nikon time

10:57 staff plate = 1.05 feet (draws down to 1.04 feet)

10:58 Pic 417 from upstream, looking downstream, gage overview, upon arrival

10:59 Pic 418 from left bank, looking cross channel, control condition upon arrival

10:59 Pic 419 staff plate condition upon arrival

11:00 staff plate = 1.05' (bounces down to 1.04' periodically)

11:03 removed debris from staff plate; staff plate = 1.05' (bounces down to 1.04')

11:05 - 11:07 removed debris from control

11:07 staff plate = 0.94' (bounces down to 0.93')

11:08 Pic 420 staff plate, after debris removed from control, water level fell 0.11 feet

11:10 & 11:11 Pic 421 & 422, respectively, from US looking ds, gage overview post debris removal

11:14 Pic 423 from left bank looking cross channel at any control post debris removal

11:23 connected to data logger
current logger reading 0.96', temp 34°F
volts 15.3

11:26:30 logger time = 12:26:52 computer time

Notes By: Brian Eppstein YYYY-MM-DD: 2015-12-07 Page 1 of 4

Boxelder Creek (cont'd)
11:27 downloaded logger: 20151207-1127_BECACWTG.csv
~~11:32:30~~ cleared logger history
11:33:00 ~~synchronized logger to computer time~~
11:32 downloaded logger: 20151207-1132_BECACWTG.csv
11:35 (12:35 logger) cleared history
11:36:01 synchronized logger to computer time
11:37:00 confirmed computer time = iPhone time
11:38:16 programmed logger to begin logging at 11:45 and log every 15 minutes
11:39 disconnected from logger

Control Survey
11:49 set up Spectra Precision Laser LL500 [Pics 424 & 425] and Spectra Precision Laser sensor HL700
5.27' left bank - bankfull line at control
6.31' pzf - center of control
5.21' right bank - bankfull line at control
6.68' base of staff plate
0.96' on rod = 0.94' on staff plate
(12:35 water level)
5.72' water level at staff plate, in gage pool
12:~~43~~ took down survey equipment
12:45 staff plate = 0.93'
• pulled up and down on staff & pt head, neither moved

Discharge Measurement
12:56 set up tagline
12:58 Pic 427 tagline looking from downstream to us
12:58 Pic 428 tagline from right bank
[See discharge measurement sheet Page 3]
13:11 synchronized FlowTracker to Delorme
• minor edge ice above water surface, downstream of tagline

Page 3 of 4	State of Colorado	Meas. No.: ~~008~~ 009
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 12-07	ADV Discharge Measurement Notes	District:

Station Name:	BECACWTG
	Boxelder River, (Creek), Canal, Ditch
At, Near, Above, (Below)	Canyon at Temporary Gage
Latitude:	Longitude:
Party:	Brian Epstein

Conditions

Weather:	~40°F Cloudy
Wind Spd / Dir:	Water Temp:
X-Sec Desc:	In place sand and cobbles
Flow Conds:	Steady minor turbulance
Control Desc.:	natural ficton control, rock bar 4' below

Measurement Rated: Excelent (2%) / Good (5%) (Fair (8%)) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
(See Previous Notes)					

Pressure Transducer Download		Weighted MGH	
File Name:	(See Previous Notes)	GH Corr.	
Time:		Correct MGH	

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	(P2354) P2355
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	BECACWTG.00~~8~~9		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	105	(ft) or mi / upstream or (downstream) of gage			
Start Edge:	REW 0.9	End Edge:	LEW 5.9	Total Width:	5.0
Start Time:	13:18	End Time:	13:46		
Discharge:	2.951	Unsertainty:	3.9	# Stations:	18
Mean v:	1.60	Width	5.00	Mean d:	0.36
Max v:	2.92	Area:	1.78	Max d:	0.51
Mean SNR:	32.2	σv:	0.045	Mean Temp:	36.7

Meas. By:	DJE	Notes By:	DJE
Processed By:		Reviewed By:	

Remarks:

14:00 0.93' = staff plate (bounces up to 0.94')
14:01 connected to logger
• logger not logging, because set to begin in PM (11:45
14:02 pressure transducer = 0.96', temp 35°F, bat 15.3 V
14:05 forced logger to log, 0.96' output
14:06 set logger to begin logging at 14:15 and log every 15 minutes
14:09 disconnected from logger
14:17 depart temp gage site

STATE OF COLORADO

Epstein - DNR, Brian <brian.epstein@state.co.us>

20151026_Boxelder

1 message

Brian Epstein - DNR <brian.epstein@state.co.us> Thu, Nov 12, 2015 at 3:03 PM
To: Brian Epstein <Brian.Epstein@state.co.us>

Boxelder Creek Field Notes

October 26, 2015

Brian Epstein

12:45 Arrive at truck pull off

- packed bag

13:02 began hike to site

13:13 arrived temporary Gage site

- iPhone picture from left bank looking downstream at pt and control

- iPhone picture of staff plate = 0.99'

13:15 staff plate = 0.99'

13:16 control

- two iPhone pictures (1st) from left bank looking cross channel (2nd) from center of channel upstream looking downstream

13:21 connect to logger

13:22:45 computer time = 13:25:47 logger time

13:23:40 synchronized logger time to computer time

13:24 downloaded logger, file name: 20151026-1314_BECACWTG.csv

13:28 clear logger history

13:28 disconnected from logger

13:30 staff plate = 0.99'

14:19 FlowTracker time = iPhone time

Discharge Measurement Notes

- File name: BECACWTG.008

- Location: Boxelder Creek at Temp Gage below Canyon Mouth

- Conditions:

• 52 deg F, light variable breeze, scattered clouds

• x-section bed sand dominated some gravel some fines, ~40' Downstream of pt

• flow lines mostly parallel and normal to tag line (14:09 iPhone Picture from downstream, looking upstream at tagline)

• 14:38 staff = 0.99'

• 14:54 staff = 0.99'

- Summary:

• FlowTracker meter s/n p2354

• start edge/time: REW 2.7 / 14:23

• end edge/time: LEW 8.5 / 14:53

• W = 5.8

• Q = 2.9

• Uncertainty = 3.3%

• Stations = 21

• V mean = 0.97

• V max = 1.44

• W = 5.9

• A = 2.96

• D mean = 0.51

• D max = 0.73

• SNR mean = 34.4

• V mean std error = 0.029

• Water Temp: 49.1 deg F

• Measurement Rating: good (channel width expanding, velocity drawdown on staff surges to 0.97)

15:15 connected to logger

15:16 downloaded logger file name: 20151026-1516_BECACWTG.csv

15:18 programed logger to begin collecting 15:30

15:19 cleared logger history

15:20 forced sample on pt = 0.99' (staff = 0.99')

15:21 disconnected from logger

15:30 depart Gage site

15:50 depart truck pullout

Brian Epstein
Hydrologist, Stream and Lake Protection Section
COLORADO
Colorado Water Conservation Board
Department of Natural Resources
Office: 303-866-3441x3253 | Cell: 720-545-6027
1313 Sherman Street, Room 721, Denver, CO 80203
brian.epstein@state.co.us | www.cwcb.state.co.us

Page 1 of 2	State of Colorado	Meas. No.: 007
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 07-15	ADV Discharge Measurement Notes	District: 10

Station Name: BECACWTG

Boulder River, (Creek), Canal, Ditch

(At) Near, Above, Below tmp gage

Latitude: Longitude:

Party: Brian Eaton

Conditions

Weather: ~70°F mostly cloudy

Wind Spd / Dir: 0 mph Water Temp:

X-Sec Desc: mostly sand & gravel, some cobbles

Flow Conds: mostly straight flowlines

Control Desc.: natural rock bank

Measurement Rated: Excelent (2%) / (Good (5%)) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
14:19	1.12				
15:10	1.12				

Pressure Transducer Download

File Name: (see page 2)

Time: 15:09

Weighted MGH

GH Corr.

Correct MGH

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	R2354 / P2355
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	BECACWTG.007		
Meas Type:	Wading / Boat / Bridge / Cableway			Method:	0.6
	~75	(ft) or mi / upstream or downstream of gage			
Start Edge:	REW 3.9	End Edge:	LEW 9.5	Total Width:	5.6
Start Time:	15:35	End Time:	16:12		
Discharge:	5.374	Unsertainty:	2.6	# Stations:	29
Mean v:	1.823	Width	5.604	Mean d:	0.53
Max v:	2.580	Area:	2.9[illegible]	Max d:	0.80
Mean SNR:	37.0	σv:	0.047	Mean Temp:	62.0

Meas. By: BJE Notes By: BJE

Processed By: Reviewed By:

Remarks: Boxelder Creek @ temp gage

14:12 Arrive Site

14:13 Pic 193-194 gage upon arrival, debris build up on staff plate

14:14-14:16 remove debris from staff

14:17 Pic 195 gage after debris removal

14:18 Pic 196 " (close up of staff)

14:19 staff = 1.12 feet

14:24 attempt to connect to logger failed (suspect batteries)

15:07 replaced batteries

15:07:00 computer time = 15:08:54 logger time

15:09:48 synchronized loggers to computer

15:09 downloaded logger

20150715-1509_BECALWTG.CSV

Page 2 of 2	State of Colorado	Meas. No.: 006
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 05-12	ADV Discharge Measurement Notes	District: 3

Station Name: BECACWTG

Boulder — River, (Creek), Canal, Ditch

At, Near, Above, Below

Latitude: Longitude:

Party: Brian Eastern

Conditions

Weather: Partly Cloudy ~65°F

Wind Spd / Dir: 0 mph / 0° Water Temp:

X-Sec Desc: mostly sand/cobbles/boulder w/ a little silt

Flow Conds: mostly laminar

Control Desc.: natural rock sand

Measurement Rated: Excelent (2%) / (Good (5%)) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
16:25	1.20 +/- 0.03	1.27			
16:35	1.20 +/- 0.03	1.27			
16:45	1.20 +/- 0.03	1.27			

Pressure Transducer Download

File Name: 20150512-1651_BECACWTG.csv

Time: 16:51

Weighted MGH		
GH Corr.		
Correct MGH		

Discharge Measurement

Manufacturer: SonTek Model: FlowTracker S/N: (P2354) / P2355

Firmware: 3.9 Software: 2.20

Diag Test File: (Yes) or No Raw Data File: BECACWTG.006

Meas Type: (Wading) / Boat / Bridge / Cableway Method: 0.6

~75 (ft) or mi / upstream or (downstream) of gage

Start Edge: LEW 1.4 End Edge: LEW 8.4 Total Width: 7.0

Start Time:	16:17	End Time:	16:42		
Discharge:	8.890	Unsertainty:	4.2	# Stations:	15
Mean v:	2.199	Width	6.999	Mean d:	0.58
Max v:	3.005	Area:	4.044	Max d:	0.76
Mean SNR:	41.1	σv:	0.065	Mean Temp:	51.2

Meas. By: BJE Notes By: BJE

Processed By: Reviewed By:

Boxelder Creek May 12, 2015

Remarks:

15:20 arrive temporary gage
15:24 Pic 994 from LEW DS, looking at control and gage
15:26 Pic 995 staff plate upon arrival
- has some debris build up
15:27 debris removed from staff plate
15:29 Pic 996 staff plate
- velocity effected gage pool
- Control looks to be in transition, approx 0.20' below left bank at control
over topped
- currently, bank defining flow
15:34 Vid 997 from left bank looking upstream, flow at control and in gage pool
15:39:35 verizon cellular time equals computer time
15:40 downloaded logger
- Windows crash
15:43:00 verizon cellular time = 14:45:00 logger time
15:43 download logger, screen attempt 20150512-1543_BELACWTG.csv
15:49:44 synchronize logger to computer time
15:49 clear history
15:51 set logger to collect every five minutes beginning at 15:55
15:52 disconnected from logger
16:00 staff = 1.21' ± 0.03
x-section right edge depositional side, left edge erosional side
willows and grass keeping banks in place
16:08 Pic 998 from creek downstream, looking upstream to x-section
16:08 Pic 999 from right bank, looking across x-section
16:39 Pic 104-0001 from center of flood plain looking downstream at flood plain around x-section
16:51 connected to logger
16:51 downloaded logger 20150512-1651_BELACWTG.csv
16:52 cleared history
16:52 programed to collect every 15 minutes starting 17:00
16:53 disconnected logger
17:07 depart field site for truck

Page 1 of 2	State of Colorado	Meas. No.: ~~004~~ 005
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 02-06	ADV Discharge Measurement Notes	District: 76

Station Name: BECACWTG

Boxelder River, (Creek), Canal, Ditch

At, Near, Above, (Below) Confluence North & South Branches

Latitude: Longitude:

Party: Brian Epstein

Conditions

Weather: Sunny with scattered clouds ~58°F

Wind Spd / Dir: gusty & variable Water Temp:

X-Sec Desc: sand/cobbles/boulders

Flow Conds: laminar steady

Control Desc.: natural rock bowl ~3ft ds of PT, two sticks caught (removed after picture)

Measurement Rated: Excelent (2%) / (Good (5%)) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
15:41	0.92		16:40	0.92	
15:43	0.92	0.98			

Pressure Transducer Download

File Name: 20150206-1646_BECACWTG.csv

Time: 16:46

Weighted MGH

GH Corr.

Correct MGH

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	(P2354) / P2355
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	BECACWTG.~~004~~ 005		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	~ 30	(ft) or mi / upstream or (downstream) of gage			
Start Edge:	REW 3.4	End Edge:	LEW ~~8.1~~ 8.1	Total Width:	4.7
Start Time:	16:15	End Time:	16:34		
Discharge:	1.98	Unsertainty:	4.9	# Stations:	13
Mean v:	0.901	Width	4.7	Mean d:	0.53
Max v:	1.026	Area:	2.475	Max d:	0.75
Mean SNR:	31.4	σv:	0.026	Mean Temp:	39°F

Meas. By: BJE Notes By: BJE

Processed By: Reviewed By:

Remarks:

15:39 arrive at Boxelder temp gage
15:40 Pic 877 site condition upon arrival
15:41 Pic 878 staff plate on arrival 0.92'
removed to sticks from control
15:42 Pic 879 site conditions after control clean
15:43 Pic 880 staff plate after control clean
15:46 logger in 0.92'
15:55:00 computer time => 15:55:26 logger time
15:55 downloaded logger: 20150206-1555_BECACWTG.csv
15:59 disconnect from logger

16:40 Staff reading 0.92'
16:43 logged in to data logger and programed
logger to commence at 16:45
16:46 downloaded logger: 20150206-1646_BECACWTG.csv

Page 1 of 2	State of Colorado	Meas. No.: 004
YYYY: 2014	**Colorado Water Conservation Board**	Division: 1
MM-DD: 11-06	ADV Discharge Measurement Notes	District: 76

Station Name: BECACWTG

Boxelder — River, (Creek), Canal, Ditch

(At) Near, Above, Below — Temp Gage

Latitude: Longitude:

Party: Brian Epstein

Conditions

Weather: sunny, clear skies, ~50°F

Wind Spd / Dir: 0 mph — Water Temp:

X-Sec Desc: steady mostly laminar

Flow Conds: cobble, sand bed, square shaped channel

Control Desc.: natural boulder bank, 5 feet downstream of staff

Measurement Rated: Excelent (2%) / Good (5%) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
09:30	0.95	1.00			
09:45	0.95	0.99			
10:00	0.95	0.99			
10:26	0.95	0.99			

Pressure Transducer Download — Weighted MGH

File Name: 20141106-1035_BECACWTG.csv — GH Corr.

Time: 10:35 — Correct MGH

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	P2354 / (P2355)
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	BECACWTG.004		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	~57	(ft) or mi / upstream or (downstream) of gage			
Start Edge:	REW 5.2	End Edge:	LEW 10.7	Total Width:	5.5
Start Time:	09:55	End Time:	10:24		
Discharge:	2.117	Unsertainty:	3.9%	# Stations:	18
Mean v:	0.659	Width	5.5	Mean d:	0.58
Max v:	1.074	Area:	3.212	Max d:	0.80
Mean SNR:	30.3	σv:	0.032	Mean Temp:	39.8

Meas. By:	BJE	Notes By:	BJE
Processed By:		Reviewed By:	

Remarks:

09:02 Arrived Site
09:10 changed FlowTracker batteries
09:26:00 synchronized camera time to phone time
* time change occured between visits ∴ until next logger is 1 hour ahead of local time plus logger drift

09:28 Pic 794 Staff Plate reading 0.95', notice water mark up to 0.97'
09:28 Pic 795 control, natural rock bend, notice leaf debris built up on left bank & right edge of water
09:34 removed leaf debris from control and threw from staff plate
09:37 staff plate 0.95', dropped about 0.003'
09:45 staff plate 0.95', dropped about 0.002'
09:51:45 - synchronized flow Tracker to phone time
10:33:15 phone time = computer time, 11:34:35 logger time
10:35 download logger
10:39:06 synchronized logger time to computer time
10:53 Pic 797 cross-section from downstream
10:58 departed Site

Page 1 of 2	State of Colorado	Meas. No.: 002
YYYY: 2014	**Colorado Water Conservation Board**	Division:
MM-DD: 09-29	ADV Discharge Measurement Notes	District:

Station Name: BECACWTG

Boxelder — River, (Creek), Canal, Ditch

At, Near, Above, Below

Latitude: Longitude:

Party: Brian Epstein

Conditions

Weather: Partly Cloudy 68°F

Wind Spd / Dir: light and variable Water Temp:

X-Sec Desc: sand and cobble with a boulder near LEW

Flow Conds: laminar

Control Desc.: natural boulder band three feet below gage

Measurement Rated: Excelent (2%) / (Good (5%)) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
10:27	1.02 (barely to 1.03)		12:00	1.02 (+/-0.01)	
11:15	1.02 (barely to 1.03)				
11:30	1.02 (barely to 1.03)				
11:45	1.02 (+/-0.01)				
11:53	1.02 (+/-0.01)				

Pressure Transducer Download		Weighted MGH		
File Name:	20140929-1207_BECACWTG.csv	GH Corr.		
Time:	12:07	Correct MGH		

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	P2354 (P2355)
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	BECACWTG.002		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	3	(ft) or mi / (upstream) or downstream of gage			
Start Edge:	REW 1.4	End Edge:	(LEW) 5.7	Total Width:	4.3
Start Time:	11:31	End Time:	11:52		
Discharge:	3.67	Unsertainty:	4.4%	# Stations:	14
Mean v:	1.20	Width	4.3	Mean d:	0.71
Max v:	1.41	Area:	3.05	Max d:	1.14
Mean SNR:	31.6	σv:	0.034	Mean Temp:	54.6

Meas. By:	Brian Epstein	Notes By:	BJE
Processed By:		Reviewed By:	

Remarks:

10:18 Arrive Boxelder Creek temp gage site
10:28 Replaced FlowTracker batteries (SN 823SS)
10:47:00 iPhone equals gps
10:49:00 Lumix Camera synchronized to gps time
10:55 Pic 598 temp gage station and control
10:57 Vid 599 staff plate reading 1.02' and bouncing to 1.03'
11:01 Pic 600 natural boulder control on left edge, leaf debris build up
11:02 cleared leafy debris from control
11:03 Pic 601 natural boulder control on left edge, debris removed
* FlowTracker set to general for BECACWTG.002
∴ measurement aborted w/out taking any velocity readings

12:07 downloaded logger

Page 1 of 2	State of Colorado	Meas. No.: 002
YYYY: 2014	**Colorado Water Conservation Board**	Division:
MM-DD: 09-29	ADV Discharge Measurement Notes	District:

Station Name: BECACWTG

Boxelder — River, (Creek), Canal, Ditch

At, Near, Above, Below

Latitude: Longitude:

Party: Brian Epstein

Conditions

Weather: Partly Cloudy 68°F

Wind Spd / Dir: light and variable Water Temp:

X-Sec Desc: sand and cobble with a boulder near LEW

Flow Conds: laminar

Control Desc.: natural boulder band three feet below gage

Measurement Rated: Excelent (2%) / (Good (5%)) / Fair (8%) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
10:27	1.02 (barely to 1.03)		12:00	1.02 (+/-0.01)	
11:15	1.02 (barely to 1.03)				
11:30	1.02 (barely to 1.03)				
11:45	1.02 (+/-0.01)				
11:53	1.02 (+/-0.01)				

Pressure Transducer Download		Weighted MGH		
File Name:	20140929-1207_BECACWTG.csv	GH Corr.		
Time:	12:07	Correct MGH		

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	P2354 (P2355)
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	BECACWTG.002		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	3	(ft) or mi / (upstream) or downstream of gage			
Start Edge:	REW 1.4	End Edge:	(LEW) 5.7	Total Width:	4.3
Start Time:	11:31	End Time:	11:52		
Discharge:	3.67	Unsertainty:	4.4%	# Stations:	14
Mean v:	1.20	Width	4.3	Mean d:	0.71
Max v:	1.41	Area:	3.05	Max d:	1.14
Mean SNR:	31.6	σv:	0.034	Mean Temp:	54.6

Meas. By:	Brian Epstein	Notes By:	BJE
Processed By:		Reviewed By:	

Remarks:

10:18 Arrive Boxelder Creek temp gage site
10:28 Replaced FlowTracker batteries (SN 823SS)
10:47:00 iPhone equals gps
10:49:00 Lumix Camera synchronized to gps time
10:55 Pic 598 temp gage station and control
10:57 Vid 599 staff plate reading 1.02' and bouncing to 1.03'
11:01 Pic 600 natural boulder control on left edge, leaf debris build up
11:02 cleared leafy debris from control
11:03 Pic 601 natural boulder control on left edge, debris removed
* FlowTracker set to general for BECACWTG.002
∴ measurement aborted w/out taking any velocity readings

12:07 downloaded logger

State of Colorado

Colorado Water Conservation Board

Field Notes

Red Mountain Open Space - Larimer County Res
Party: Brian Epstein, Jeff Baessler, Jay Skinner, Amy Laughlin, Carly Jacobs, & Mattie Albert

Lower Sand Creek
- R2X completed, SC: SCRTXNPL.002
- wide & shallow
- general location by parking lot best to establish a rated section

Upper Sand Creek
- constrained channel, approx 5' wide
- good natural rock band control
  - can establish rated section here
  - best option on Sand Creek

Box Elder below Canyon
- past through gate and cut over to creek at fence line
- all glide, approximately five feet wide
- will require a manmade control
  - design weir to measure around 3cfs definitely under 5 cfs
    - depth of plate 1.00' or 0.75'

Notes By: Brian Epstein YYYY-MM-DD: 2014-07-11 Page 1 of 1

Station Num.	State of Colorado **Colorado Water Conservation Board** ADV Discharge Measurement Notes	Meas. No.: 002
		Comp. By:
		Checked By:

Station Name: Box Elder

River, Creek, Canal, Ditch

At, Near, Above, Below: Canyon

Date: 7/10/2014 Party: Brian Eppler

Conditions

Weather: Thunderstorm Brewing

Wind Spd / Dir: 0 mph / 0° Water Temp:

X-Sec Desc: Sand/gravel bed, at "normal flow" for channel

Flow Conds: mostly laminar stationary

Control Desc.: N/A

Measurement Rate: Excelent (2%) / Good (5%) / Fair (8%) / Poor (>8%)

[based on the above conditions]

Gage Reading

Time	Outside	Inside	Encoder	Recorder	Other
N/A	GPS Waypoint R2X	N 40° 56' 47.52"			
		W 105° 11' 02.32"			
		NAD 83			
Weighted MGH					
GH Corr					
Correct MGH					

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	P2354 / P2355
Firmware:	3.7	Software:	2.20		
Diag Test File:	Yes	Raw Data File:	BXEBCR2X.002		
Meas Type:	Wading / Boat / Bridge / Cableway			Method:	0.6
	N/A		ft. or mi / upstream or downstream of gage		
Start Edge: LEW	4.1	Total Width:	5.4	# Sections:	11
Start Time:	14:46	End Time:	15:07		
Discharge:	2.999	Uncertainty:	5.5%		
Mean v:	1.314	Width	5.4	Mean d:	0.41
Max v:	2.029	Area:	2.287	Max d:	0.56
Mean SNR:	34.8	cv:	0.037	Mean Temp:	62.4

RP 0.5
LEW 4.1
5.4

Remarks:

Page 1 of 2
YYYY: 2014
MM-DD: 03-26

State of Colorado
Colorado Water Conservation Board
ADV Discharge Measurement Notes

Meas. No.: 001
Division: 1
District: 3

Station Name: Boxelder

River, (Creek) Canal, Ditch

At, Near, Above, (Below) Canyon and Above Lake

Latitude: N 40° 56'55.19" Longitude: W 105°11'09.30" NAD83

Party: Brian Epstein & Jay Skinner

Conditions

Weather: Cloudy, ~55°F
Wind Spd / Dir: light down stream breeze Water Temp:
X-Sec Desc: Rocky Bottom
Flow Conds: mostly laminar
Control Desc.: N/A

Measurement Rated: Excelent (2%) / Good (5%) / (Fair (8%)) / Poor (>8%) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.
N/A					

Pressure Transducer Download
File Name: N/A
Time:

Weighted MGH
GH Corr.
Correct MGH

Discharge Measurement

Manufacturer: SonTek Model: FlowTracker S/N: (P2354) / P2355
Firmware: 3.7 Software: 2.20
Diag Test File: (Yes) or No Raw Data File: BXELDR2X.001
Meas Type: (Wading) / Boat / Bridge / Cableway Method: 0.6
N/A ft. or mi / upstream or downstream of gage
Start Edge: LEW 6.7 End Edge: REW 12.6 Total Width: 5.9
Start Time: 10:45 End Time: 11:04
Discharge: 5.182 Unsertainty: 4.0 # Stations: 16
Mean v: 2.342 Width 5.9 Mean d: 0.39
Max v: 2.914 Area: 2.212 Max d: 0.49
Mean SNR: 30.4 σv: 0.059 Mean Temp: 39.4°F

12.6
6.7
5.9

Meas. By: BJE Notes By: BJE
Processed By: Reviewed By:

Remarks:

Picture 9471949 Looking upstream at R2X section

*more pictures on Jeff Baessler camera

GPS: BoxelderBlwCnR2X

State of Colorado

Colorado Water Conservation Board

Field Notes

Box Elder Creek

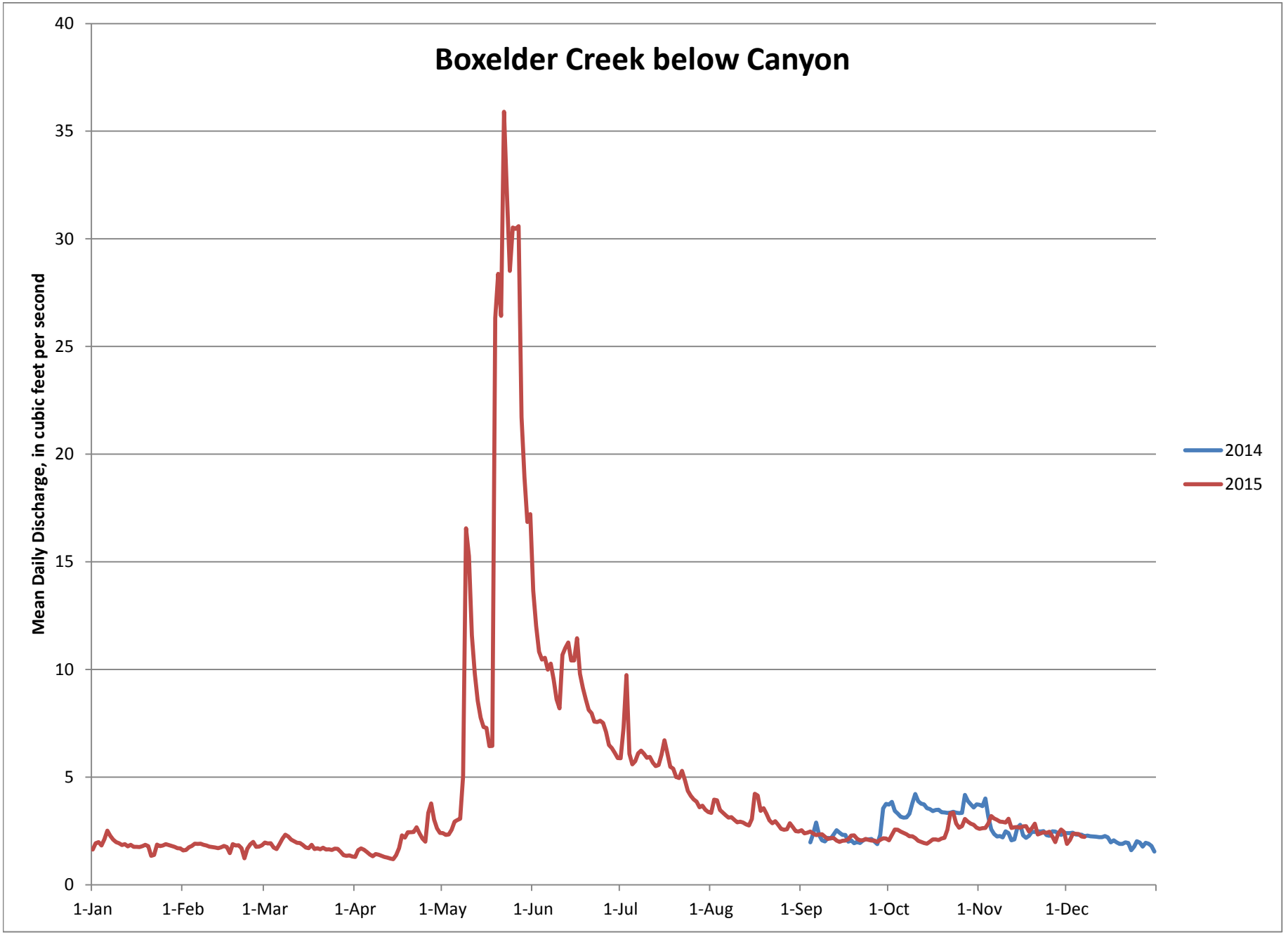
GPS: BoxelderCr Pic N 40° 56' 54.44" NAD 83
W 105° 11' 04.64"

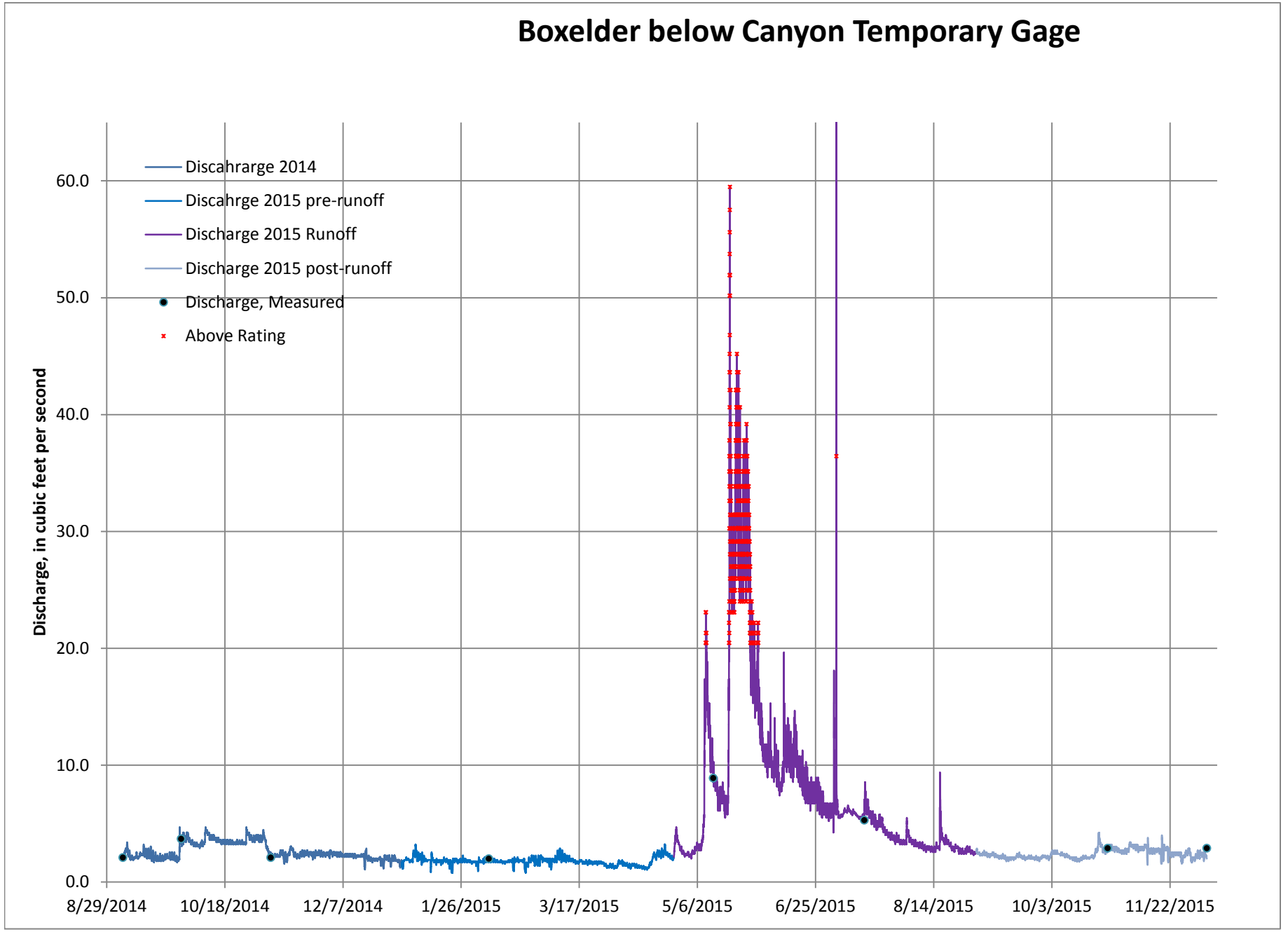
Picture 102-0945 Boxelder Creek above cattle water gap
0946 Larimer County, City of Fort Collins, Gpw & CWCB at Boxelder

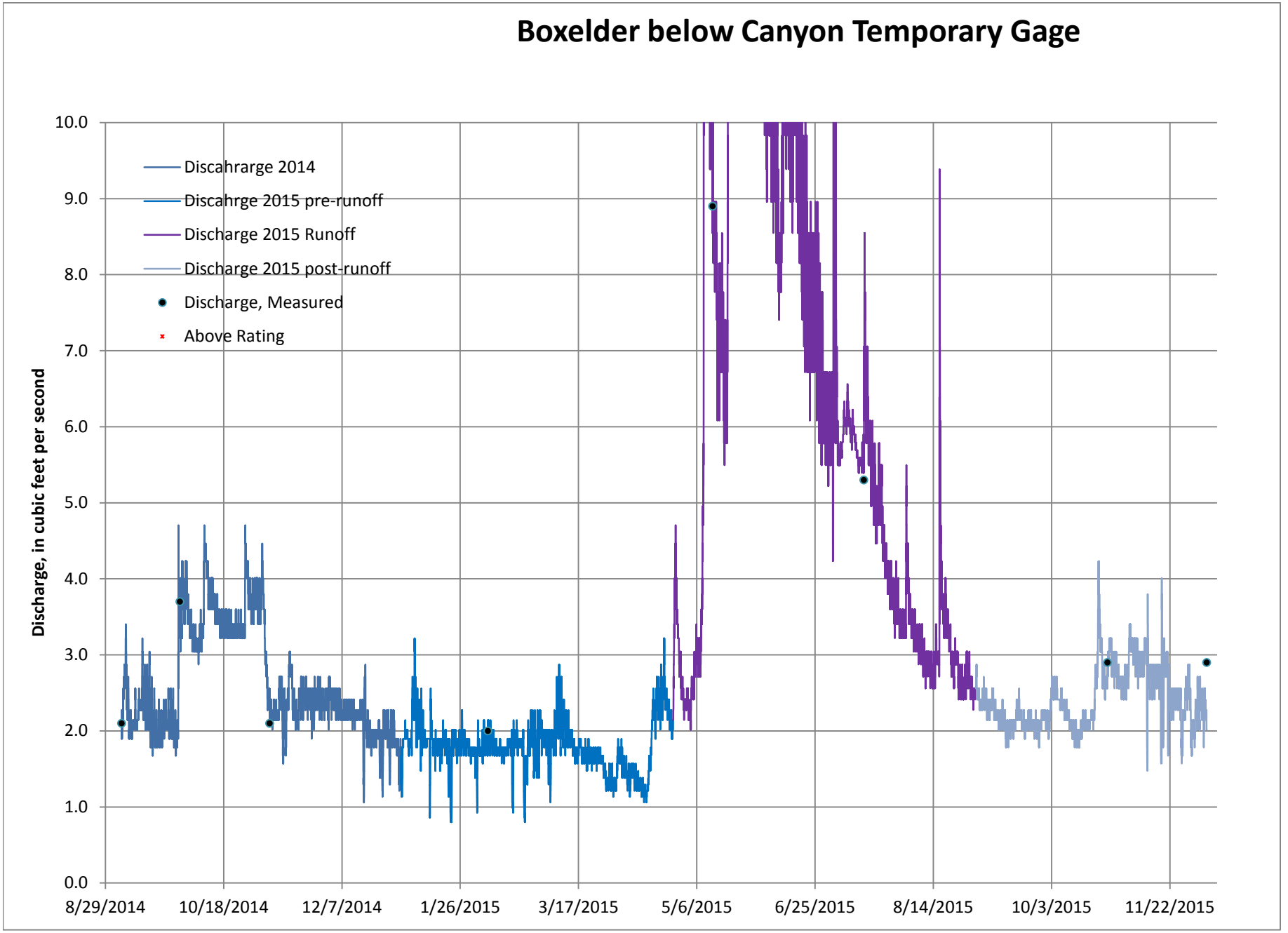
GPS: BoxelderCr UpStr Dam
→ Standing on outflow pipe on downstream side of the most upstream flood retention dam

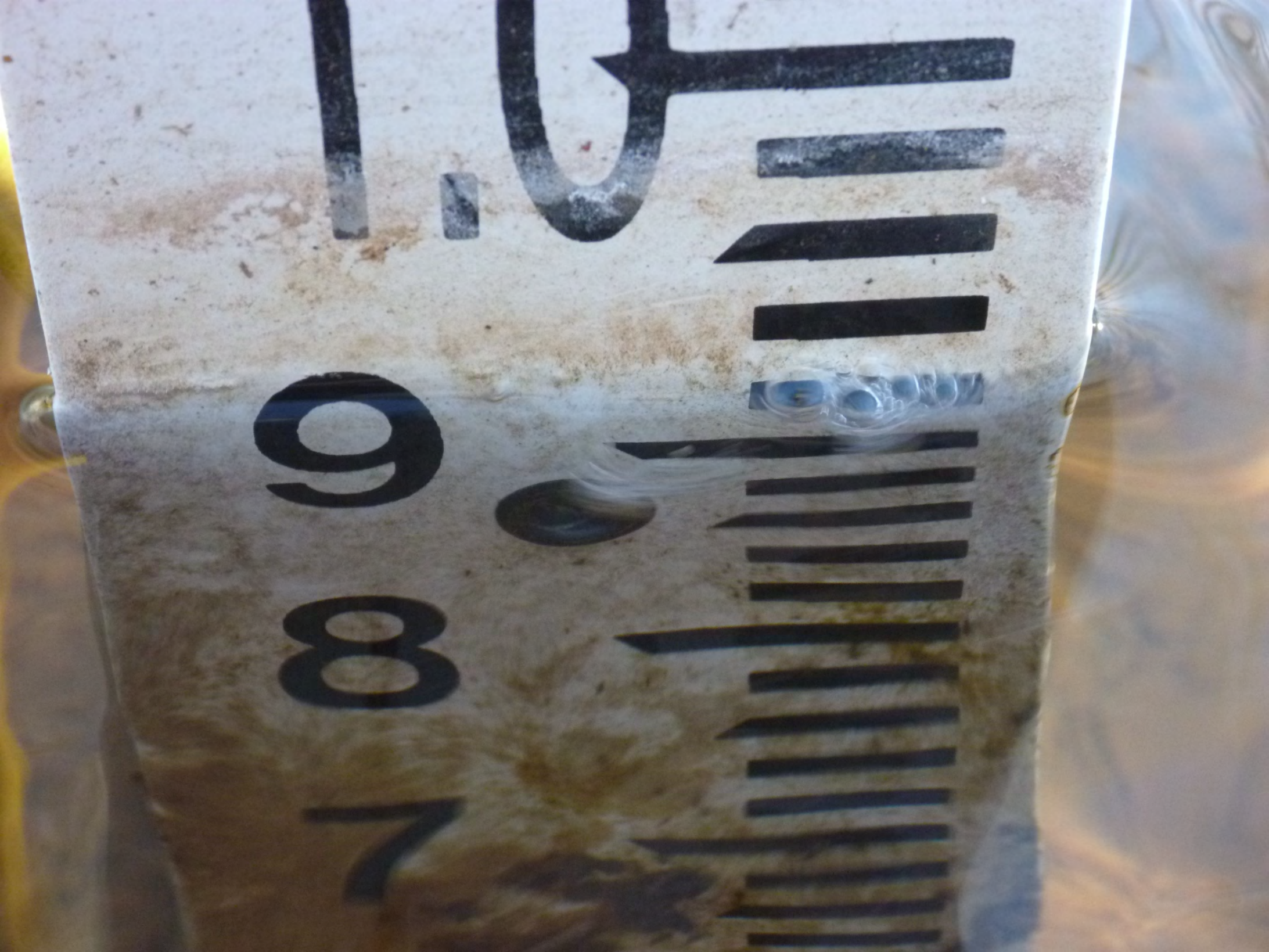
Picture 949 Outflow Boxelder upper most retention dam, from right embankment
950 Video dam from toe on right side
951 outflow from standing on pipe (at GPS location)

Notes By: Brian Epstein YYYY-MM-DD: 2014-03-26 Page 1 of 1


Boxelder Creek below Canyon
Mean Daily Discharge, in cubic feet per second
40
35
30
25
20
15
10
5
0
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
2014
2015


Boxelder below Canyon Temporary Gage
Discahrarge 2014
Discahrge 2015 pre-runoff
Discharge 2015 Runoff
Discharge 2015 post-runoff
Discharge, Measured
Above Rating
Discharge, in cubic feet per second
60.0
50.0
40.0
30.0
20.0
10.0
0.0
8/29/2014
10/18/2014
12/7/2014
1/26/2015
3/17/2015
5/6/2015
6/25/2015
8/14/2015
10/3/2015
11/22/2015


Boxelder below Canyon Temporary Gage
Discharge, in cubic feet per second
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Discahrarge 2014
Discahrge 2015 pre-runoff
Discharge 2015 Runoff
Discharge 2015 post-runoff
Discharge, Measured
Above Rating
8/29/2014
10/18/2014
12/7/2014
1/26/2015
3/17/2015
5/6/2015
6/25/2015
8/14/2015
10/3/2015
11/22/2015


1.0
9
8
7


7
6
5
4
3
2
1
1.0


3
2
1
1.0

2

1

1.0

9

8


4
3
2
1
1.0