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Department of Natural Resources

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13 November 2015

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

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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

Sand Creek

Upper Terminus: A point where Sand Creek enters Colorado from Wyoming (see Recommendation Summary Table for legal description)

Lower Terminus: A point where surface flow ceases (see Recommendation Summary Table for legal description)

Natural Environment:

Sand Creek has an existing natural environment consisting of a wild population of brook trout and fathead minnows; there are on-going discussions with the State of Wyoming regarding the removal of brook trout and the stocking/reintroduction of native cutthroat trout to the upper reaches of Sand Creek. It is believed that there is adequate flow, habitat, and cold water for such an effort to be successful. Sand Creek is very isolated and any such population would be protected as a result of the geographic isolation. The City of Ft. Collins and Larimer County are supportive of this proposal. Sand Creek also supports a diverse macroinvertebrate community. Due to the relative rarity of water features such as this on the high prairie, it is reasonable to assume that Sand Creek and its riparian corridor is important to both terrestrial wildlife and avian species.

R2CROSS Results:

In 2014, CPW, CWCB, Larimer County and City of Fort Collins personnel collected R2CROSS data at 3 sites within the proposed ISF segment. The results of the R2CROSS modeling are summarized below:

Date	Q Measured	40% - 250%	Flow meeting two criteria	Flow meeting three criteria
3/26/2014	5.07 cfs	2.0 - 12.7 cfs	all values out of range	
3/26/2014	4.99 cfs	2.0 - 12.5 cfs	3.5 cfs	5.5 cfs
7/10/2014	3.5 cfs	1.4 - 8.8 cfs	3.3 cfs	
		AVERAGE	3.4 cfs	5.5 cfs

The average of the individual R2CROSS driven seasonal flow recommendations are 3.4 cfs WINTER and 5.5 cfs SUMMER; these flow recommendations are subject to revision after a detailed water availability analysis is conducted by CWCB staff.

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.

Summary of the Suitability of Sand Creek for Greenback Cutthroat Trout Restoration

F. Boyd Wright, Aquatic Biologist
Colorado Parks and Wildlife
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Fort Collins, CO 80526

Overview

Sand Creek was surveyed by Colorado Parks and Wildlife (CPW) in Haygood Canyon on Larimer County's Red Mountain Open Space on 7/29/2015, with the intent of evaluating the stream suitability for a greenback cutthroat trout restoration project. The current fish population was sampled at two locations (table 1, figure 1). The most downstream sample location (DS1) occurred near the mouth of Haygood Canyon and was also sampled by CPW in 2006. The second site (US2) occurred 1.4 stream miles upstream from DS1 and was a new site in 2015. All available fish data were compiled for both sites and are presented in this report.

Table 1. Fish sampling sites in Sand Creek at RMOS

Location ID	Location Description	Coordinates (UTM)	Sampling History	Site Length (ft)	Average Width (ft)
DS1	Mouth of Haygood Canyon	13T 484408 4536597	8/29/2006 7/29/2015	250	7.95
US2	1.4 miles upstream of DS1	13T 483300 4537420	7/29/2015	375	8.52

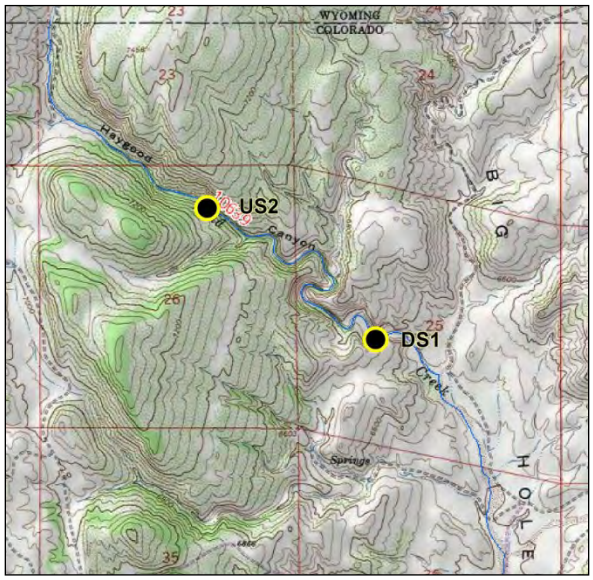


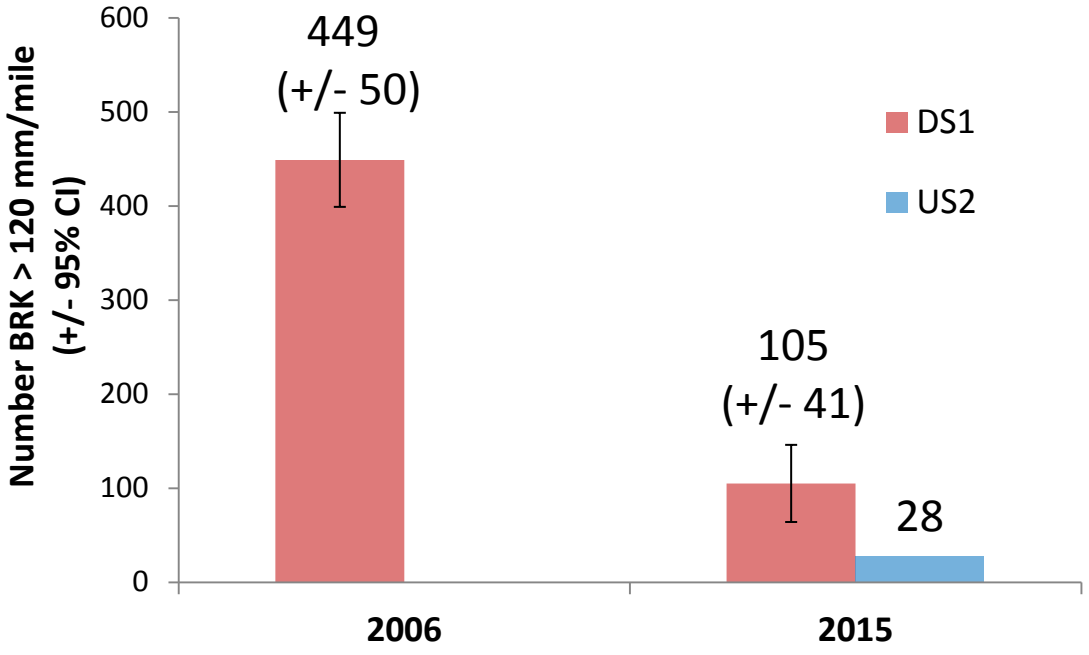
Figure 1. Location of two sample sites in Sand Creek on RMOS

In addition to fish sampling data Sand Creek was walked from the mouth of Haygood Canyon, 1.5 miles upstream to US2 and stream habitat was qualitatively characterized in terms of degree of fragmentation from physical features in the hydrology, availability of spawning and rearing habitat, and availability of over wintering habitat. A temperature data logger was also deployed on 7/29/2015 within the DS1 sampling site. Data was retrieved from the logger on 11/16/2015.

Fish Population Results

Three species were captured at the two sites sampled in Sand Creek in 2015, including brook trout, fathead minnow, and Snake River cutthroat trout. Brook trout were the predominant species and were captured at both sites. Only one Snake River cutthroat trout was observed and it was captured as DS1. It was a relatively large adult (302 mm TL) and was in poor body condition, suggesting it was likely an escapee from a stocked private pond upstream. Fathead minnow were not captured at DS1, but were relatively abundant at DS2. All fathead minnows were adults and also were probably escapees from upstream stoked ponds, since Sand Creek is likely too cold to support fathead minnow reproduction.

Brook trout were the only self-sustaining fish population in Sand Creek. The 2016 population estimates suggest low densities of adult brook trout (>120 mm) currently present in Sand Creek. Adult brook trout were at least three times more abundant at DS1 than at US2 in 2015 (figure 2). In 2015, adult brook trout density at DS1 was approximately 25% of the 2006 estimate at the same site (figure 2).



The pronounced decline in abundance of adult brook trout from 2006 to 2015 can be explained, in part, by the absence of multiple intermediate age classes from the population (figure 3). This marked change in the population age structure was consistent across both sites sampled in 2015 (figure 4). What few adults that were captured in 2015 were larger than the maximum length of adult brook trout that were captured in 2006. In 2015 the population was primarily comprised of juvenile fish, apparently

representing three age classes. Age 0 fish were 30-40 mm , age 1 fish were 80-120 mm, and age 2 fish were 110 to 150 mm. Based on the presence of these age classes and lack of all intermediate age classes, it is likely that something occurred prior to the 2013 fall spawning season that caused a massive reduction in the brook trout population, leaving very few adults that were afforded good growth conditions due to low densities, and that now have had three years to reproduce and begin rebuilding the population. While the exact cause is unknown, it seems likely that the September 2013 flood was the culprit that caused this drastic population decline.

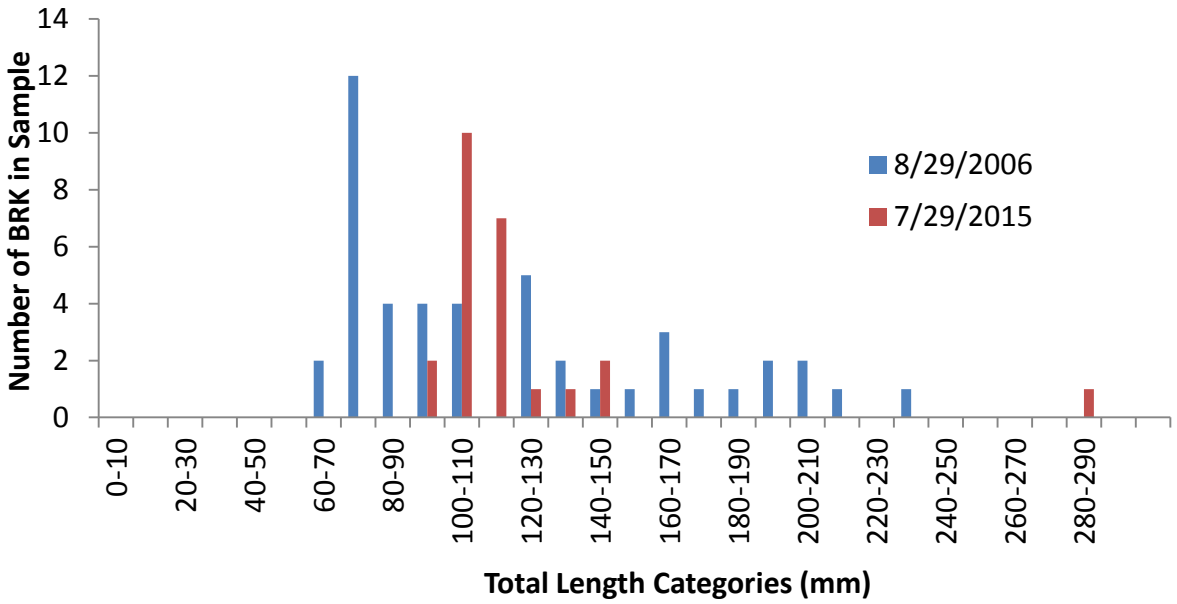


Figure 3. Length frequency of brook trout sampled as site DS1 in Sand Creek on 8/29/2006 (blue) and 7/29/2015 (red).

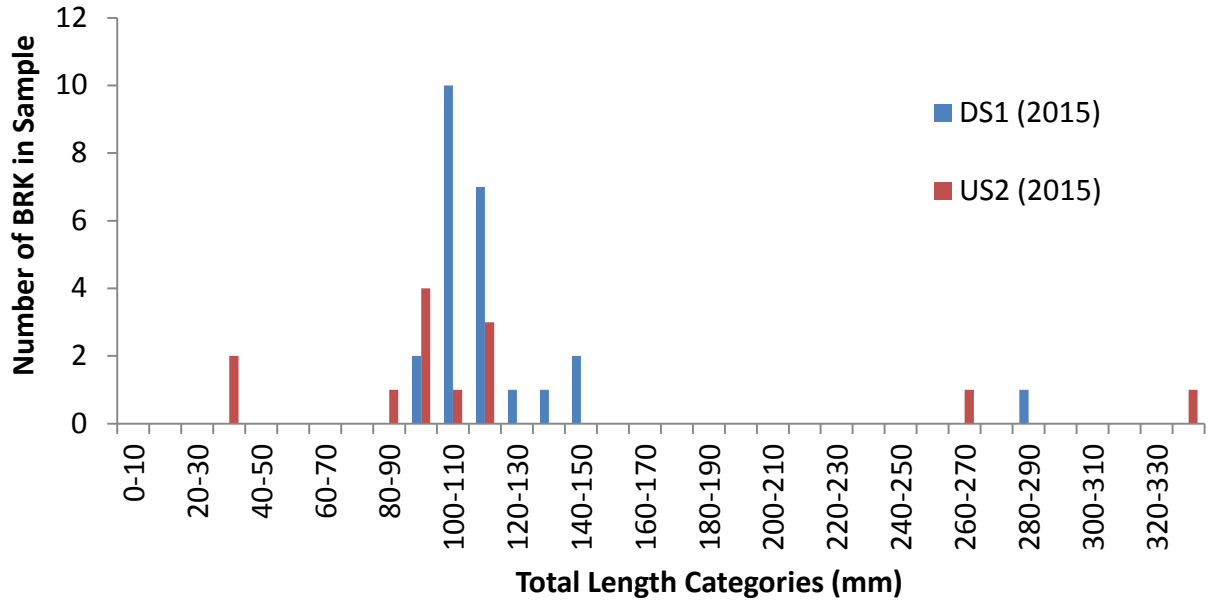


Figure 4. Length frequency of brook trout sampled at two sites in 2015.

Disease Status

Twenty brook trout head samples were collected and submitted to CPW's Aquatic Animal Health Lab for whirling disease testing using the Peptotrypsin Digestion quantitative sport count. Whirling Disease was not detected in the 20 samples submitted.

Habitat Characterization

Sand Creek, from the mouth of Haygood Canyon upstream 1.5 miles featured ample spawning, rearing, and over winter habitat for trout. Though bedrock is a primary bed feature, good spawning gravel was present throughout. Numerous pools of adequate depth for over-winter survival were also found throughout this reach. One potentially concerning aspect of habitat throughout this reach is the presence of multiple potential impedances to fish passage in the form of bedrock chutes and small waterfalls (figure 5a and 5b).

a.  b. 

Figure 5. Exampe bedrock chute (a) and waterfall (b) that were found at multiple locations in Sand Creek.

It is unknown to what degree these features limit fish passage, but it is likely that to some degree they limit gene flow wihin the pouplation thereby decreasing overall genetic diversity.

Water Temperature

The temperuature logger revealed low daily fluctuation in water temperature from the dates of July 29 to November 16, with an average daily temperature of 11.2 ^{o}C that fluctuated within a range of 3-4 ^{o}C (figure 6). Such reltaively little fluctuation is typical of spring-fed streams such as Sand Creek.

Though data across the entire growing season and multipleyears are needed to adequately assess the suitablilty for cutthroat trout recruitment, the temperature data that has been collected suggests that Sand Creek should support strong recruitment and survival of cutthroat trout. The maximum 30 day

average temperature (M30AT), calculated as the mean of the warmest 30 consecutive days, is shown to be a strong indicator of whether stream temperatures meet the minumum requirement (i.e. are warm enough) to support cutthroat trout recrutment (Roberst et al. 2013, Coleman and Fausch 2007)Studies suggest that a minimum M30AT of 8 is needed to support any recruitment of cutthroat trout, and an M30AT above 9 should support good cutthroat trout recruitment. The M30AT for Sand Creek, measured from 7/29/15 to 11/16/15, was 13.3, well above the minimum requirement suggested for cutthroat trout.

The thermal data we collected also suggests that typical maximum water temperatures in Sand Creek should support good survival of cutthroat trout. The warmest 7-day mean of the maximum daily stream temperature (MWMT) is used to determine if streams are cool enough for cutthroat trout survival, with a 26 ^{o}C suggested as the metric beyond which populations are negatively impacted (Roberts et al. 2013). The MWMT of 15.5 suggests that Sand Creek is cool enough to support survival of cutthroat trout. However, temperature data across the entire growning season and among multiple years are needed to better charactarize the thermal regime.

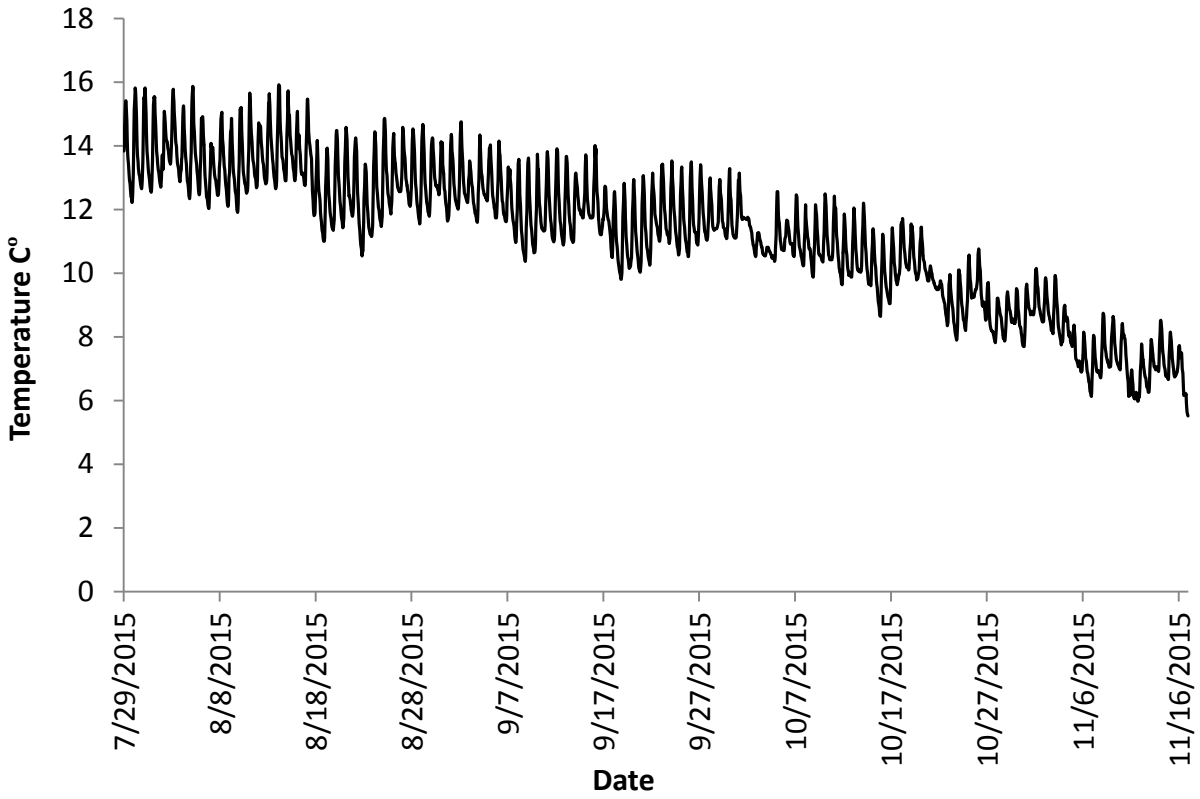


Figure 6. Water temperature data collected at 1 hour intervals, from 7/29/15 to 11/16/15, in Sand Creek at the Mouth of Haygood Canyon.

Summary

- Brook trout comprise the only self-sustaining fish population in Sand Creek, though other trout species and forage species occur at low levels due to stocking practices in upstream ponds.
- Brook abundance seems highly variable across the time frame for which data is available. Though it is likely the population has fluctuated most recently due historic flooding in

September of 2013, more frequent sampling would be required to determine if this was an isolated event in Sand Creek, or if such stochasticity occurrs with greater regularity.

- In-stream habitat features appear favorable for supporting trout populations, with ample over-winter, spawning, and rearing habitat present.
- However, there may be some issues with longitudinal connectivity, due to waterfalls and bedrock chutes that that could limit gene flow by preculding upstream fish movement.
- Thermally, Sand Creek should support cutthroat trout recruitment and survival, though temperature data spanning longer time periods is needed to more accurately charactarize the thermal regime.
- Due to all of these factors, Sand Creek warrants further pursuance of a greenback cuthroat restoration project, with the caveat that close monitoring would be required to assess how these fish perform in what is certainly a unique stream environment compared to the typcial cutthrout restoration stream.
- Species composition was influenced by stocking practices in private ponds located upstream in Wyoming. Therefore, to promote a successful cutthroat trout reintroduction, certain measures would be required to prevent fish stocked into private ponds located upstream from escaping and establishing in Sand Creek. This could include chemically treating the ponds and stocking them with sterile fish and/or with greenback cutthroat trout, or the more costly option of screening outlet structures in the ponds.

Literature Cited

Coleman, M.A., and K.D. Fausch. 2007. Cold summer temperature limits recruitment of Age-0 cutthroat trout in high elevation Colorado streams. Transactions of the American Fisheries Society 136:1231-1244.

Roberts, J.J., K.D. Fausch, D.P. Peterson, and M.B. Hooten. 2013. Fragmentation and thermal risks from climate change interact to affect persistence of native trout in the Colorado River Basin. Global Climate Change Biology 19:1383-1398.

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

LOCATION INFORMATION

STREAM NAME:	Sand Creek
XS LOCATION:	0
XS NUMBER:	Lower
DATE:	7.10.14
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

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.005

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

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

STREAM NAME: Sand Creek
XS LOCATION: 0
XS NUMBER: Lower

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
	0.00	5.05			0.00		0.00	0.00	0.0%
1 gl	2.20	5.05			0.00		0.00	0.00	0.0%
	4.30	6.15			0.00		0.00	0.00	0.0%
wl	5.40	6.45	0.00	0.00	0.00		0.00	0.00	0.0%
	6.00	6.60	0.20	0.65	0.62	0.20	0.16	0.10	3.0%
	7.00	6.70	0.30	0.65	1.00	0.30	0.30	0.20	5.6%
	8.00	6.75	0.35	0.65	1.00	0.35	0.35	0.23	6.5%
	9.00	6.80	0.40	0.65	1.00	0.40	0.40	0.26	7.4%
	10.00	6.90	0.45	0.65	1.00	0.45	0.45	0.29	8.3%
	11.00	6.80	0.40	0.65	1.00	0.40	0.40	0.26	7.4%
	12.00	6.80	0.40	0.65	1.00	0.40	0.40	0.26	7.4%
	13.00	6.75	0.35	0.65	1.00	0.35	0.35	0.23	6.5%
	14.00	6.85	0.45	0.65	1.00	0.45	0.45	0.29	8.3%
	15.00	6.75	0.35	0.65	1.00	0.35	0.35	0.23	6.5%
	16.00	6.75	0.30	0.65	1.00	0.30	0.30	0.20	5.6%
	17.00	6.75	0.35	0.65	1.00	0.35	0.35	0.23	6.5%
	18.00	6.80	0.40	0.65	1.00	0.40	0.40	0.26	7.4%
	19.00	6.70	0.30	0.65	1.00	0.30	0.30	0.20	5.6%
	20.00	6.60	0.20	0.65	1.00	0.20	0.20	0.13	3.7%
	21.00	6.55	0.20	0.65	1.00	0.20	0.23	0.15	4.3%
wl	22.30	6.35	0.00	0.00	1.32		0.00	0.00	0.0%
	25.00	6.05			0.00		0.00	0.00	0.0%
	30.00	6.00			0.00		0.00	0.00	0.0%
1 gl	34.00	5.60			0.00		0.00	0.00	0.0%
TOTALS ----------					16.97	0.45 (Max.)	5.39	3.50	100.0%

Manning's n = 0.0752
Hydraulic Radius= 0.31752728

STREAM NAME: Sand Creek
XS LOCATION: 0
XS NUMBER: Lower

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	5.39	5.43	0.7%
6.15	5.39	9.99	85.3%
6.17	5.39	9.59	78.0%
6.19	5.39	9.20	70.7%
6.21	5.39	8.82	63.6%
6.23	5.39	8.44	56.6%
6.25	5.39	8.07	49.7%
6.27	5.39	7.70	42.9%
6.29	5.39	7.34	36.1%
6.31	5.39	6.98	29.5%
6.33	5.39	6.63	22.9%
6.35	5.39	6.28	16.5%
6.36	5.39	6.11	13.3%
6.37	5.39	5.94	10.1%
6.38	5.39	5.76	7.0%
6.39	5.39	5.60	3.8%
6.40	5.39	5.43	0.7%
6.41	5.39	5.26	-2.4%
6.42	5.39	5.09	-5.5%
6.43	5.39	4.93	-8.5%
6.44	5.39	4.77	-11.6%
6.45	5.39	4.60	-14.6%
6.47	5.39	4.28	-20.6%
6.49	5.39	3.96	-26.5%
6.51	5.39	3.65	-32.3%
6.53	5.39	3.34	-38.1%
6.55	5.39	3.03	-43.8%
6.57	5.39	2.73	-49.3%
6.59	5.39	2.44	-54.7%
6.61	5.39	2.16	-59.9%
6.63	5.39	1.89	-65.0%
6.65	5.39	1.63	-69.9%

WATERLINE AT ZERO
AREA ERROR = 6.402

STREAM NAME: Sand Creek
XS LOCATION: 0
XS NUMBER: Lower

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	5.60	30.75	0.80	1.30	24.54	31.04	100.0%	0.79	29.30	1.19
	5.60	30.72	0.80	1.30	24.47	31.01	99.9%	0.79	29.18	1.19
	5.65	30.13	0.76	1.25	22.95	30.40	97.9%	0.75	26.57	1.16
	5.70	29.53	0.73	1.20	21.46	29.79	96.0%	0.72	24.08	1.12
	5.75	28.94	0.69	1.15	19.99	29.18	94.0%	0.69	21.70	1.09
	5.80	28.34	0.65	1.10	18.56	28.57	92.0%	0.65	19.45	1.05
	5.85	27.75	0.62	1.05	17.16	27.96	90.1%	0.61	17.31	1.01
	5.90	27.15	0.58	1.00	15.79	27.35	88.1%	0.58	15.29	0.97
	5.95	26.55	0.54	0.95	14.45	26.74	86.1%	0.54	13.38	0.93
	6.00	25.76	0.51	0.90	13.13	25.92	83.5%	0.51	11.66	0.89
	6.05	20.87	0.57	0.85	11.97	21.02	67.7%	0.57	11.49	0.96
	6.10	20.32	0.54	0.80	10.94	20.46	65.9%	0.53	10.07	0.92
	6.15	19.77	0.50	0.75	9.94	19.90	64.1%	0.50	8.74	0.88
	6.20	19.14	0.47	0.70	8.97	19.25	62.0%	0.47	7.53	0.84
	6.25	18.50	0.43	0.65	8.03	18.61	60.0%	0.43	6.40	0.80
	6.30	17.87	0.40	0.60	7.12	17.97	57.9%	0.40	5.36	0.75
	6.35	17.24	0.36	0.55	6.24	17.33	55.8%	0.36	4.41	0.71
WL	6.40	16.74	0.32	0.50	5.39	16.81	54.2%	0.32	3.53	0.65
	6.45	16.23	0.28	0.45	4.57	16.29	52.5%	0.28	2.73	0.60
	6.50	15.70	0.24	0.40	3.77	15.76	50.8%	0.24	2.03	0.54
	6.55	15.15	0.20	0.35	3.00	15.19	49.0%	0.20	1.42	0.47
	6.60	13.95	0.16	0.30	2.27	13.99	45.1%	0.16	0.94	0.42
	6.65	12.95	0.12	0.25	1.60	12.99	41.9%	0.12	0.55	0.35
	6.70	11.93	0.08	0.20	0.97	11.96	38.5%	0.08	0.26	0.26
	6.75	8.30	0.05	0.15	0.42	8.32	26.8%	0.05	0.08	0.19
	6.80	2.91	0.04	0.10	0.12	2.92	9.4%	0.04	0.02	0.16
	6.85	0.95	0.02	0.05	0.02	0.96	3.1%	0.02	0.00	0.12

STREAM NAME: Sand Creek
XS LOCATION: 0
XS NUMBER: Lower

SUMMARY SHEET

MEASURED FLOW (Qm)=	3.50	cfs
CALCULATED FLOW (Qc)=	3.53	cfs
(Qm-Qc)/Qm * 100 =	-0.6	%
MEASURED WATERLINE (WLm)=	6.40	ft
CALCULATED WATERLINE (WLc)=	6.40	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.45	ft
MAX CALCULATED DEPTH (Dc)=	0.50	ft
(Dm-Dc)/Dm * 100	-10.6	%
MEAN VELOCITY=	0.65	ft/sec
MANNING'S N=	0.075	
SLOPE=	0.005	ft/ft
.4 * Qm =	1.4	cfs
2.5 * Qm=	8.8	cfs

RECOMMENDED INSTREAM FLOW:
==============================

FLOW (CFS)	PERIOD
===========	========
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

RATIONALE FOR RECOMMENDATION:
==============================

RECOMMENDATION BY: ……………………………………………… AGENCY……………………………………………… DATE:………………………………

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

STREAM NAME: Sand Creek
XS LOCATION: 0
XS NUMBER: Lower

Jarrett Variable Manning's n Correction Applied

STAGING TABLE

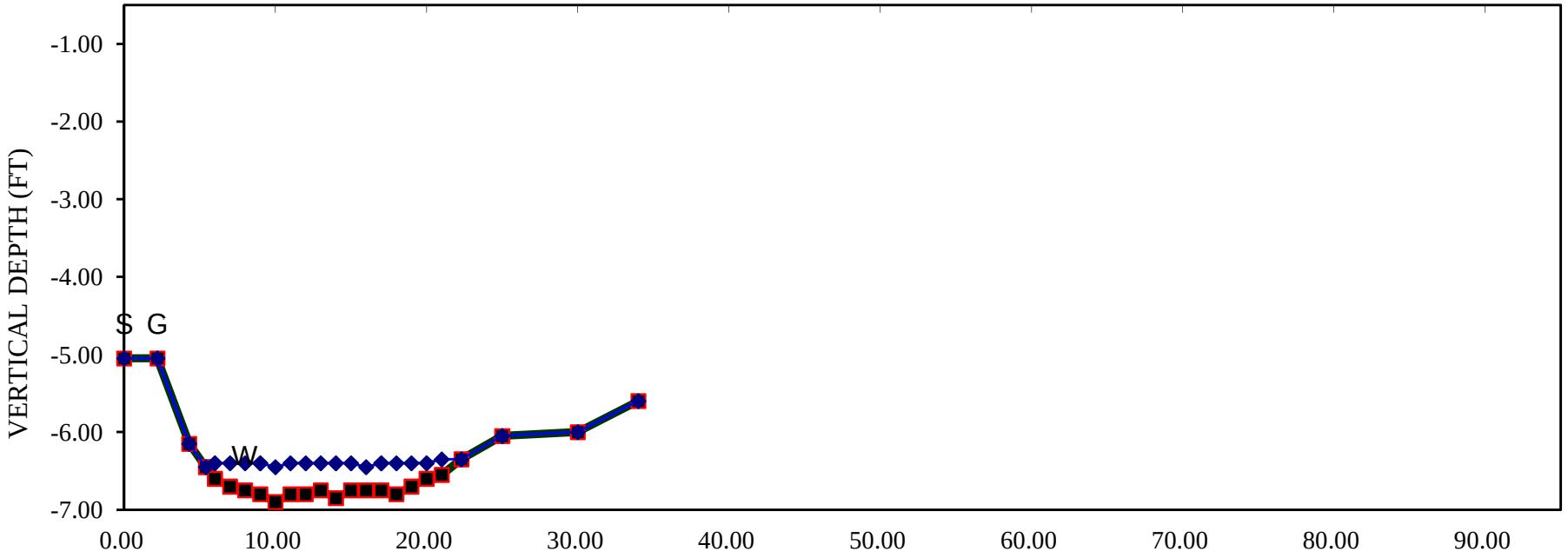
GL = lowest Grassline elevation corrected for sag
WL = Waterline corrected for variations in field measured water surface elevations and sag

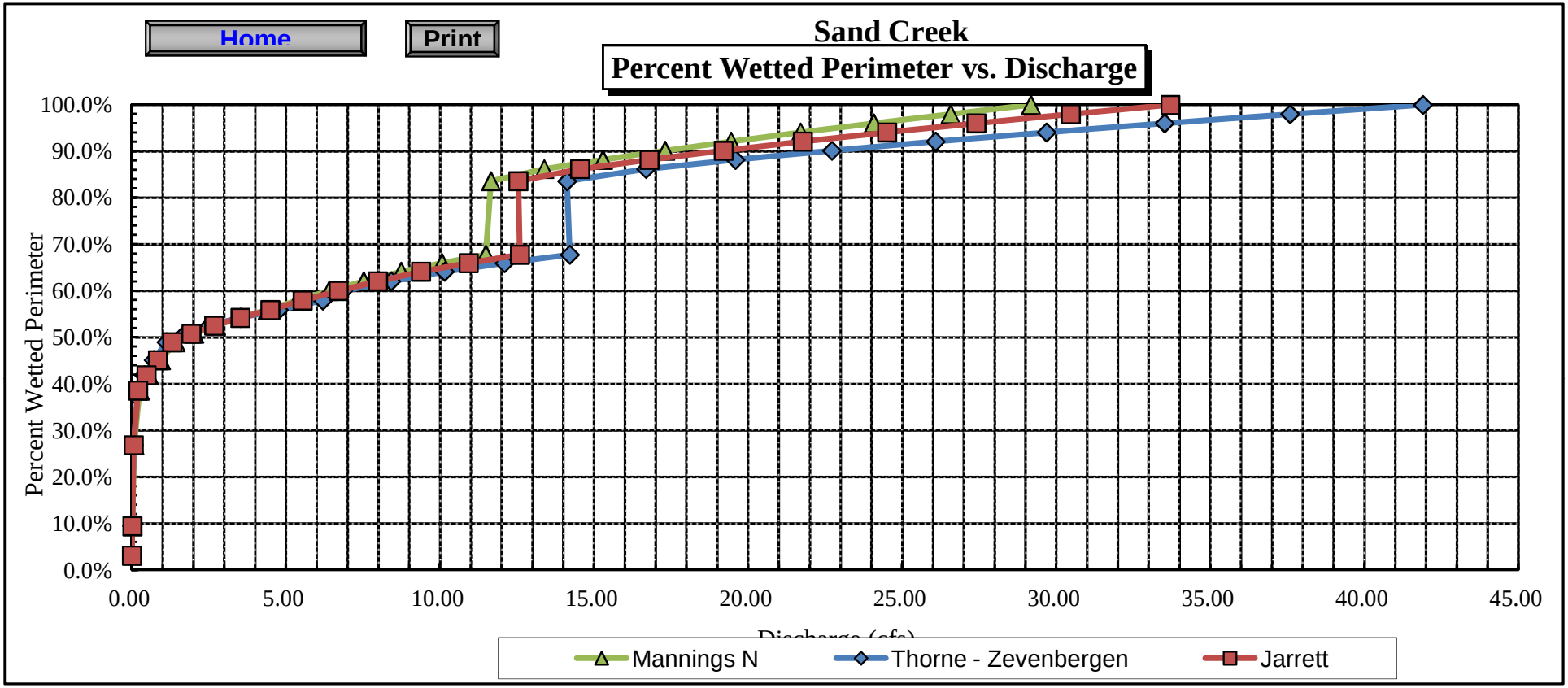
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.60	30.75	0.80	1.30	24.54	31.04	100.0%	0.79	33.86	1.38
	5.60	30.72	0.80	1.30	24.47	31.01	99.9%	0.79	33.71	1.38
	5.65	30.13	0.76	1.25	22.95	30.40	97.9%	0.75	30.47	1.33
	5.70	29.53	0.73	1.20	21.46	29.79	96.0%	0.72	27.41	1.28
	5.75	28.94	0.69	1.15	19.99	29.18	94.0%	0.69	24.51	1.23
	5.80	28.34	0.65	1.10	18.56	28.57	92.0%	0.65	21.78	1.17
	5.85	27.75	0.62	1.05	17.16	27.96	90.1%	0.61	19.21	1.12
	5.90	27.15	0.58	1.00	15.79	27.35	88.1%	0.58	16.80	1.06
	5.95	26.55	0.54	0.95	14.45	26.74	86.1%	0.54	14.55	1.01
	6.00	25.76	0.51	0.90	13.13	25.92	83.5%	0.51	12.54	0.95
	6.05	20.87	0.57	0.85	11.97	21.02	67.7%	0.57	12.59	1.05
	6.10	20.32	0.54	0.80	10.94	20.46	65.9%	0.53	10.93	1.00
	6.15	19.77	0.50	0.75	9.94	19.90	64.1%	0.50	9.38	0.94
	6.20	19.14	0.47	0.70	8.97	19.25	62.0%	0.47	7.99	0.89
	6.25	18.50	0.43	0.65	8.03	18.61	60.0%	0.43	6.71	0.84
	6.30	17.87	0.40	0.60	7.12	17.97	57.9%	0.40	5.55	0.78
	6.35	17.24	0.36	0.55	6.24	17.33	55.8%	0.36	4.49	0.72
WL	6.40	16.74	0.32	0.50	5.39	16.81	54.2%	0.32	3.53	0.65
	6.45	16.23	0.28	0.45	4.57	16.29	52.5%	0.28	2.67	0.59
	6.50	15.70	0.24	0.40	3.77	15.76	50.8%	0.24	1.93	0.51
	6.55	15.15	0.20	0.35	3.00	15.19	49.0%	0.20	1.31	0.44
	6.60	13.95	0.16	0.30	2.27	13.99	45.1%	0.16	0.84	0.37
	6.65	12.95	0.12	0.25	1.60	12.99	41.9%	0.12	0.47	0.30
	6.70	11.93	0.08	0.20	0.97	11.96	38.5%	0.08	0.20	0.21
	6.75	8.30	0.05	0.15	0.42	8.32	26.8%	0.05	0.06	0.14
	6.80	2.91	0.04	0.10	0.12	2.92	9.4%	0.04	0.01	0.12
	6.85	0.95	0.02	0.05	0.02	0.96	3.1%	0.02	0.00	0.08

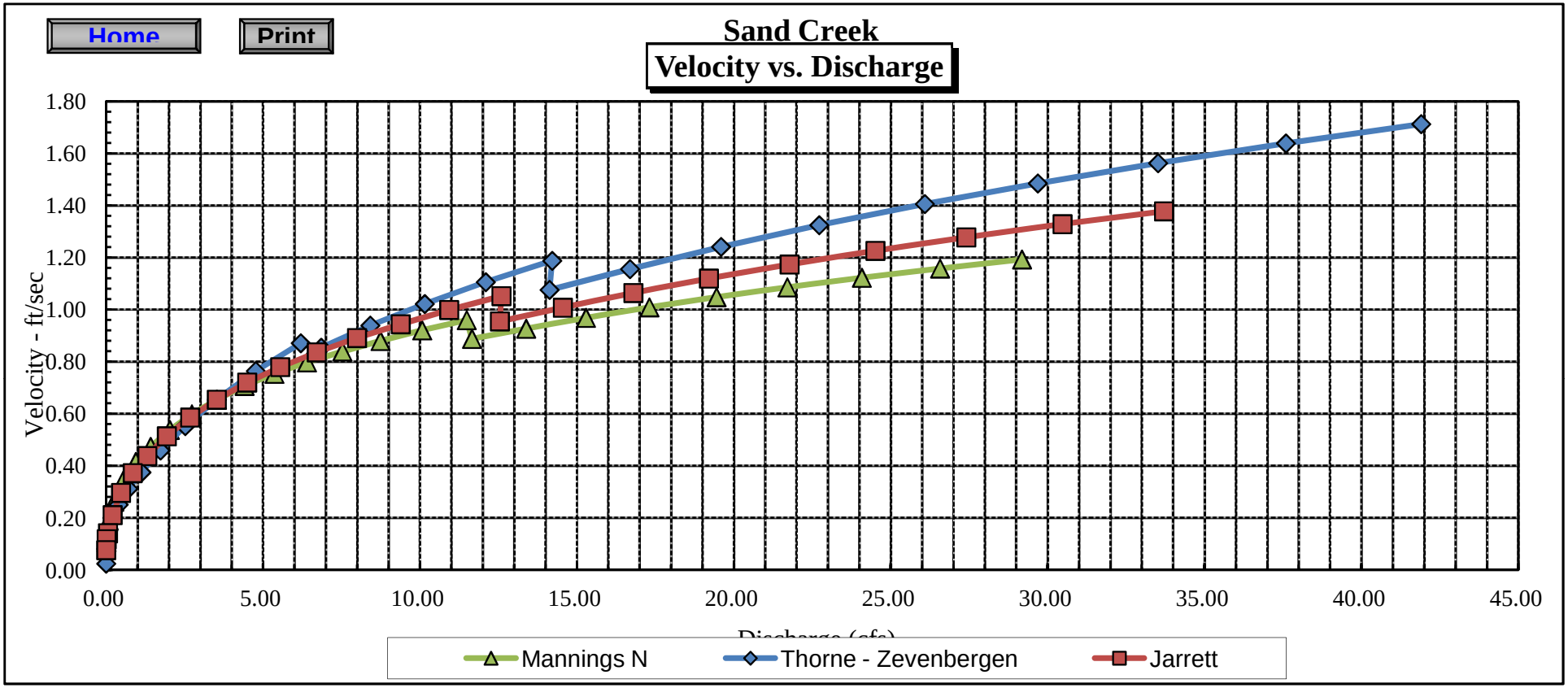
Home Print

Sand Creek

CROSS SECTION DATA ANALYSIS



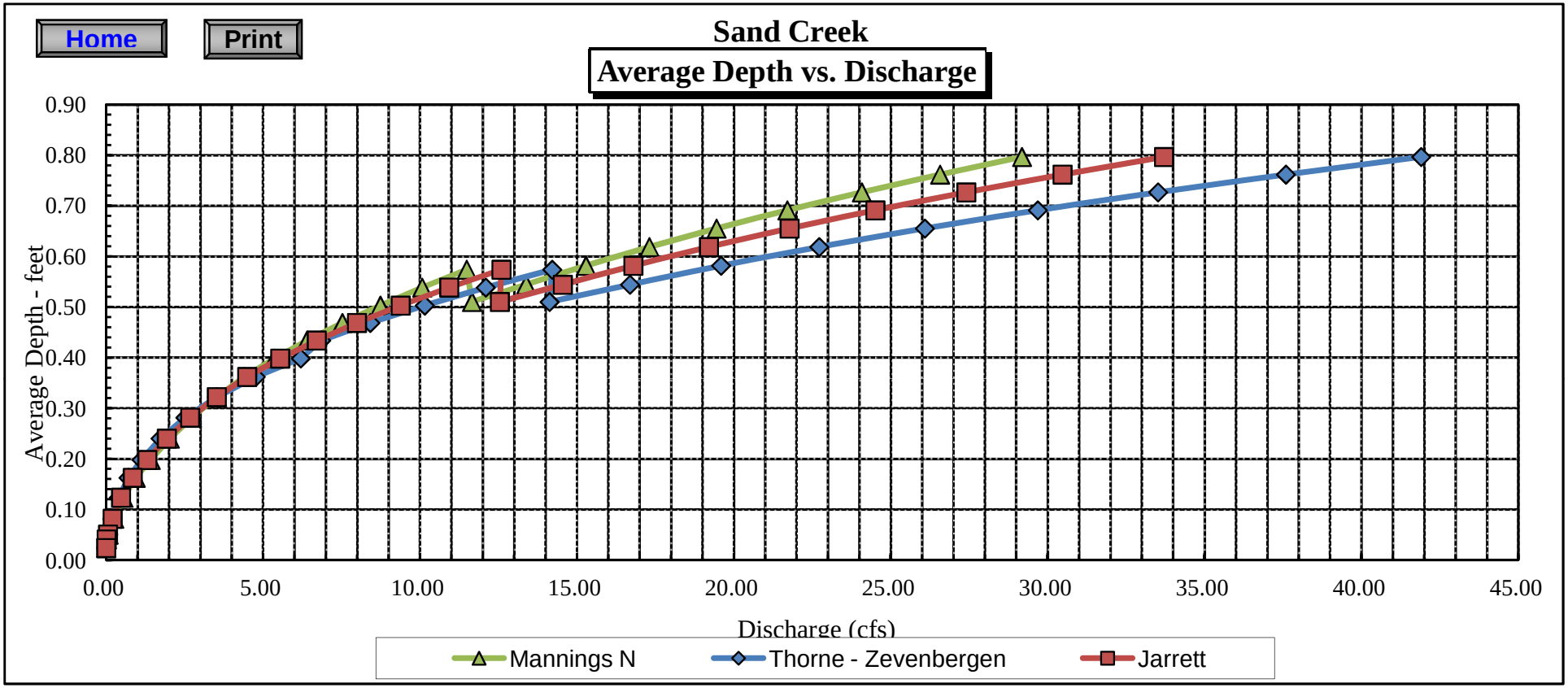

Home
Print
Sand Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Mannings N
Thorne - Zevenbergen
Jarrett

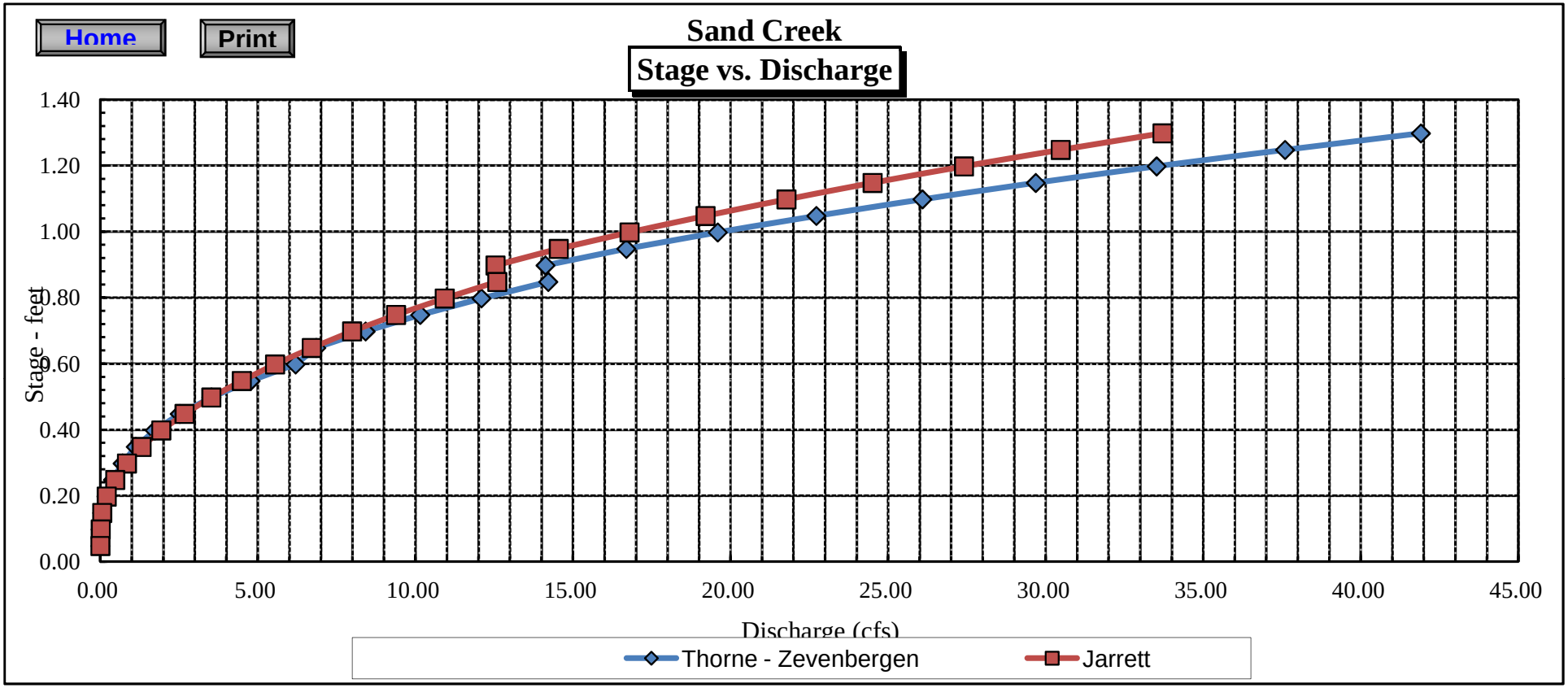

Home
Print
Sand Creek
Velocity vs. Discharge
Velocity - ft/sec
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Mannings N
Thorne - Zevenbergen
Jarrett

Home Print

Sand Creek

Average Depth vs. Discharge




Home
Print
Sand Creek
Stage vs. Discharge
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
30.00
35.00
40.00
45.00
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:	Sand Creek
XS LOCATION:	Lower
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

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.005

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

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

STREAM NAME: Sand Creek
XS LOCATION: Lower
XS NUMBER: 0

DATA POINTS= 35

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
		0.00	5.40			0.00		0.00	0.00	0.0%
1	gl	2.00	5.75			0.00		0.00	0.00	0.0%
		5.00	6.55			0.00		0.00	0.00	0.0%
	wl	5.90	7.01	0.00	0.00	0.00		0.00	0.00	0.0%
		6.40	7.20	0.30	0.01	0.53	0.30	0.15	0.00	0.0%
		6.90	7.40	0.40	0.72	0.54	0.40	0.20	0.14	2.9%
		7.40	7.45	0.50	1.21	0.50	0.50	0.25	0.30	6.1%
		7.90	7.60	0.65	0.97	0.52	0.65	0.33	0.32	6.3%
		8.40	7.65	0.65	0.71	0.50	0.65	0.33	0.23	4.6%
		8.90	7.55	0.60	1.00	0.51	0.60	0.30	0.30	6.0%
		9.40	7.45	0.45	0.98	0.51	0.45	0.23	0.22	4.4%
		9.90	7.45	0.30	1.06	0.50	0.30	0.15	0.16	3.2%
		10.40	7.30	0.35	0.84	0.52	0.35	0.18	0.15	2.9%
		10.90	7.30	0.30	0.97	0.50	0.30	0.15	0.15	2.9%
		11.40	7.30	0.35	0.56	0.50	0.35	0.18	0.10	2.0%
		11.90	7.35	0.30	1.08	0.50	0.30	0.15	0.16	3.2%
		12.40	7.30	0.35	1.00	0.50	0.35	0.18	0.18	3.5%
		12.90	7.30	0.30	0.99	0.50	0.30	0.15	0.15	3.0%
		13.40	7.40	0.40	1.12	0.51	0.40	0.20	0.22	4.5%
		13.90	7.40	0.30	1.30	0.50	0.30	0.15	0.20	3.9%
		14.40	7.35	0.40	1.27	0.50	0.40	0.20	0.25	5.1%
		14.90	7.30	0.45	0.51	0.50	0.45	0.23	0.11	2.3%
		15.40	7.40	0.45	1.21	0.51	0.45	0.23	0.27	5.5%
		15.90	7.30	0.40	1.48	0.51	0.40	0.20	0.30	5.9%
		16.40	7.25	0.35	1.37	0.50	0.35	0.18	0.24	4.8%
		16.90	7.20	0.30	1.44	0.50	0.30	0.15	0.22	4.3%
		17.40	7.20	0.35	0.94	0.50	0.35	0.18	0.16	3.3%
		17.90	7.35	0.45	0.76	0.52	0.45	0.23	0.17	3.4%
		18.40	7.25	0.40	0.91	0.51	0.40	0.20	0.18	3.6%
		18.90	7.20	0.15	0.92	0.50	0.15	0.12	0.11	2.2%
	wl	20.00	6.96	0.00	0.00	1.13		0.00	0.00	0.0%
		23.00	6.70			0.00		0.00	0.00	0.0%
		27.50	6.35			0.00		0.00	0.00	0.0%
1	gl	30.60	6.10			0.00		0.00	0.00	0.0%
		33.30	6.00			0.00		0.00	0.00	0.0%
	TOTALS ----------					14.35	0.65 (Max.)	5.15	4.99	100.0%

Manning's n = 0.0547
Hydraulic Radius= 0.35860709

STREAM NAME: Sand Creek
XS LOCATION: Lower
XS NUMBER: 0

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	5.15	4.85	-5.7%
6.74	5.15	8.74	69.9%
6.76	5.15	8.40	63.3%
6.78	5.15	8.06	56.7%
6.80	5.15	7.73	50.3%
6.82	5.15	7.41	44.0%
6.84	5.15	7.09	37.7%
6.86	5.15	6.77	31.6%
6.88	5.15	6.46	25.6%
6.90	5.15	6.16	19.7%
6.92	5.15	5.86	13.9%
6.94	5.15	5.57	8.2%
6.95	5.15	5.42	5.4%
6.96	5.15	5.28	2.6%
6.97	5.15	5.14	-0.2%
6.98	5.15	4.99	-2.9%
6.99	5.15	4.85	-5.7%
7.00	5.15	4.71	-8.4%
7.01	5.15	4.57	-11.1%
7.02	5.15	4.44	-13.8%
7.03	5.15	4.30	-16.5%
7.04	5.15	4.16	-19.1%
7.06	5.15	3.89	-24.4%
7.08	5.15	3.62	-29.7%
7.10	5.15	3.35	-34.8%
7.12	5.15	3.09	-40.0%
7.14	5.15	2.83	-45.0%
7.16	5.15	2.57	-50.1%
7.18	5.15	2.31	-55.0%
7.20	5.15	2.06	-59.9%
7.22	5.15	1.82	-64.6%
7.24	5.15	1.60	-69.0%

WATERLINE AT ZERO
AREA ERROR = 6.964

STREAM NAME: Sand Creek
XS LOCATION: Lower
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	6.10	27.29	0.84	1.55	22.81	27.74	100.0%	0.82	38.47	1.69
	6.11	27.06	0.83	1.54	22.42	27.50	99.2%	0.82	37.59	1.68
	6.16	26.25	0.80	1.49	21.09	26.69	96.2%	0.79	34.63	1.64
	6.21	25.44	0.78	1.44	19.80	25.87	93.3%	0.77	31.82	1.61
	6.26	24.63	0.75	1.39	18.55	25.06	90.3%	0.74	29.15	1.57
	6.31	23.83	0.73	1.34	17.33	24.24	87.4%	0.72	26.63	1.54
	6.36	23.01	0.70	1.29	16.16	23.42	84.4%	0.69	24.25	1.50
	6.41	22.18	0.68	1.24	15.03	22.58	81.4%	0.67	22.02	1.46
	6.46	21.35	0.65	1.19	13.94	21.74	78.4%	0.64	19.93	1.43
	6.51	20.52	0.63	1.14	12.90	20.90	75.3%	0.62	17.96	1.39
	6.56	19.72	0.60	1.09	11.89	20.09	72.4%	0.59	16.11	1.35
	6.61	18.97	0.58	1.04	10.93	19.33	69.7%	0.57	14.35	1.31
	6.66	18.23	0.55	0.99	9.99	18.58	67.0%	0.54	12.70	1.27
	6.71	17.51	0.52	0.94	9.10	17.84	64.3%	0.51	11.16	1.23
	6.76	16.84	0.49	0.89	8.24	17.15	61.8%	0.48	9.72	1.18
	6.81	16.16	0.46	0.84	7.42	16.46	59.4%	0.45	8.38	1.13
	6.86	15.49	0.43	0.79	6.63	15.77	56.9%	0.42	7.14	1.08
	6.91	14.81	0.40	0.74	5.87	15.09	54.4%	0.39	6.01	1.02
WL	6.96	14.17	0.36	0.69	5.14	14.43	52.0%	0.36	4.97	0.97
	7.01	13.84	0.32	0.64	4.44	14.08	50.8%	0.32	3.96	0.89
	7.06	13.48	0.28	0.59	3.76	13.70	49.4%	0.27	3.05	0.81
	7.11	13.12	0.24	0.54	3.10	13.33	48.1%	0.23	2.25	0.73
	7.16	12.76	0.19	0.49	2.45	12.95	46.7%	0.19	1.55	0.63
	7.21	11.63	0.16	0.44	1.83	11.81	42.6%	0.15	1.01	0.55
	7.26	10.41	0.12	0.39	1.28	10.57	38.1%	0.12	0.60	0.47
	7.31	7.32	0.11	0.34	0.81	7.44	26.8%	0.11	0.36	0.44
	7.36	4.77	0.11	0.29	0.52	4.84	17.5%	0.11	0.22	0.43
	7.41	2.98	0.11	0.24	0.32	3.03	10.9%	0.11	0.14	0.43
	7.46	1.88	0.10	0.19	0.20	1.92	6.9%	0.10	0.08	0.42
	7.51	1.46	0.08	0.14	0.11	1.49	5.4%	0.08	0.04	0.34
	7.56	1.05	0.05	0.09	0.05	1.06	3.8%	0.05	0.01	0.25
	7.61	0.53	0.02	0.04	0.01	0.54	1.9%	0.02	0.00	0.13

STREAM NAME: Sand Creek
XS LOCATION: Lower
XS NUMBER: 0

SUMMARY SHEET

MEASURED FLOW (Qm)=	4.99	cfs
CALCULATED FLOW (Qc)=	4.97	cfs
(Qm-Qc)/Qm * 100 =	0.4	%
MEASURED WATERLINE (WLm)=	6.99	ft
CALCULATED WATERLINE (WLc)=	6.96	ft
(WLm-WLc)/WLm * 100 =	0.3	%
MAX MEASURED DEPTH (Dm)=	0.65	ft
MAX CALCULATED DEPTH (Dc)=	0.69	ft
(Dm-Dc)/Dm * 100	-5.5	%
MEAN VELOCITY=	0.97	ft/sec
MANNING'S N=	0.055	
SLOPE=	0.005	ft/ft
.4 * Qm =	2.0	cfs
2.5 * Qm=	12.5	cfs

RECOMMENDED INSTREAM FLOW:
==========

FLOW (CFS)	PERIOD
==========	========
_____	_____
_____	_____
_____	_____
_____	_____

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

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

STREAM NAME: Sand Creek
XS LOCATION: Lower
XS NUMBER: 0

Jarrett Variable Manning's n Correction Applied

GL = lowest Grassline elevation corrected for sag

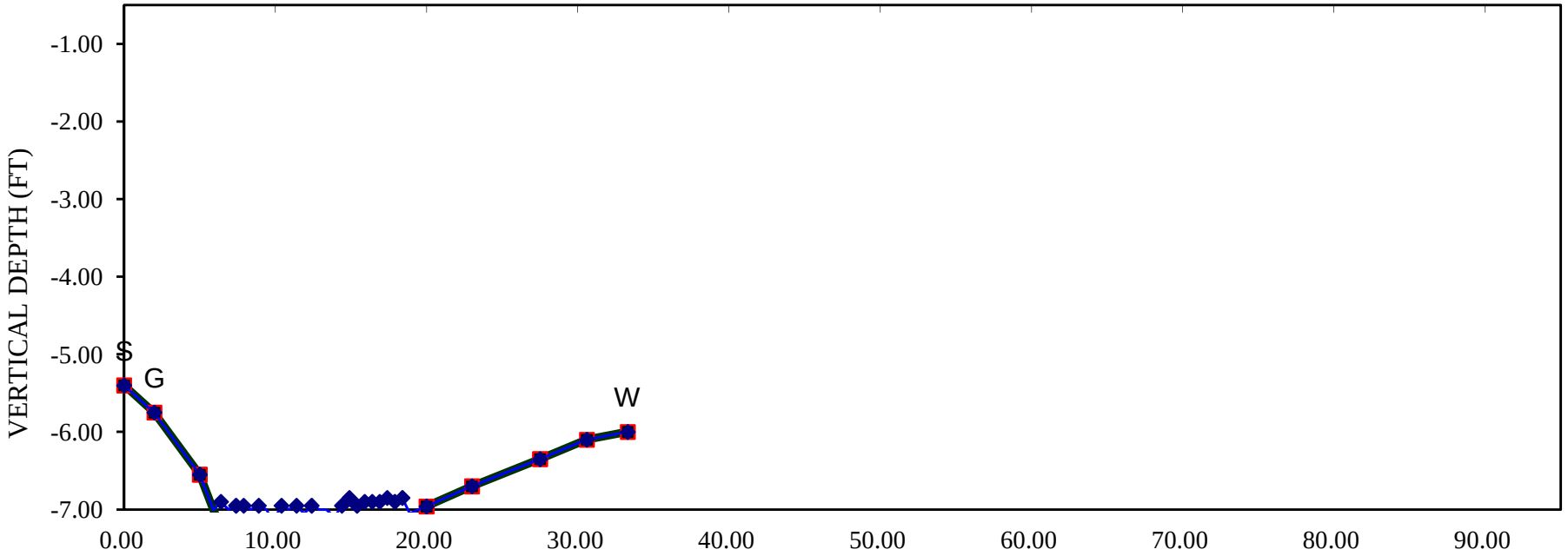
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

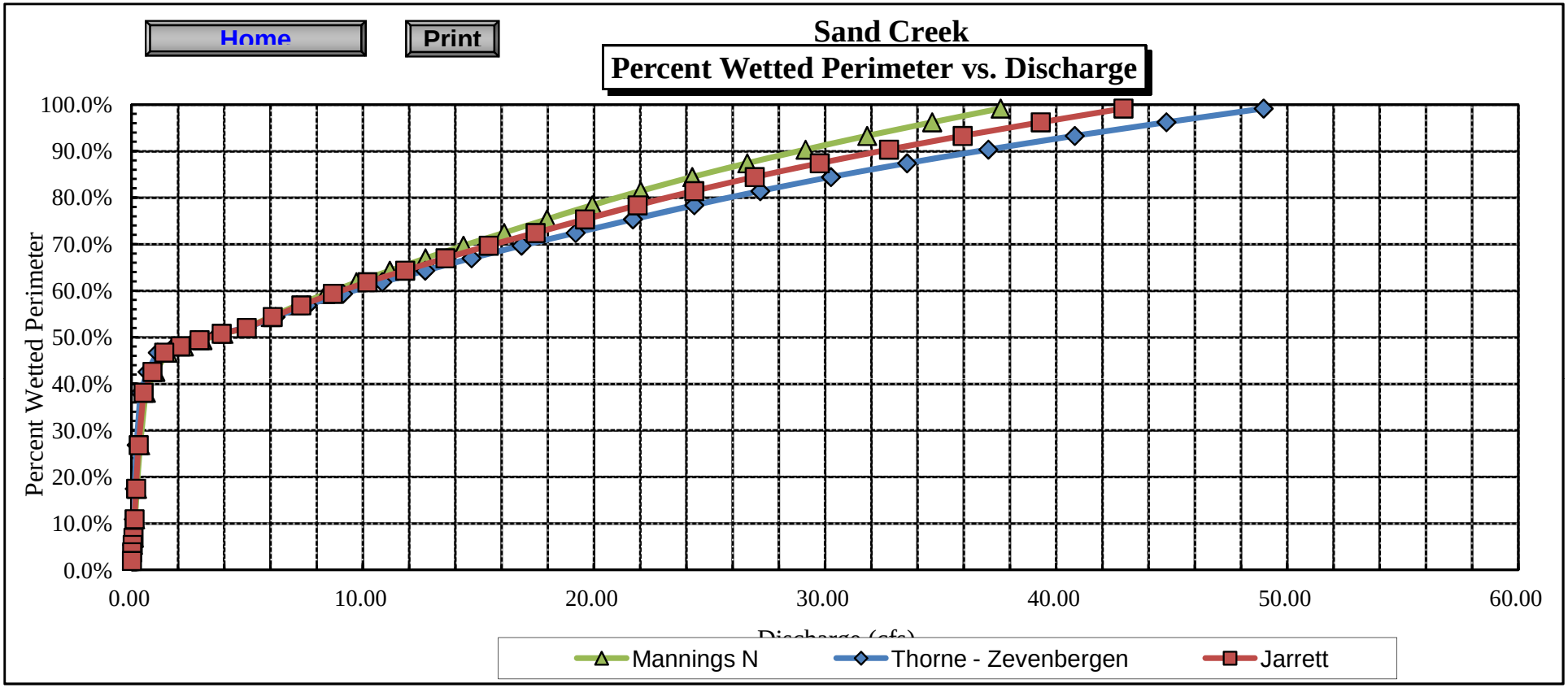
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.10	27.29	0.84	1.55	22.81	27.74	100.0%	0.82	43.97	1.93
	6.11	27.06	0.83	1.54	22.42	27.50	99.2%	0.82	42.91	1.91
	6.16	26.25	0.80	1.49	21.09	26.69	96.2%	0.79	39.33	1.87
	6.21	25.44	0.78	1.44	19.80	25.87	93.3%	0.77	35.95	1.82
	6.26	24.63	0.75	1.39	18.55	25.06	90.3%	0.74	32.77	1.77
	6.31	23.83	0.73	1.34	17.33	24.24	87.4%	0.72	29.76	1.72
	6.36	23.01	0.70	1.29	16.16	23.42	84.4%	0.69	26.95	1.67
	6.41	22.18	0.68	1.24	15.03	22.58	81.4%	0.67	24.33	1.62
	6.46	21.35	0.65	1.19	13.94	21.74	78.4%	0.64	21.89	1.57
	6.51	20.52	0.63	1.14	12.90	20.90	75.3%	0.62	19.61	1.52
	6.56	19.72	0.60	1.09	11.89	20.09	72.4%	0.59	17.47	1.47
	6.61	18.97	0.58	1.04	10.93	19.33	69.7%	0.57	15.44	1.41
	6.66	18.23	0.55	0.99	9.99	18.58	67.0%	0.54	13.57	1.36
	6.71	17.51	0.52	0.94	9.10	17.84	64.3%	0.51	11.82	1.30
	6.76	16.84	0.49	0.89	8.24	17.15	61.8%	0.48	10.19	1.24
	6.81	16.16	0.46	0.84	7.42	16.46	59.4%	0.45	8.69	1.17
	6.86	15.49	0.43	0.79	6.63	15.77	56.9%	0.42	7.33	1.11
	6.91	14.81	0.40	0.74	5.87	15.09	54.4%	0.39	6.09	1.04
WL	6.96	14.17	0.36	0.69	5.14	14.43	52.0%	0.36	4.97	0.97
	7.01	13.84	0.32	0.64	4.44	14.08	50.8%	0.32	3.88	0.87
	7.06	13.48	0.28	0.59	3.76	13.70	49.4%	0.27	2.93	0.78
	7.11	13.12	0.24	0.54	3.10	13.33	48.1%	0.23	2.10	0.68
	7.16	12.76	0.19	0.49	2.45	12.95	46.7%	0.19	1.40	0.57
	7.21	11.63	0.16	0.44	1.83	11.81	42.6%	0.15	0.89	0.49
	7.26	10.41	0.12	0.39	1.28	10.57	38.1%	0.12	0.51	0.40
	7.31	7.32	0.11	0.34	0.81	7.44	26.8%	0.11	0.29	0.36
	7.36	4.77	0.11	0.29	0.52	4.84	17.5%	0.11	0.18	0.36
	7.41	2.98	0.11	0.24	0.32	3.03	10.9%	0.11	0.11	0.36
	7.46	1.88	0.10	0.19	0.20	1.92	6.9%	0.10	0.07	0.34
	7.51	1.46	0.08	0.14	0.11	1.49	5.4%	0.08	0.03	0.27
	7.56	1.05	0.05	0.09	0.05	1.06	3.8%	0.05	0.01	0.18
	7.61	0.53	0.02	0.04	0.01	0.54	1.9%	0.02	0.00	0.08

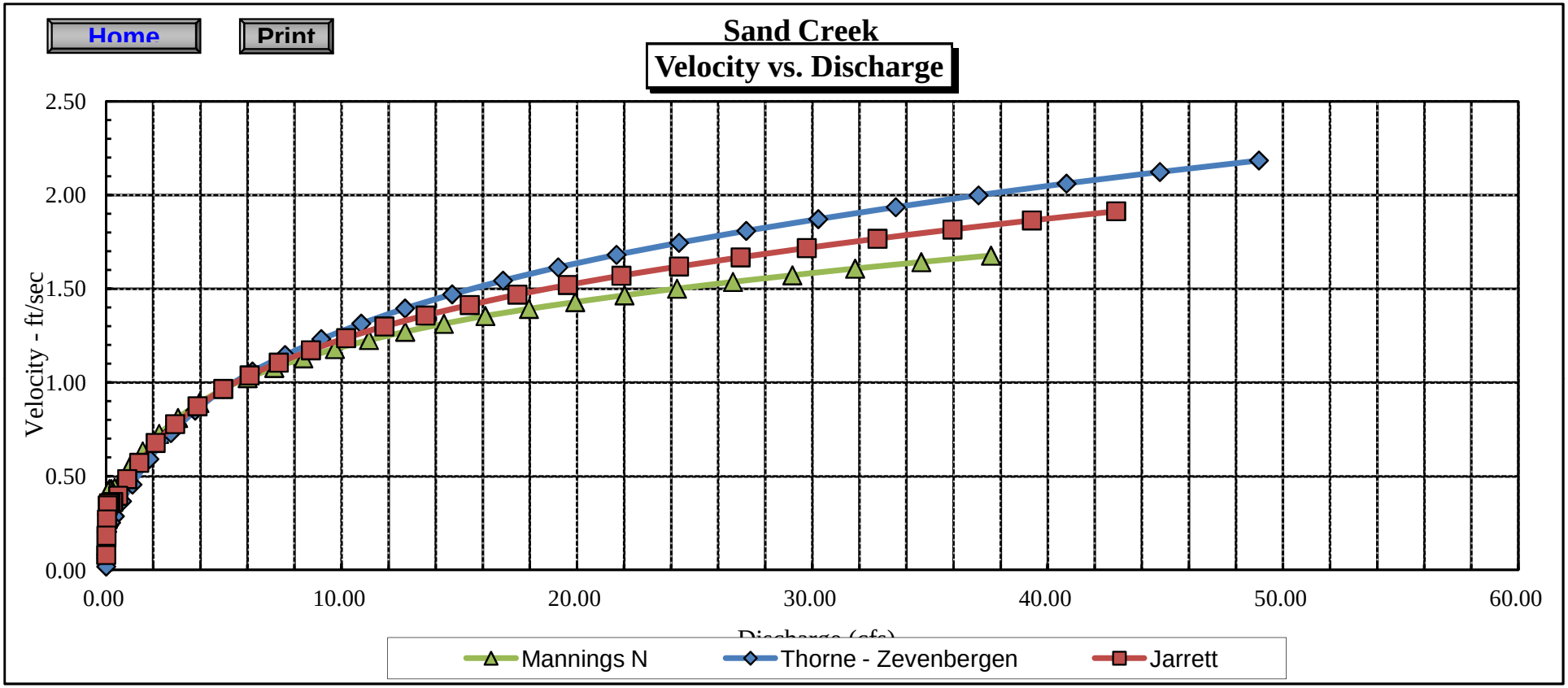
Home Print

Sand Creek

CROSS SECTION DATA ANALYSIS



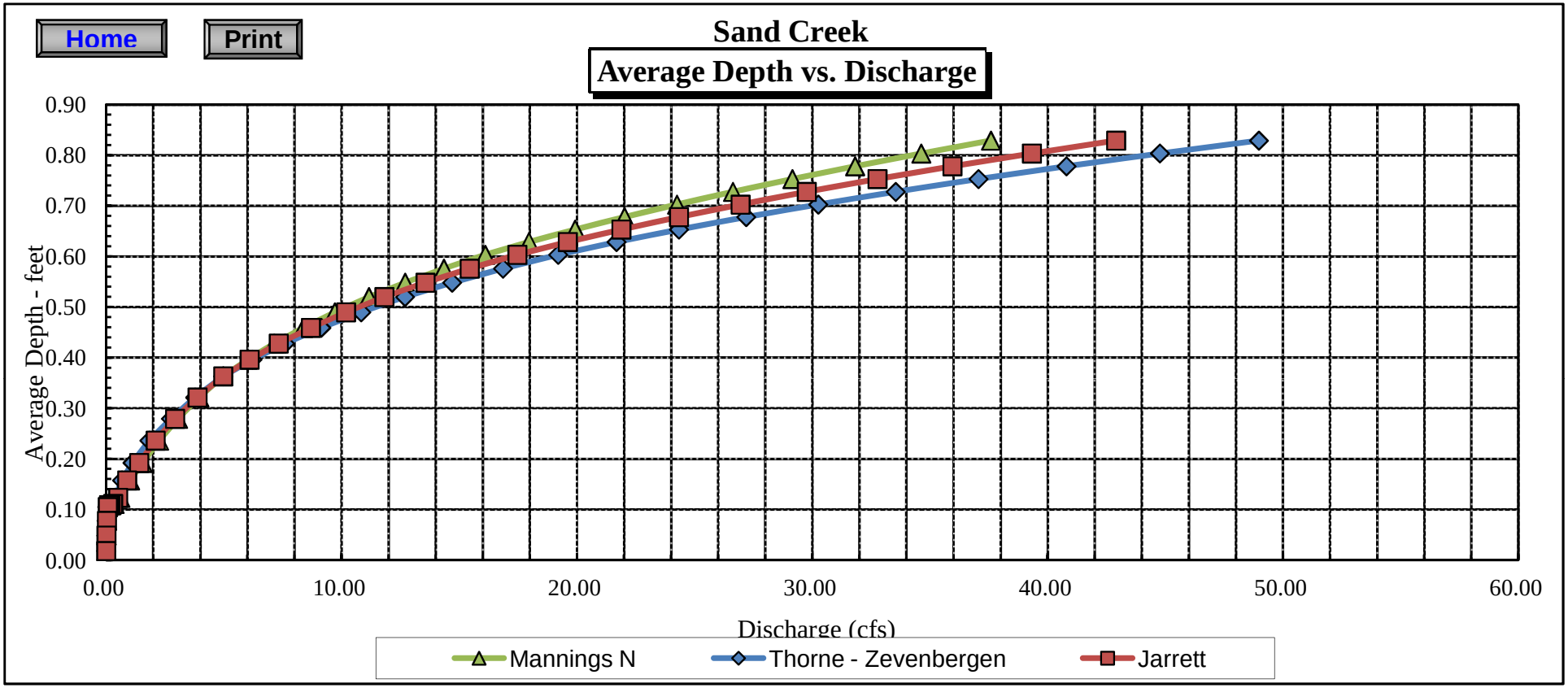

Home
Print
Sand Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Mannings N
Thorne - Zevenbergen
Jarrett

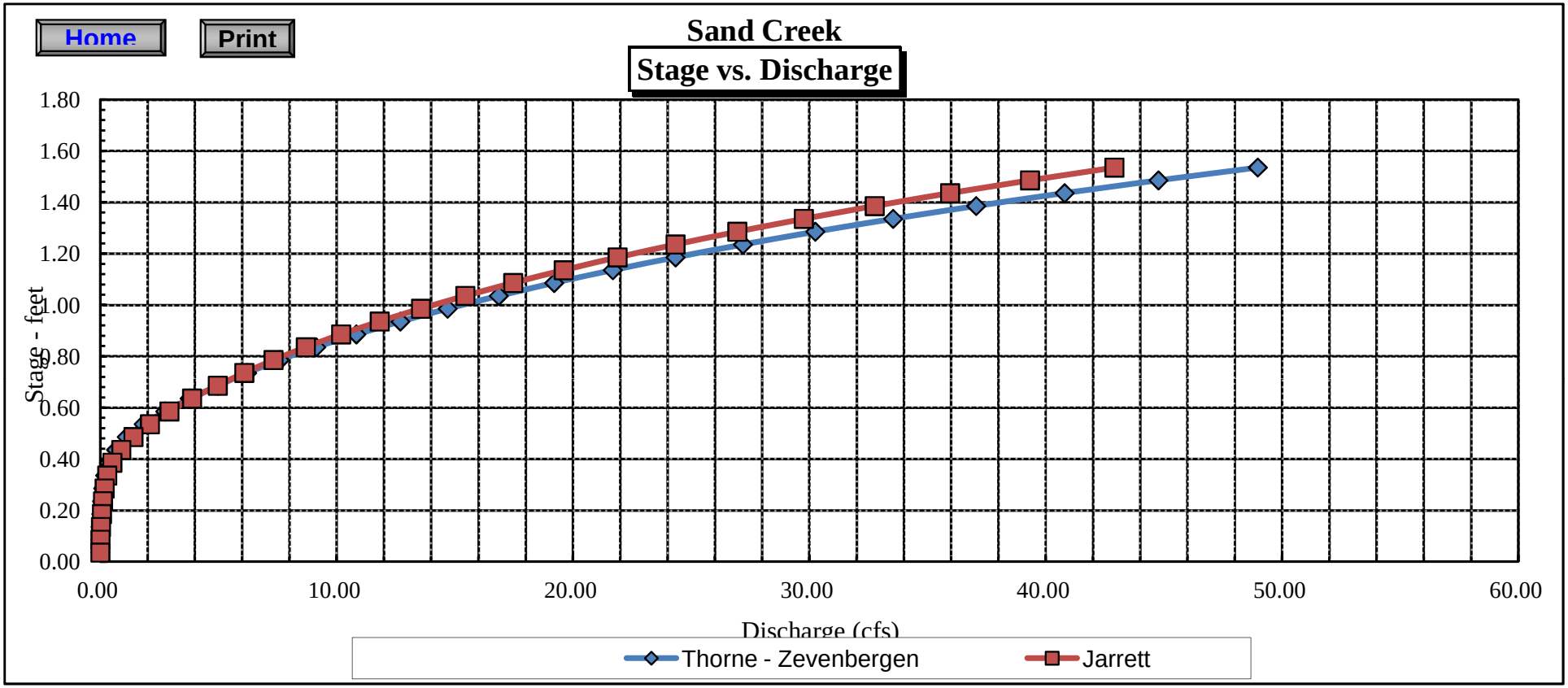

Home
Print
Sand Creek
Velocity vs. Discharge
2.50
2.00
1.50
1.00
0.50
0.00
Velocity - ft/sec
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Mannings N
Thorne - Zevenbergen
Jarrett

Home Print

Sand Creek

Average Depth vs. Discharge




Home
Print
Sand Creek
Stage vs. Discharge
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Stage - feet
0.00
10.00
20.00
30.00
40.00
50.00
60.00
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:	Sand Creek
XS LOCATION:	upper
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

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.013

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

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

STREAM NAME: Sand Creek
XS LOCATION: upper
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
		0.00	5.30			0.00		0.00	0.00	0.0%
1	gl	4.90	5.45			0.00		0.00	0.00	0.0%
		5.80	5.70			0.00		0.00	0.00	0.0%
		6.10	6.55			0.00		0.00	0.00	0.0%
		6.50	6.75			0.00		0.00	0.00	0.0%
	wl	6.60	6.86	0.00	0.00	0.00		0.00	0.00	0.0%
		6.90	7.10	0.50	1.96	0.38	0.50	0.18	0.34	6.8%
		7.30	7.45	0.75	1.07	0.53	0.75	0.30	0.32	6.3%
		7.70	7.60	0.80	1.80	0.43	0.80	0.32	0.58	11.4%
		8.10	7.70	0.85	1.61	0.41	0.85	0.34	0.55	10.8%
		8.50	7.40	0.80	1.62	0.50	0.80	0.32	0.52	10.2%
		8.90	7.55	0.65	1.71	0.43	0.65	0.26	0.44	8.8%
		9.30	7.55	0.70	1.26	0.40	0.70	0.28	0.35	7.0%
		9.70	7.55	0.70	1.91	0.40	0.70	0.28	0.53	10.6%
		10.10	7.55	0.70	1.13	0.40	0.70	0.28	0.32	6.2%
		10.50	7.45	0.65	1.33	0.41	0.65	0.26	0.35	6.8%
		10.90	7.50	0.50	1.28	0.40	0.50	0.20	0.26	5.1%
		11.30	7.45	0.50	1.61	0.40	0.50	0.20	0.32	6.4%
		11.70	7.30	0.50	0.84	0.43	0.50	0.20	0.17	3.3%
		12.10	7.20	0.35	0.09	0.41	0.35	0.21	0.02	0.4%
	wl	12.90	6.83	0.00	0.00	0.88		0.00	0.00	0.0%
		13.20	6.70			0.00		0.00	0.00	0.0%
1	gl	15.20	6.10			0.00		0.00	0.00	0.0%
		19.70	4.35			0.00		0.00	0.00	0.0%
	TOTALS ----------					6.82	0.85 (Max.)	3.63	5.07	100.0%

Manning's n = 0.0795
Hydraulic Radius= 0.53137906

STREAM NAME: Sand Creek
XS LOCATION: upper
XS NUMBER: 0

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.63	3.46	-4.5%
6.60	3.63	5.15	42.1%
6.62	3.63	5.01	38.1%
6.64	3.63	4.86	34.1%
6.66	3.63	4.72	30.2%
6.68	3.63	4.58	26.3%
6.70	3.63	4.44	22.6%
6.72	3.63	4.31	18.8%
6.74	3.63	4.17	15.1%
6.76	3.63	4.04	11.5%
6.78	3.63	3.91	7.9%
6.80	3.63	3.78	4.3%
6.81	3.63	3.72	2.5%
6.82	3.63	3.65	0.8%
6.83	3.63	3.59	-1.0%
6.84	3.63	3.53	-2.7%
6.85	3.63	3.46	-4.5%
6.86	3.63	3.40	-6.2%
6.87	3.63	3.34	-7.9%
6.88	3.63	3.28	-9.6%
6.89	3.63	3.21	-11.3%
6.90	3.63	3.15	-13.0%
6.92	3.63	3.03	-16.4%
6.94	3.63	2.91	-19.7%
6.96	3.63	2.79	-23.0%
6.98	3.63	2.67	-26.2%
7.00	3.63	2.56	-29.4%
7.02	3.63	2.44	-32.6%
7.04	3.63	2.33	-35.7%
7.06	3.63	2.22	-38.8%
7.08	3.63	2.11	-41.9%
7.10	3.63	2.00	-44.9%

WATERLINE AT ZERO
AREA ERROR = 6.819

STREAM NAME: Sand Creek
XS LOCATION: upper
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	6.10	9.26	1.00	1.60	9.28	10.31	100.0%	0.90	18.43	1.99
	6.12	9.19	0.99	1.58	9.10	10.22	99.1%	0.89	17.95	1.97
	6.17	9.00	0.96	1.53	8.65	10.00	96.9%	0.87	16.73	1.93
	6.22	8.82	0.93	1.48	8.20	9.77	94.7%	0.84	15.55	1.90
	6.27	8.63	0.90	1.43	7.77	9.54	92.5%	0.81	14.42	1.86
	6.32	8.45	0.87	1.38	7.34	9.31	90.3%	0.79	13.34	1.82
	6.37	8.27	0.84	1.33	6.92	9.09	88.1%	0.76	12.30	1.78
	6.42	8.08	0.81	1.28	6.51	8.86	85.9%	0.74	11.30	1.73
	6.47	7.90	0.77	1.23	6.11	8.63	83.7%	0.71	10.34	1.69
	6.52	7.71	0.74	1.18	5.72	8.41	81.5%	0.68	9.43	1.65
	6.57	7.50	0.71	1.13	5.34	8.16	79.1%	0.66	8.58	1.61
	6.62	7.23	0.69	1.08	4.97	7.87	76.3%	0.63	7.80	1.57
	6.67	6.96	0.66	1.03	4.62	7.58	73.6%	0.61	7.07	1.53
	6.72	6.72	0.64	0.98	4.28	7.32	71.0%	0.58	6.37	1.49
	6.77	6.52	0.61	0.93	3.95	7.10	68.8%	0.56	5.69	1.44
WL	6.82	6.36	0.57	0.88	3.62	6.90	67.0%	0.53	5.02	1.39
	6.87	6.20	0.53	0.83	3.31	6.71	65.1%	0.49	4.40	1.33
	6.92	6.03	0.50	0.78	3.00	6.51	63.2%	0.46	3.82	1.27
	6.97	5.86	0.46	0.73	2.71	6.31	61.2%	0.43	3.28	1.21
	7.02	5.69	0.42	0.68	2.42	6.12	59.3%	0.40	2.78	1.15
	7.07	5.52	0.39	0.63	2.14	5.92	57.4%	0.36	2.31	1.08
	7.12	5.35	0.35	0.58	1.87	5.72	55.5%	0.33	1.88	1.01
	7.17	5.19	0.31	0.53	1.60	5.52	53.6%	0.29	1.50	0.93
	7.22	4.99	0.27	0.48	1.35	5.30	51.4%	0.25	1.15	0.86
	7.27	4.73	0.23	0.43	1.11	5.01	48.6%	0.22	0.86	0.78
	7.32	4.50	0.19	0.38	0.88	4.76	46.1%	0.18	0.60	0.69
	7.37	4.31	0.15	0.33	0.65	4.54	44.0%	0.14	0.38	0.59
	7.42	4.04	0.11	0.28	0.45	4.23	41.0%	0.11	0.21	0.47
	7.47	3.28	0.08	0.23	0.26	3.43	33.2%	0.07	0.10	0.38
	7.52	2.26	0.05	0.18	0.12	2.36	22.9%	0.05	0.04	0.30
	7.57	0.66	0.07	0.13	0.04	0.72	7.0%	0.06	0.02	0.34
	7.62	0.43	0.04	0.08	0.02	0.47	4.5%	0.04	0.00	0.24
	7.67	0.16	0.02	0.03	0.00	0.18	1.7%	0.01	0.00	0.12

STREAM NAME: Sand Creek
XS LOCATION: upper
XS NUMBER: 0

SUMMARY SHEET

MEASURED FLOW (Qm)=	5.07	cfs
CALCULATED FLOW (Qc)=	5.02	cfs
(Qm-Qc)/Qm * 100 =	0.8	%
MEASURED WATERLINE (WLm)=	6.85	ft
CALCULATED WATERLINE (WLc)=	6.82	ft
(WLm-WLc)/WLm * 100 =	0.4	%
MAX MEASURED DEPTH (Dm)=	0.85	ft
MAX CALCULATED DEPTH (Dc)=	0.88	ft
(Dm-Dc)/Dm * 100	-3.6	%
MEAN VELOCITY=	1.39	ft/sec
MANNING'S N=	0.080	
SLOPE=	0.013	ft/ft
.4 * Qm =	2.0	cfs
2.5 * Qm=	12.7	cfs

RECOMMENDED INSTREAM FLOW:
=============================

FLOW (CFS)	PERIOD
___________	___________
___________	___________
___________	___________
___________	___________

RATIONALE FOR RECOMMENDATION:
=============================

RECOMMENDATION BY: ………………………………………………………… AGENCY………………………………………………… DATE:………………………………

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

STREAM NAME: Sand Creek
XS LOCATION: upper
XS NUMBER: 0

Jarrett Variable Manning's n Correction Applied

GL = lowest Grassline elevation corrected for sag

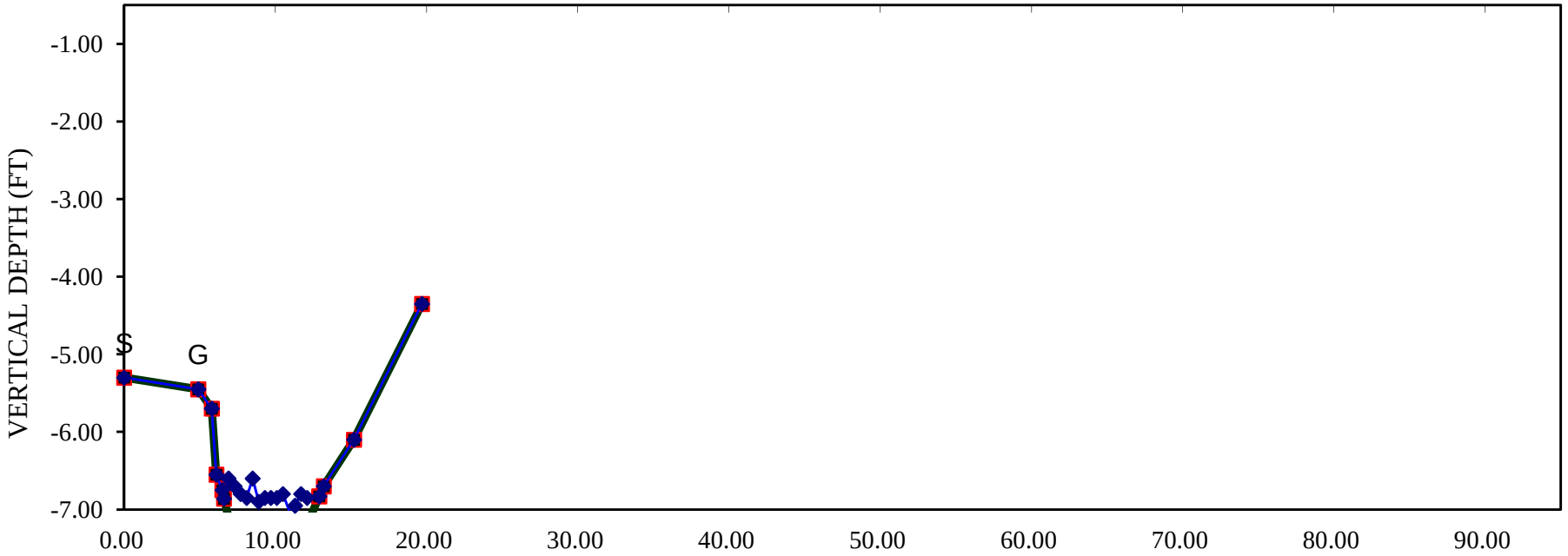
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

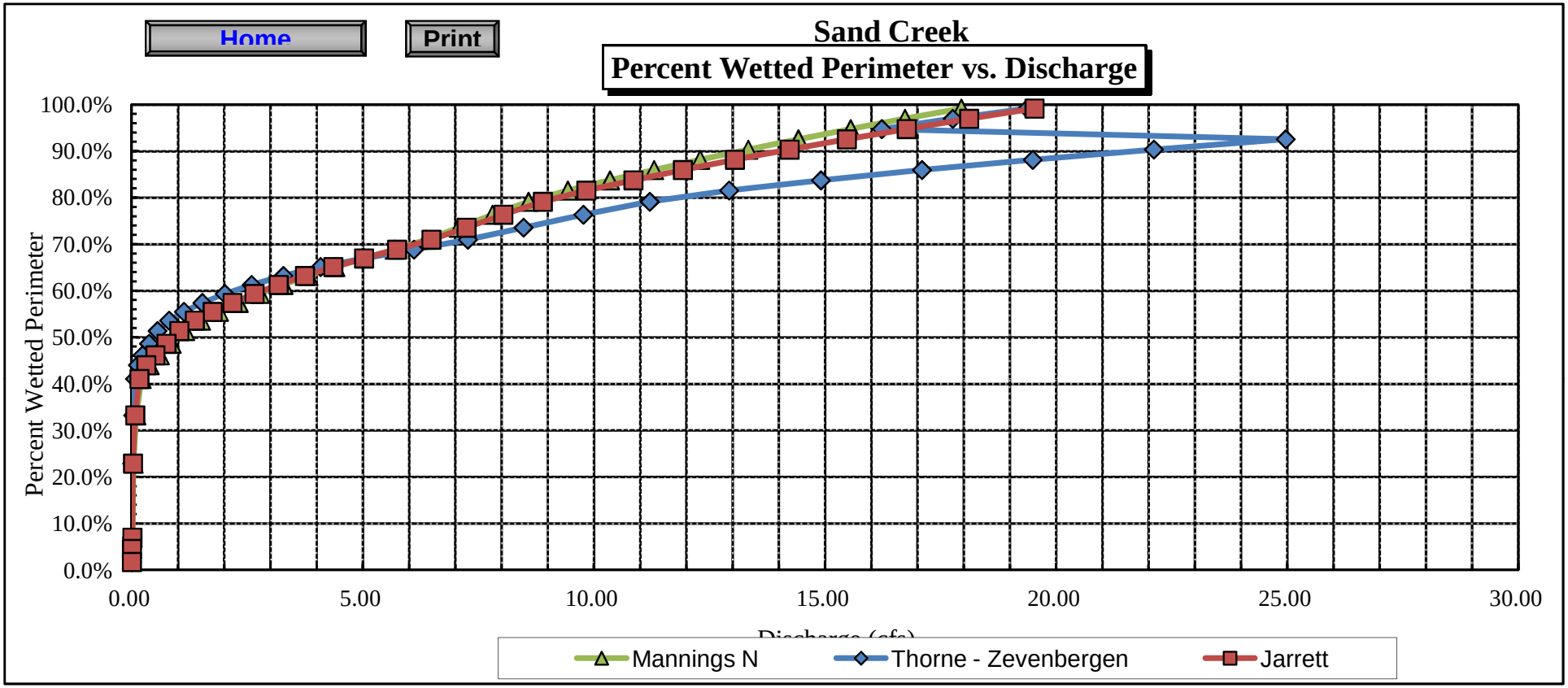
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.10	9.26	1.00	1.60	9.28	10.31	100.0%	0.90	20.09	2.16
	6.12	9.19	0.99	1.58	9.10	10.22	99.1%	0.89	19.53	2.15
	6.17	9.00	0.96	1.53	8.65	10.00	96.9%	0.87	18.12	2.09
	6.22	8.82	0.93	1.48	8.20	9.77	94.7%	0.84	16.76	2.04
	6.27	8.63	0.90	1.43	7.77	9.54	92.5%	0.81	15.47	1.99
	6.32	8.45	0.87	1.38	7.34	9.31	90.3%	0.79	14.23	1.94
	6.37	8.27	0.84	1.33	6.92	9.09	88.1%	0.76	13.05	1.89
	6.42	8.08	0.81	1.28	6.51	8.86	85.9%	0.74	11.92	1.83
	6.47	7.90	0.77	1.23	6.11	8.63	83.7%	0.71	10.85	1.78
	6.52	7.71	0.74	1.18	5.72	8.41	81.5%	0.68	9.83	1.72
	6.57	7.50	0.71	1.13	5.34	8.16	79.1%	0.66	8.89	1.66
	6.62	7.23	0.69	1.08	4.97	7.87	76.3%	0.63	8.04	1.62
	6.67	6.96	0.66	1.03	4.62	7.58	73.6%	0.61	7.24	1.57
	6.72	6.72	0.64	0.98	4.28	7.32	71.0%	0.58	6.48	1.51
	6.77	6.52	0.61	0.93	3.95	7.10	68.8%	0.56	5.74	1.45
WL	6.82	6.36	0.57	0.88	3.62	6.90	67.0%	0.53	5.02	1.39
	6.87	6.20	0.53	0.83	3.31	6.71	65.1%	0.49	4.36	1.32
	6.92	6.03	0.50	0.78	3.00	6.51	63.2%	0.46	3.74	1.25
	6.97	5.86	0.46	0.73	2.71	6.31	61.2%	0.43	3.17	1.17
	7.02	5.69	0.42	0.68	2.42	6.12	59.3%	0.40	2.65	1.10
	7.07	5.52	0.39	0.63	2.14	5.92	57.4%	0.36	2.18	1.02
	7.12	5.35	0.35	0.58	1.87	5.72	55.5%	0.33	1.75	0.94
	7.17	5.19	0.31	0.53	1.60	5.52	53.6%	0.29	1.36	0.85
	7.22	4.99	0.27	0.48	1.35	5.30	51.4%	0.25	1.03	0.76
	7.27	4.73	0.23	0.43	1.11	5.01	48.6%	0.22	0.75	0.68
	7.32	4.50	0.19	0.38	0.88	4.76	46.1%	0.18	0.51	0.58
	7.37	4.31	0.15	0.33	0.65	4.54	44.0%	0.14	0.31	0.48
	7.42	4.04	0.11	0.28	0.45	4.23	41.0%	0.11	0.16	0.37
	7.47	3.28	0.08	0.23	0.26	3.43	33.2%	0.07	0.07	0.28
	7.52	2.26	0.05	0.18	0.12	2.36	22.9%	0.05	0.03	0.21
	7.57	0.66	0.07	0.13	0.04	0.72	7.0%	0.06	0.01	0.24
	7.62	0.43	0.04	0.08	0.02	0.47	4.5%	0.04	0.00	0.16
	7.67	0.16	0.02	0.03	0.00	0.18	1.7%	0.01	0.00	0.07

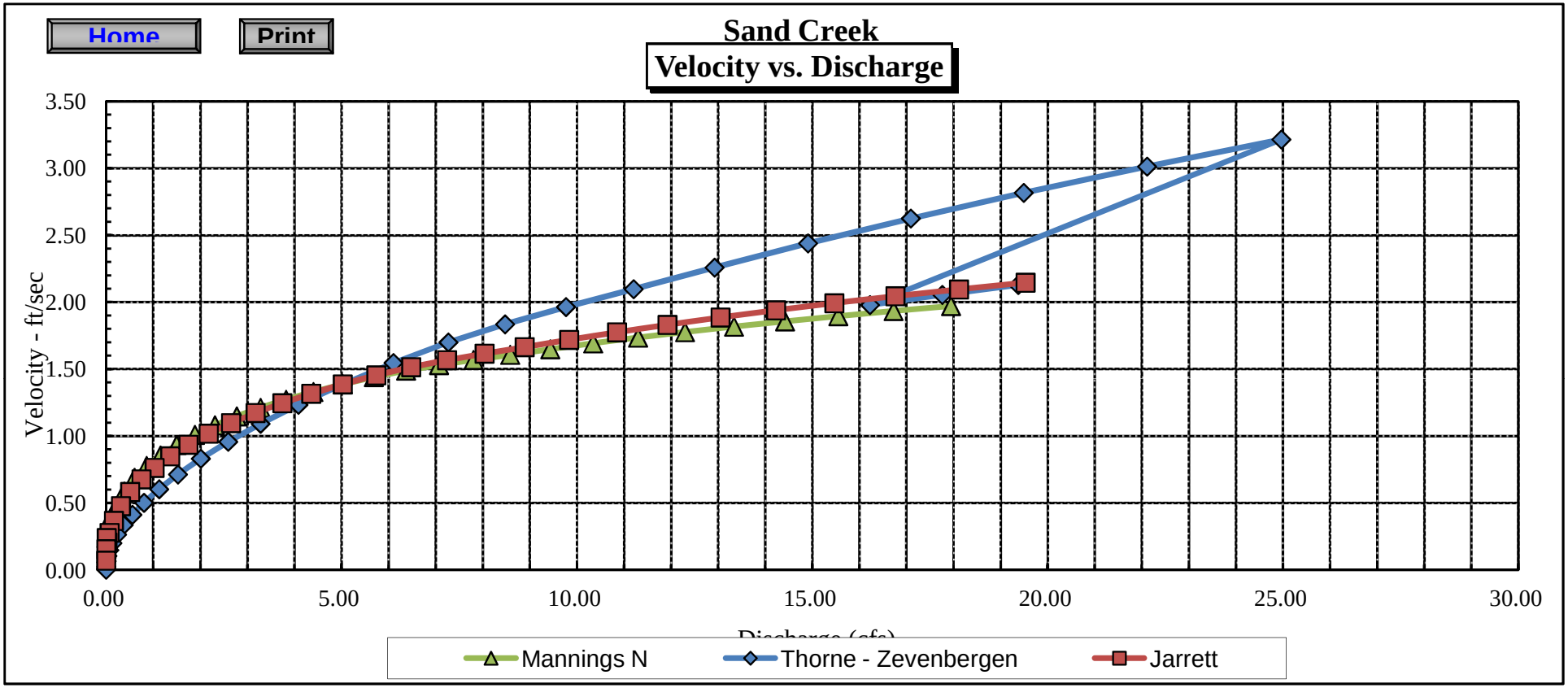
Home Print

Sand Creek

CROSS SECTION DATA ANALYSIS



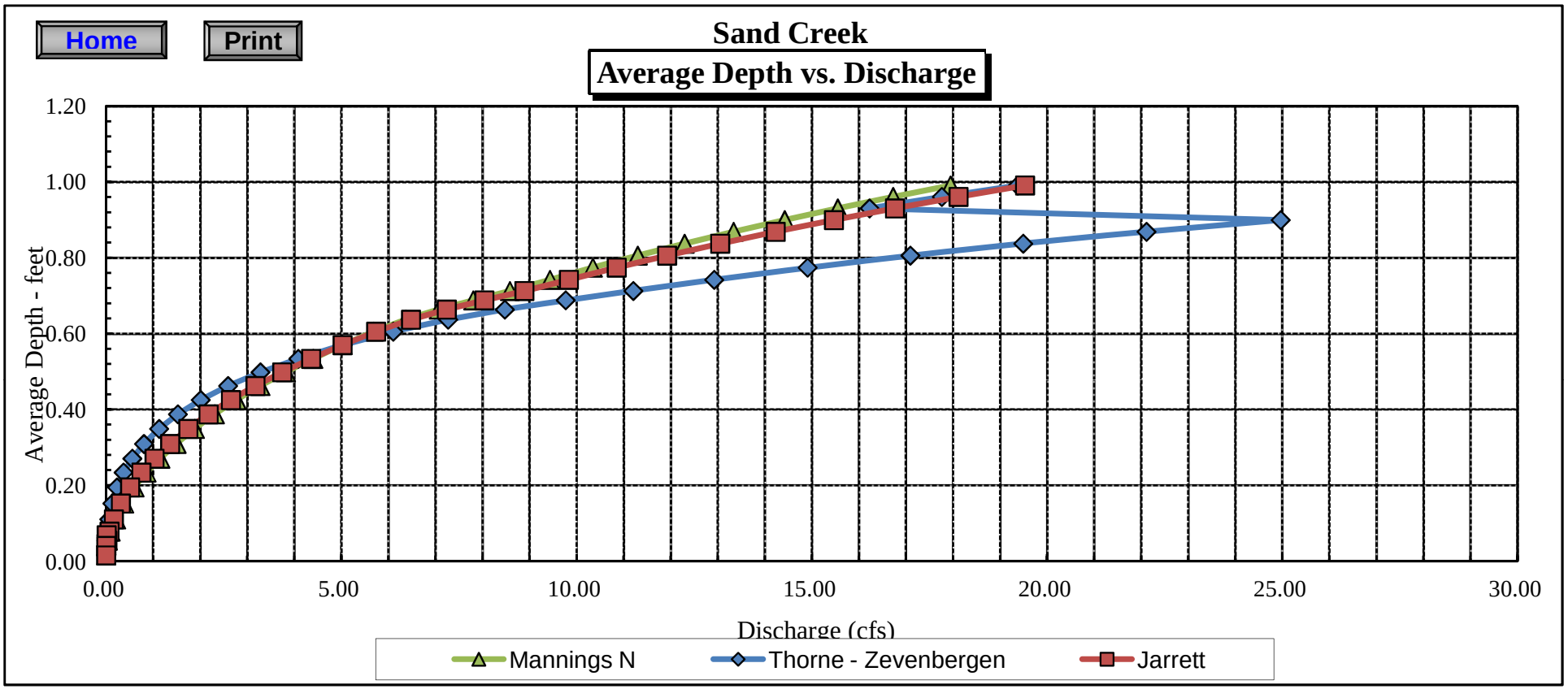

Home
Print
Sand Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
5.00
10.00
15.00
20.00
25.00
30.00
Mannings N
Thorne - Zevenbergen
Jarrett

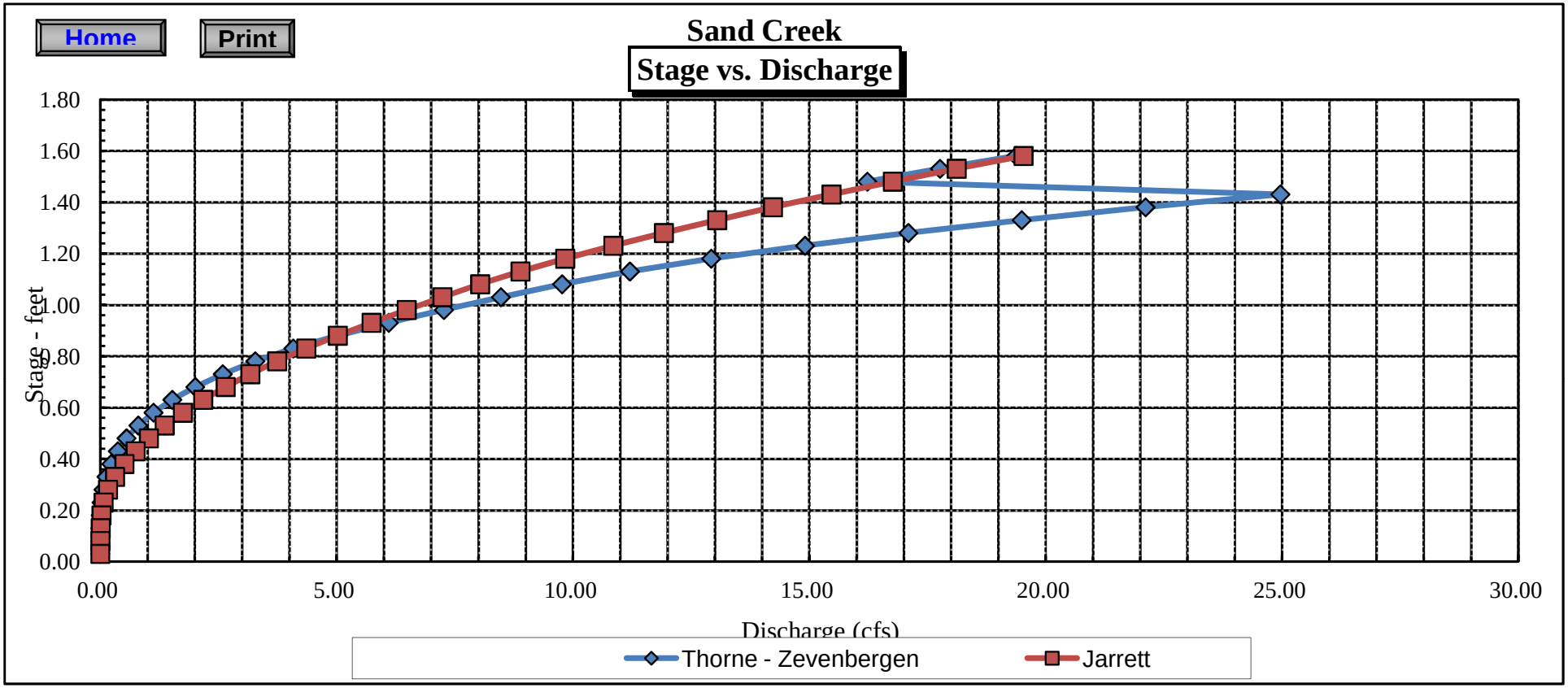

Home
Print
Sand Creek
Velocity vs. Discharge
Velocity - ft/sec
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
Mannings N
Thorne - Zevenbergen
Jarrett

Home Print

Sand Creek

Average Depth vs. Discharge




Home
Print
Sand Creek
Stage vs. Discharge
1.80
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
30.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

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Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Dec 14 2015

File Information

File Name	SCAMHGTG.008.WAD
Start Date and Time	2015/09/28 14:05:55

Site Details

Site Name	SAND CR AT HAYGOOD
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%	1.7%
Velocity	1.3%	4.3%
Width	0.2%	0.2%
Method	2.3%	-
# Stations	3.9%	-
Overall	**4.8%**	**4.8%**

Summary

Averaging Int.	40	# Stations	13
Start Edge	REW	Total Width	5.000
Mean SNR	32.0 dB	Total Area	2.718
Mean Temp	55.87 °F	Mean Depth	0.544
Disch. Equation	Mid-Section	Mean Velocity	0.9832
		Total Discharge	**2.6724**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	14:05	2.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	14:06	2.60	0.6	0.430	0.6	0.172	0.4206	1.00	0.4206	0.172	0.0724	2.7
2	14:08	3.00	0.6	0.550	0.6	0.220	0.9324	1.00	0.9324	0.220	0.2050	7.7
3	14:09	3.40	0.6	0.600	0.6	0.240	1.1257	1.00	1.1257	0.240	0.2701	10.1
4	14:10	3.80	0.6	0.520	0.6	0.208	1.3510	1.00	1.3510	0.208	0.2810	10.5
5	14:11	4.20	0.6	0.550	0.6	0.220	1.0272	1.00	1.0272	0.220	0.2259	8.5
6	14:12	4.60	0.6	0.600	0.6	0.240	0.9921	1.00	0.9921	0.240	0.2381	8.9
7	14:13	5.00	0.6	0.620	0.6	0.248	1.0892	1.00	1.0892	0.248	0.2701	10.1
8	14:14	5.40	0.6	0.700	0.6	0.280	1.0843	1.00	1.0843	0.280	0.3036	11.4
9	14:15	5.80	0.6	0.700	0.6	0.280	1.0154	1.00	1.0154	0.280	0.2843	10.6
10	14:16	6.20	0.6	0.650	0.6	0.260	1.1670	1.00	1.1670	0.260	0.3033	11.4
11	14:17	6.60	0.6	0.700	0.6	0.280	0.6237	1.00	0.6237	0.350	0.2185	8.2
12	14:17	7.20	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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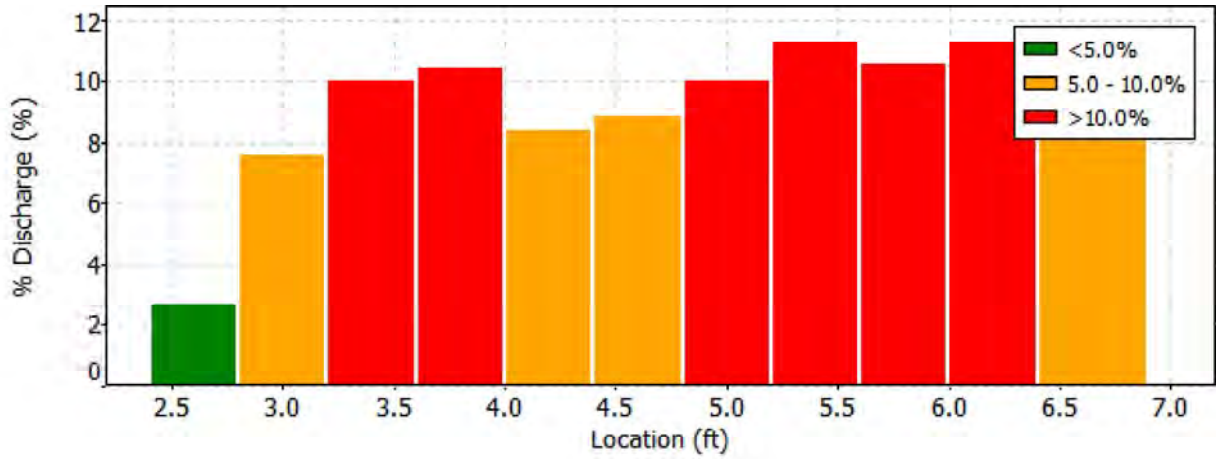
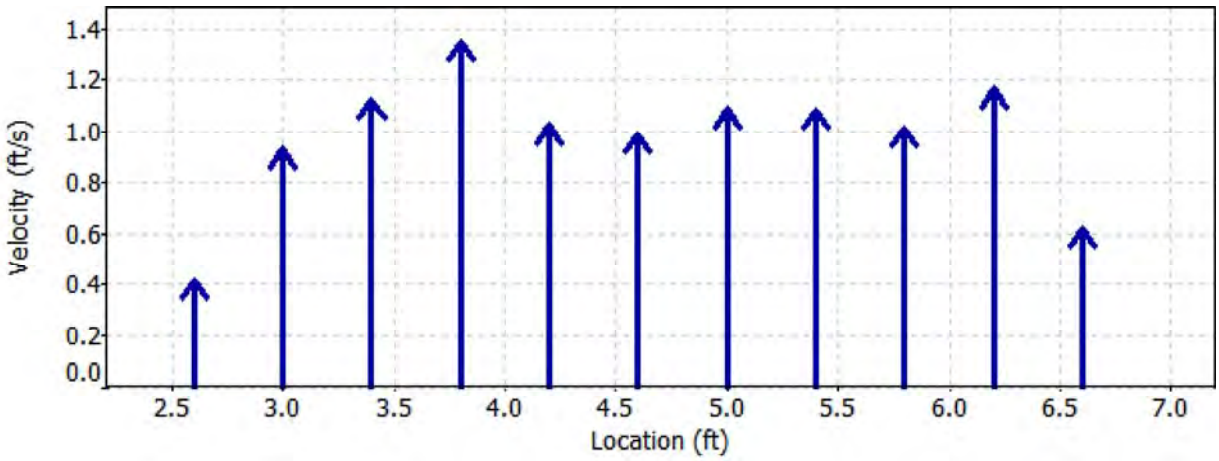
Colorado Water Conservation Board
Department of Natural Resources

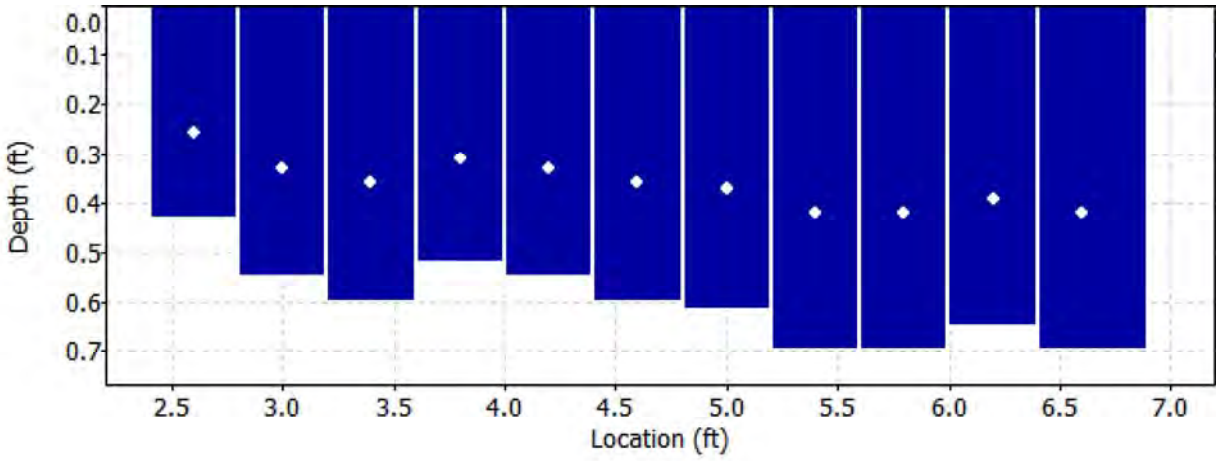
Discharge Measurement Summary

Date Generated: Mon Dec 14 2015

File Information		Site Details	
File Name	SCAMHGTG.008.WAD	Site Name	SAND CR AT HAYGOOD
Start Date and Time	2015/09/28 14:05:55	Operator(s)	BRIAN EPSTEIN







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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Dec 14 2015

File Information	
File Name	SCAMHGTG.008.WAD
Start Date and Time	2015/09/28 14:05:55

Site Details	
Site Name	SAND CR AT HAYGOOD
Operator(s)	BRIAN EPSTEIN

Quality Control

No Quality Control warnings

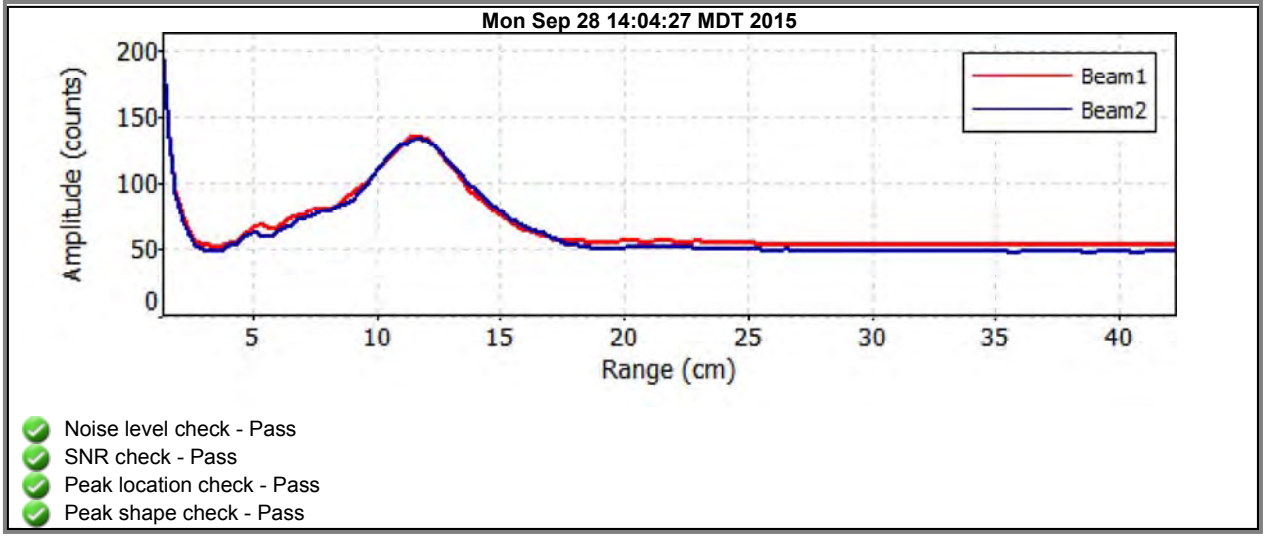
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Dec 14 2015

File Information		Site Details	
File Name	SCAMHGTG.008.WAD	Site Name	SAND CR AT HAYGOOD
Start Date and Time	2015/09/28 14:05:55	Operator(s)	BRIAN EPSTEIN

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: Wed Sep 2 2015

File Information

File Name	SCAMHCTG.021.WAD
Start Date and Time	2015/08/27 14:17:33

Site Details

Site Name	SAND CR 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	0.4%	1.0%
Velocity	0.9%	2.0%
Width	0.1%	0.1%
Method	1.8%	-
# Stations	2.3%	-
Overall	**3.2%**	**2.4%**

Summary

Averaging Int.	40	# Stations	22
Start Edge	REW	Total Width	5.200
Mean SNR	34.0 dB	Total Area	2.794
Mean Temp	58.26 °F	Mean Depth	0.537
Disch. Equation	Mid-Section	Mean Velocity	1.1337
		Total Discharge	**3.1679**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	14:17	8.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	14:17	9.30	0.6	0.490	0.6	0.196	0.7290	1.00	0.7290	0.196	0.1429	4.5
2	14:18	9.70	0.6	0.510	0.6	0.204	1.1296	1.00	1.1296	0.204	0.2303	7.3
3	14:19	10.10	0.6	0.550	0.6	0.220	1.2923	1.00	1.2923	0.165	0.2132	6.7
4	14:37	10.30	0.6	0.520	0.6	0.208	1.2526	1.00	1.2526	0.104	0.1303	4.1
5	14:21	10.50	0.6	0.570	0.6	0.228	1.4124	1.00	1.4124	0.114	0.1611	5.1
6	14:39	10.70	0.6	0.610	0.6	0.244	1.2379	1.00	1.2379	0.122	0.1510	4.8
7	14:22	10.90	0.6	0.630	0.6	0.252	1.3087	1.00	1.3087	0.126	0.1649	5.2
8	14:41	11.10	0.6	0.600	0.6	0.240	1.4413	1.00	1.4413	0.120	0.1729	5.5
9	14:23	11.30	0.6	0.650	0.6	0.260	1.2667	1.00	1.2667	0.130	0.1646	5.2
10	14:43	11.50	0.6	0.660	0.6	0.264	1.3593	1.00	1.3593	0.132	0.1794	5.7
11	14:25	11.70	0.6	0.630	0.6	0.252	1.3360	1.00	1.3360	0.126	0.1683	5.3
12	14:44	11.90	0.6	0.630	0.6	0.252	1.2710	1.00	1.2710	0.126	0.1601	5.1
13	14:26	12.10	0.6	0.630	0.6	0.252	1.2113	1.00	1.2113	0.126	0.1526	4.8
14	14:46	12.30	0.6	0.630	0.6	0.252	1.3058	1.00	1.3058	0.126	0.1645	5.2
15	14:27	12.50	0.6	0.700	0.6	0.280	1.3576	1.00	1.3576	0.140	0.1902	6.0
16	14:47	12.70	0.6	0.700	0.6	0.280	1.2766	1.00	1.2766	0.140	0.1787	5.6
17	14:28	12.90	0.6	0.700	0.6	0.280	1.0220	1.00	1.0220	0.210	0.2143	6.8
18	14:29	13.30	0.6	0.500	0.6	0.200	1.0000	1.00	1.0000	0.175	0.1752	5.5
19	14:32	13.60	0.6	0.450	0.6	0.180	0.4728	1.00	0.4728	0.113	0.0533	1.7
20	*14:35*	*13.80*	*0.6*	*0.400*	*0.6*	*0.160*	*0.0010*	*1.00*	*0.0010*	*0.100*	*0.0001*	*0.0*
21	14:35	14.10	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

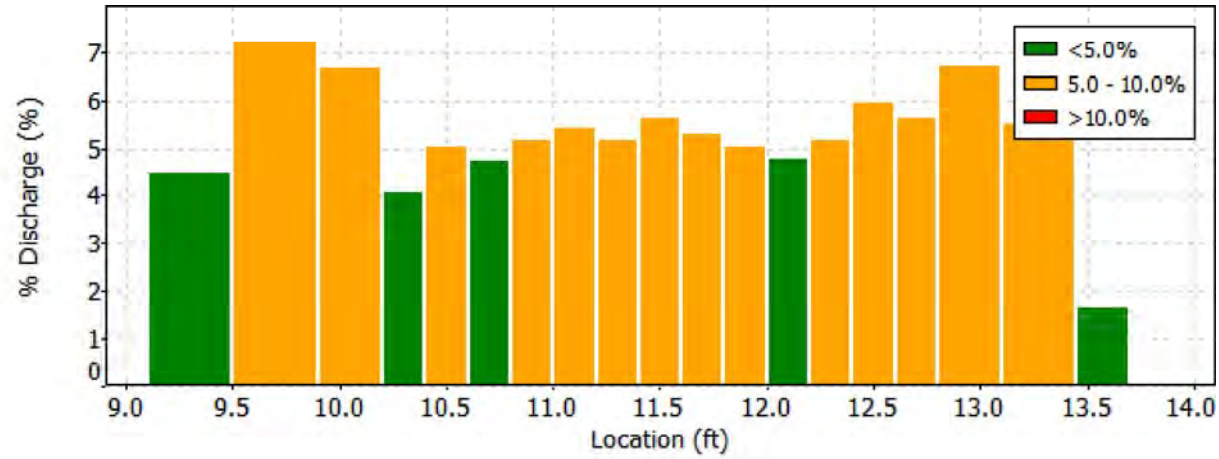
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

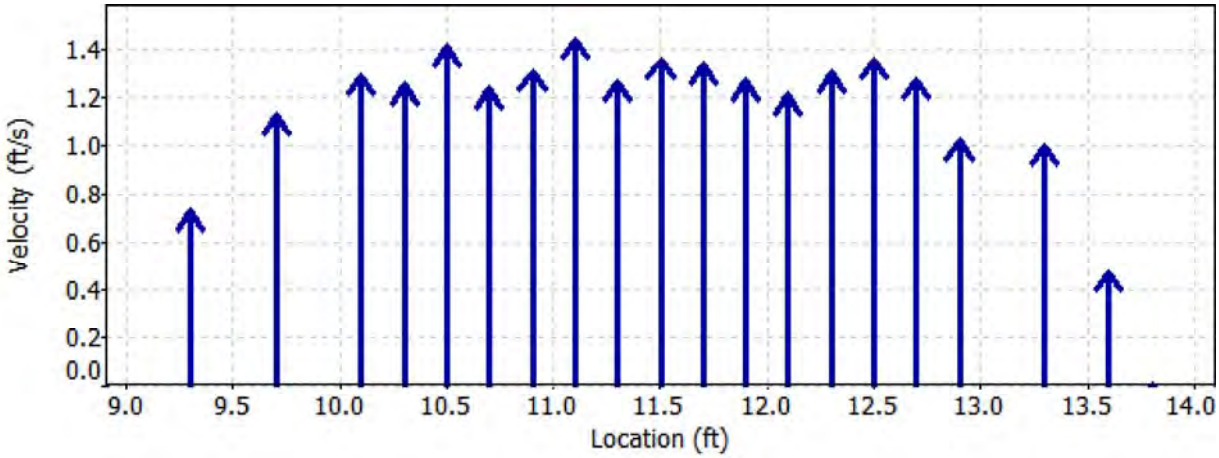
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

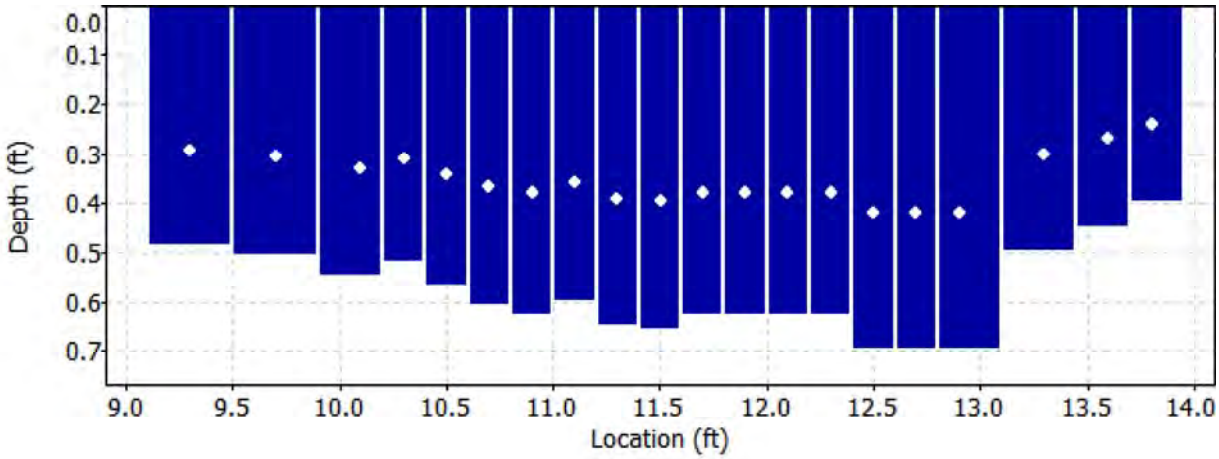
Discharge Measurement Summary

Date Generated: Wed Sep 2 2015

File Information		Site Details	
File Name	SCAMHCTG.021.WAD	Site Name	SAND CR TEMP GAGE
Start Date and Time	2015/08/27 14:17:33	Operator(s)	BJE







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Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Wed Sep 2 2015

File Information

File Name	SCAMHCTG.021.WAD
Start Date and Time	2015/08/27 14:17:33

Site Details

Site Name	SAND CR TEMP GAGE
Operator(s)	BJE

Quality Control

St	Loc	%Dep	Message
20	13.80	0.6	SNR (65.1) is different from typical SNR (34.0)
		0.6	High SNR variation during measurement: 4.7,5.2

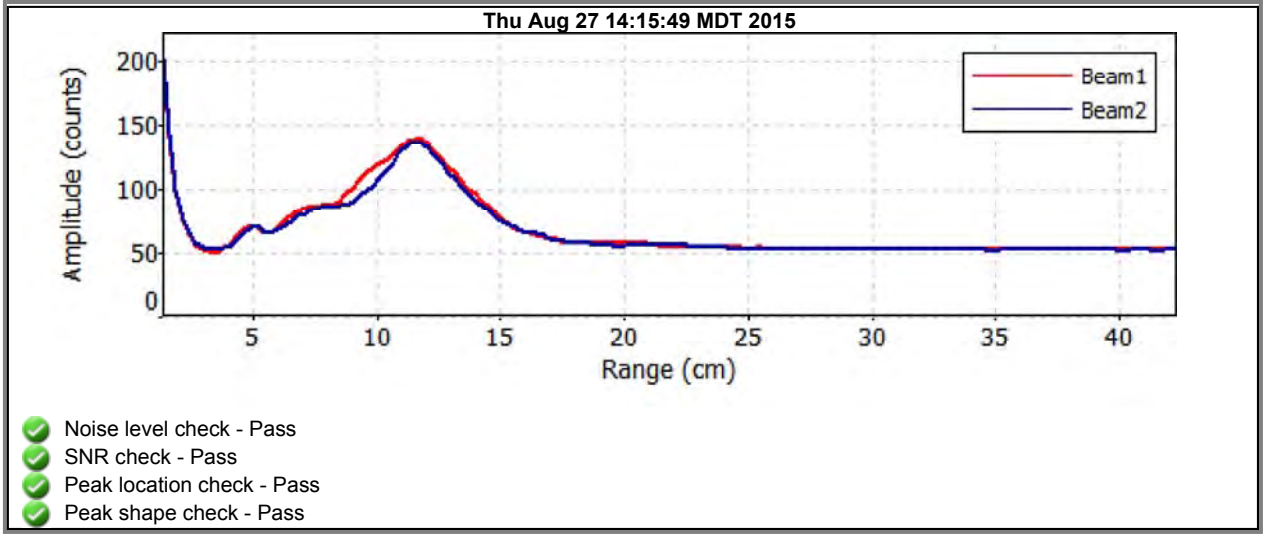
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Wed Sep 2 2015

File Information		Site Details	
File Name	SCAMHCTG.021.WAD	Site Name	SAND CR TEMP GAGE
Start Date and Time	2015/08/27 14:17:33	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: Mon Dec 14 2015

File Information

File Name	SCAMHCTG.006.WAD
Start Date and Time	2015/07/15 12:35:03

Site Details

Site Name	SAND CR AT MTH HAYGD
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%	0.5%
Velocity	0.7%	0.9%
Width	0.1%	0.1%
Method	1.6%	-
# Stations	2.0%	-
Overall	**2.9%**	**1.4%**

Summary

Averaging Int.	40	# Stations	25
Start Edge	REW	Total Width	5.200
Mean SNR	38.5 dB	Total Area	3.341
Mean Temp	59.63 °F	Mean Depth	0.642
Disch. Equation	Mid-Section	Mean Velocity	1.7974
		Total Discharge	**6.0050**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:35	1.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	12:35	1.40	0.6	0.520	0.6	0.208	1.6660	1.00	1.6660	0.156	0.2599	4.3
2	12:44	1.60	0.6	0.550	0.6	0.220	1.8038	1.00	1.8038	0.110	0.1983	3.3
3	12:36	1.80	0.6	0.600	0.6	0.240	1.8005	1.00	1.8005	0.120	0.2161	3.6
4	12:46	2.00	0.6	0.640	0.6	0.256	1.8199	1.00	1.8199	0.128	0.2329	3.9
5	12:38	2.20	0.6	0.610	0.6	0.244	1.6719	1.00	1.6719	0.122	0.2039	3.4
6	12:47	2.40	0.6	0.680	0.6	0.272	1.8301	1.00	1.8301	0.136	0.2489	4.1
7	12:40	2.60	0.6	0.700	0.6	0.280	1.9111	1.00	1.9111	0.140	0.2676	4.5
8	12:50	2.80	0.6	0.700	0.6	0.280	2.0128	1.00	2.0128	0.140	0.2818	4.7
9	12:41	3.00	0.6	0.700	0.6	0.280	1.9665	1.00	1.9665	0.140	0.2755	4.6
10	12:51	3.20	0.6	0.720	0.6	0.288	2.0548	1.00	2.0548	0.144	0.2959	4.9
11	12:42	3.40	0.6	0.720	0.6	0.288	1.9196	1.00	1.9196	0.144	0.2758	4.6
12	12:53	3.60	0.6	0.750	0.6	0.300	1.9820	1.00	1.9820	0.150	0.2965	4.9
13	12:54	3.80	0.6	0.700	0.6	0.280	2.0430	1.00	2.0430	0.140	0.2853	4.8
14	12:56	4.00	0.6	0.740	0.6	0.296	2.0387	1.00	2.0387	0.148	0.3010	5.0
15	12:57	4.20	0.6	0.750	0.6	0.300	2.0935	1.00	2.0935	0.150	0.3132	5.2
16	12:58	4.40	0.6	0.780	0.6	0.312	2.0469	1.00	2.0469	0.156	0.3184	5.3
17	12:59	4.60	0.6	0.800	0.6	0.320	1.8878	1.00	1.8878	0.160	0.3012	5.0
18	13:00	4.80	0.6	0.800	0.6	0.320	1.8625	1.00	1.8625	0.160	0.2972	4.9
19	13:02	5.00	0.6	0.800	0.6	0.320	1.7408	1.00	1.7408	0.162	0.2814	4.7
20	13:04	5.20	0.6	0.790	0.6	0.316	1.7077	1.00	1.7077	0.162	0.2762	4.6
21	13:05	5.40	0.6	0.770	0.6	0.308	1.6923	1.00	1.6923	0.154	0.2606	4.3
22	13:06	5.60	0.6	0.700	0.6	0.280	1.4491	1.00	1.4491	0.137	0.1981	3.3
23	13:07	5.80	0.6	0.620	0.6	0.248	0.6414	1.00	0.6414	0.186	0.1193	2.0
24	13:07	6.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

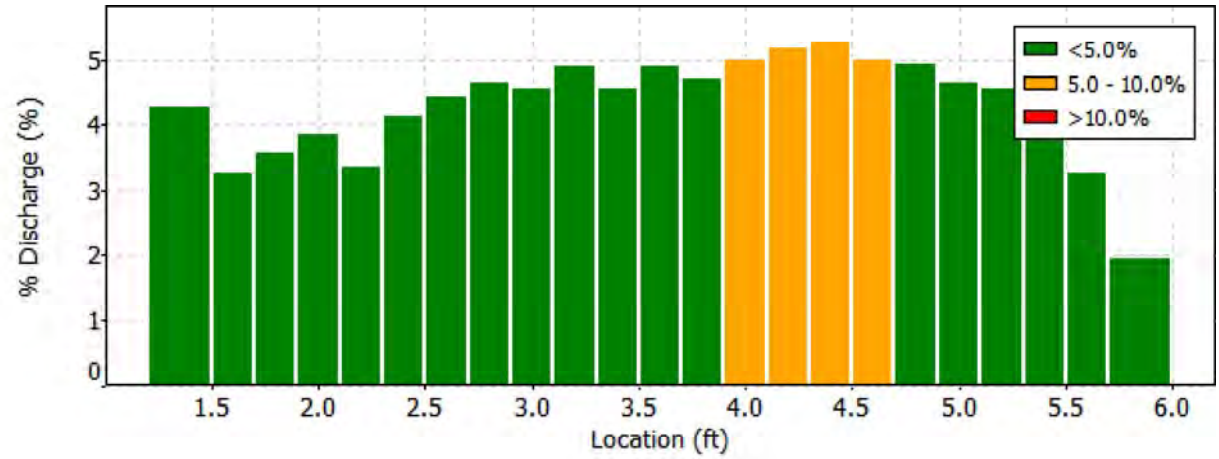
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

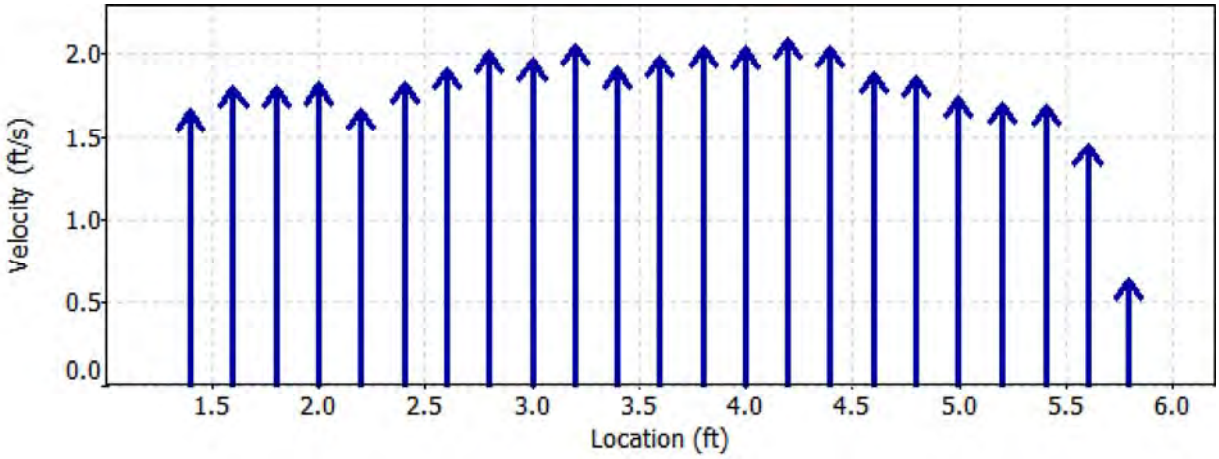
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

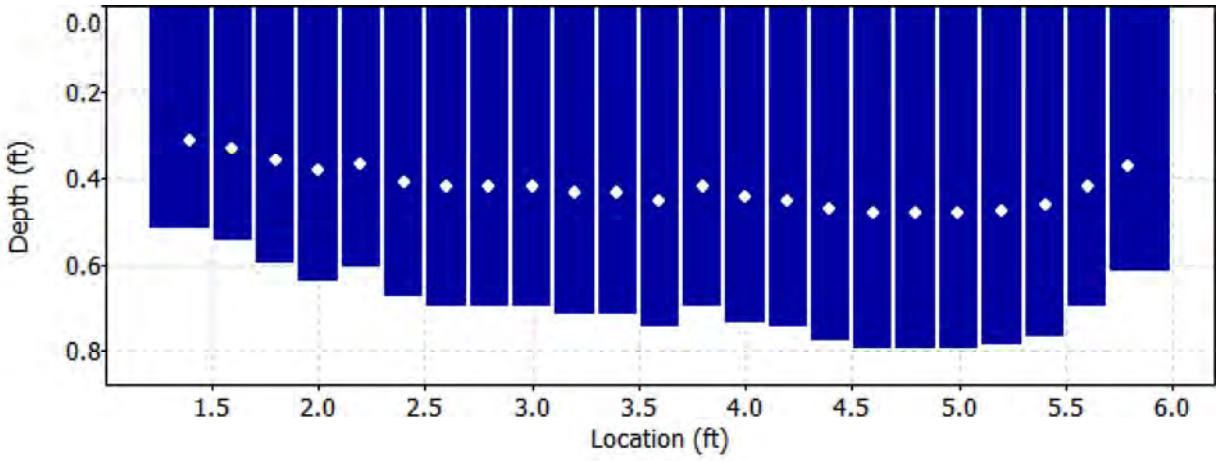
Discharge Measurement Summary

Date Generated: Mon Dec 14 2015

File Information		Site Details	
File Name	SCAMHCTG.006.WAD	Site Name	SAND CR AT MTH HAYGD
Start Date and Time	2015/07/15 12:35:03	Operator(s)	BRIAN EPSTEIN







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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Dec 14 2015

File Information		Site Details	
File Name	SCAMHCTG.006.WAD	Site Name	SAND CR AT MTH HAYGD
Start Date and Time	2015/07/15 12:35:03	Operator(s)	BRIAN EPSTEIN

Quality Control

No Quality Control warnings

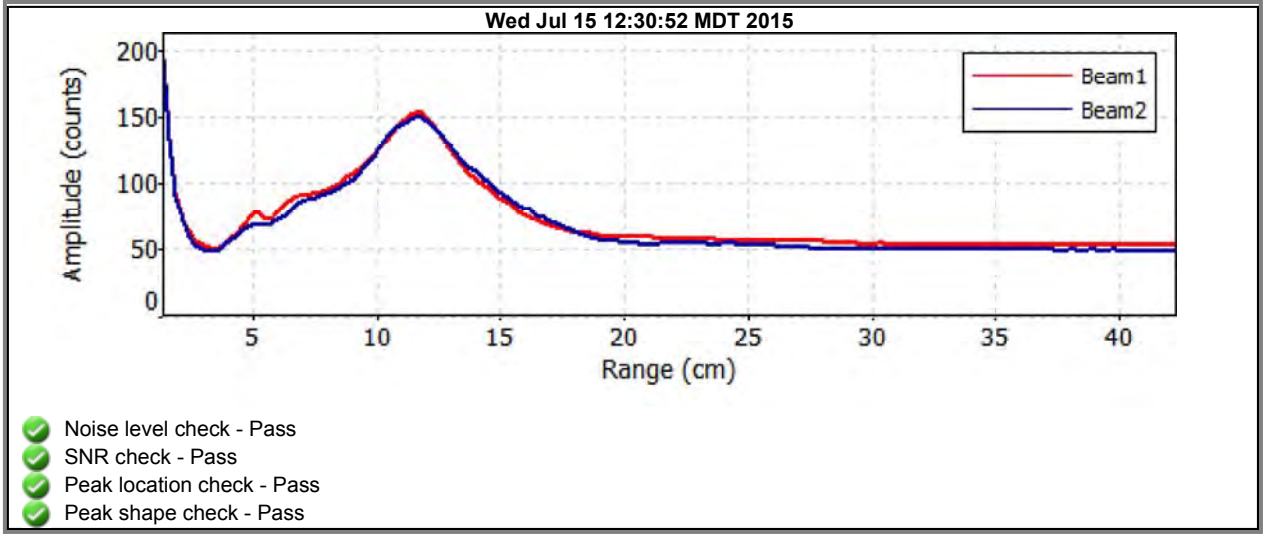
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Dec 14 2015

File Information		Site Details	
File Name	SCAMHCTG.006.WAD	Site Name	SAND CR AT MTH HAYGD
Start Date and Time	2015/07/15 12:35:03	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: Wed Jun 3 2015

File Information

File Name	SCAMHCTG.005.WAD
Start Date and Time	2015/05/12 19:15:44

Site Details

Site Name	SAND CR H CAN MOUTH
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%	1.9%
Velocity	1.2%	2.3%
Width	0.2%	0.2%
Method	2.6%	-
# Stations	4.2%	-
Overall	**5.2%**	**3.1%**

Summary

Averaging Int.	40	# Stations	12
Start Edge	REW	Total Width	5.000
Mean SNR	42.4 dB	Total Area	3.550
Mean Temp	49.63 °F	Mean Depth	0.710
Disch. Equation	Mid-Section	Mean Velocity	2.1631
		Total Discharge	**7.6782**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	19:15	2.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	19:15	2.50	0.6	0.650	0.6	0.260	1.4639	1.00	1.4639	0.260	0.3805	5.0
2	19:16	3.00	0.6	0.700	0.6	0.280	1.8396	1.00	1.8396	0.350	0.6440	8.4
3	19:17	3.50	0.6	0.730	0.6	0.292	2.1086	1.00	2.1086	0.365	0.7696	10.0
4	19:18	4.00	0.6	0.750	0.6	0.300	2.4554	1.00	2.4554	0.375	0.9208	12.0
5	19:19	4.50	0.6	0.800	0.6	0.320	2.3287	1.00	2.3287	0.400	0.9313	12.1
6	19:21	5.00	0.6	0.880	0.6	0.352	2.7375	1.00	2.7375	0.440	1.2044	15.7
7	19:22	5.50	0.6	0.900	0.6	0.360	2.6490	1.00	2.6490	0.450	1.1919	15.5
8	19:23	6.00	0.6	0.840	0.6	0.336	2.3875	1.00	2.3875	0.378	0.9023	11.8
9	19:24	6.40	0.6	0.820	0.6	0.328	1.7448	1.00	1.7448	0.328	0.5721	7.5
10	*19:25*	*6.80*	*0.6*	*0.510*	*0.6*	*0.204*	*0.7910*	*1.00*	*0.7910*	*0.204*	*0.1613*	*2.1*
11	19:25	7.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

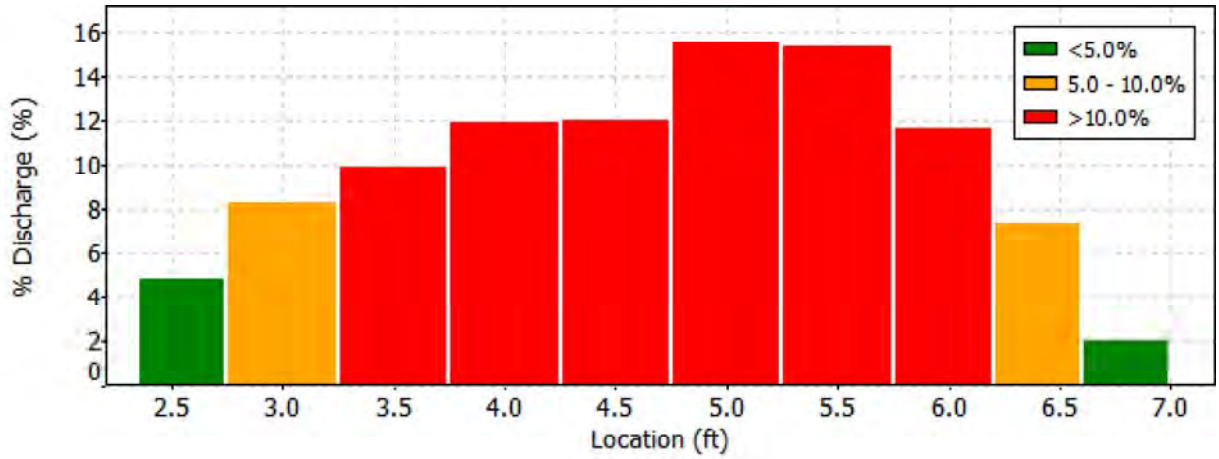
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

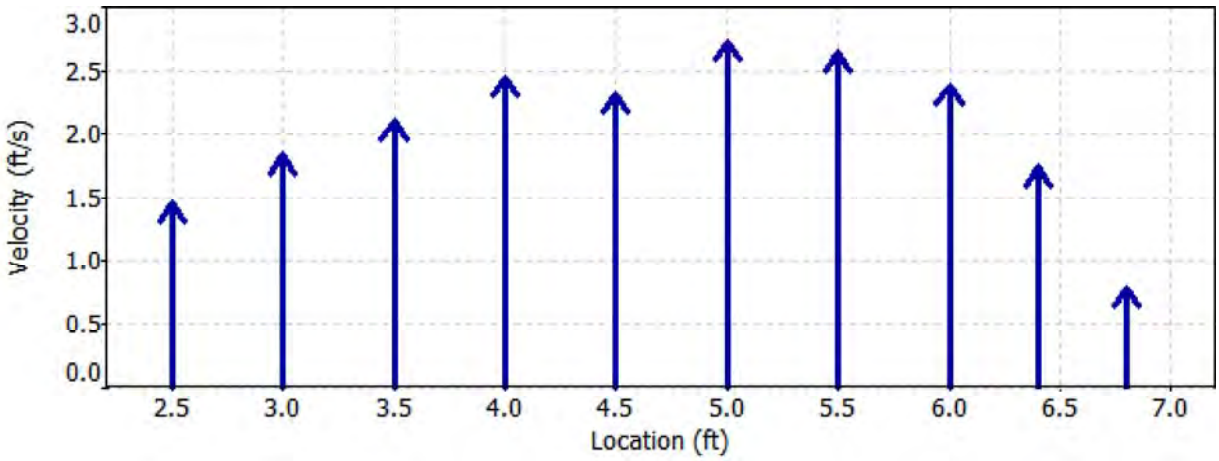
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

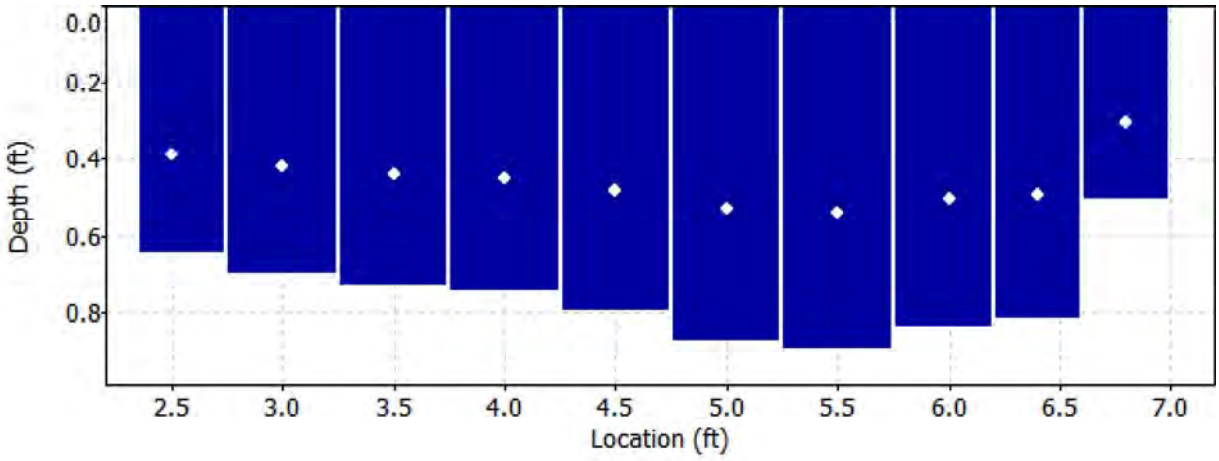
Discharge Measurement Summary

Date Generated: Wed Jun 3 2015

File Information		Site Details	
File Name	SCAMHCTG.005.WAD	Site Name	SAND CR H CAN MOUTH
Start Date and Time	2015/05/12 19:15:44	Operator(s)	BRIAN EPSTEIN







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Discharge Measurement Summary

Date Generated: Wed Jun 3 2015

File Information

File Name	SCAMHCTG.005.WAD
Start Date and Time	2015/05/12 19:15:44

Site Details

Site Name	SAND CR H CAN MOUTH
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
10	6.80	0.6	High SNR variation during measurement: 4.7,5.2
		0.6	High standard error: 0.120

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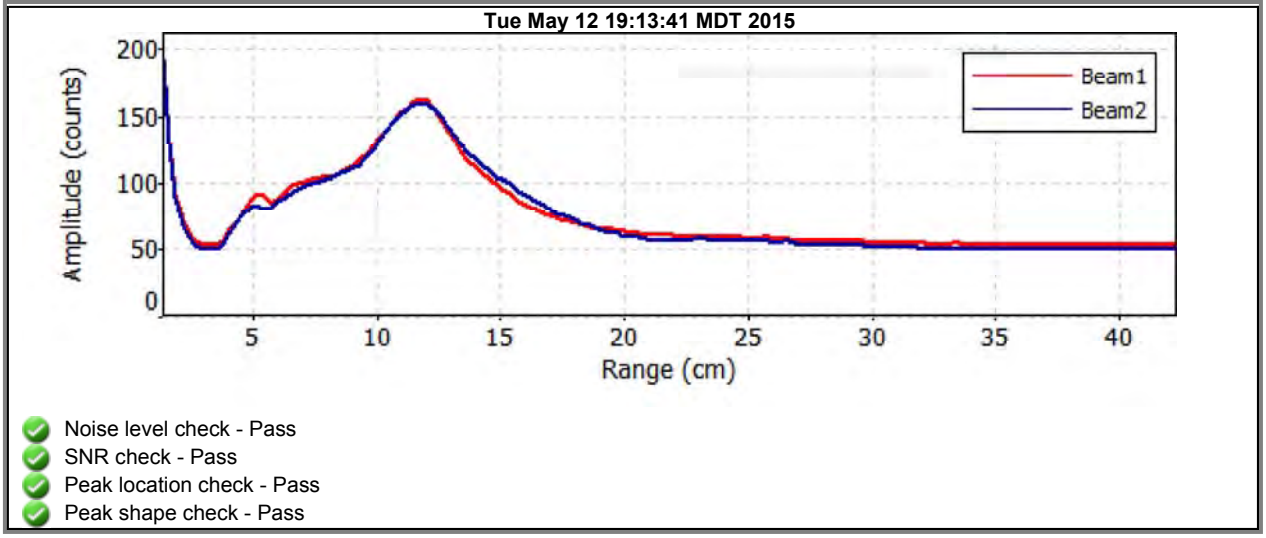
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Wed Jun 3 2015

File Information		Site Details	
File Name	SCAMHCTG.005.WAD	Site Name	SAND CR H CAN MOUTH
Start Date and Time	2015/05/12 19:15:44	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: Thu Feb 12 2015

File Information

File Name	SCAMHCTG.004.WAD
Start Date and Time	2015/02/06 14:20:12

Site Details

Site Name	SAND CR 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	0.5%	2.3%
Velocity	1.1%	2.6%
Width	0.2%	0.2%
Method	2.3%	-
# Stations	3.6%	-
Overall	**4.5%**	**3.6%**

Summary

Averaging Int.	40	# Stations	14
Start Edge	REW	Total Width	5.000
Mean SNR	30.0 dB	Total Area	2.366
Mean Temp	45.99 °F	Mean Depth	0.473
Disch. Equation	Mid-Section	Mean Velocity	0.7332
		Total Discharge	**1.7349**

Supplemental Data

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Fri Feb 6 14:39:12 MST 2015	5.100			REVERSE AND COR FCTR
2	Fri Feb 6 14:43:32 MST 2015	5.500			RVRS MTR COR NEG 1

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	14:20	0.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	14:20	1.10	0.6	0.270	0.6	0.108	0.5804	1.00	0.5804	0.108	0.0627	3.6
2	14:22	1.50	0.6	0.480	0.6	0.192	0.5978	1.00	0.5978	0.192	0.1147	6.6
3	14:23	1.90	0.6	0.570	0.6	0.228	0.7566	1.00	0.7566	0.228	0.1724	9.9
4	14:24	2.30	0.6	0.580	0.6	0.232	0.7923	1.00	0.7923	0.232	0.1838	10.6
5	14:26	2.70	0.6	0.570	0.6	0.228	0.7746	1.00	0.7746	0.228	0.1765	10.2
6	14:28	3.10	0.6	0.550	0.6	0.220	0.8445	1.00	0.8445	0.220	0.1857	10.7
7	14:29	3.50	0.6	0.580	0.6	0.232	0.9416	1.00	0.9416	0.232	0.2184	12.6
8	14:30	3.90	0.6	0.560	0.6	0.224	0.9236	1.00	0.9236	0.224	0.2069	11.9
9	*14:32*	*4.30*	*0.6*	*0.590*	*0.6*	*0.236*	*0.6096*	*1.00*	*0.6096*	*0.236*	*0.1438*	*8.3*
10	*14:34*	*4.70*	*0.6*	*0.580*	*0.6*	*0.232*	*0.5144*	*1.00*	*0.5144*	*0.232*	*0.1193*	*6.9*
11	*14:35*	*5.10*	*0.6*	*0.490*	*0.6*	*0.196*	*-0.6342*	*-1.00*	*0.6342*	*0.172*	*0.1089*	*6.3*
12	*14:40*	*5.40*	*0.6*	*0.210*	*0.6*	*0.084*	*-0.6611*	*-1.00*	*0.6611*	*0.063*	*0.0417*	*2.4*
13	14:40	5.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

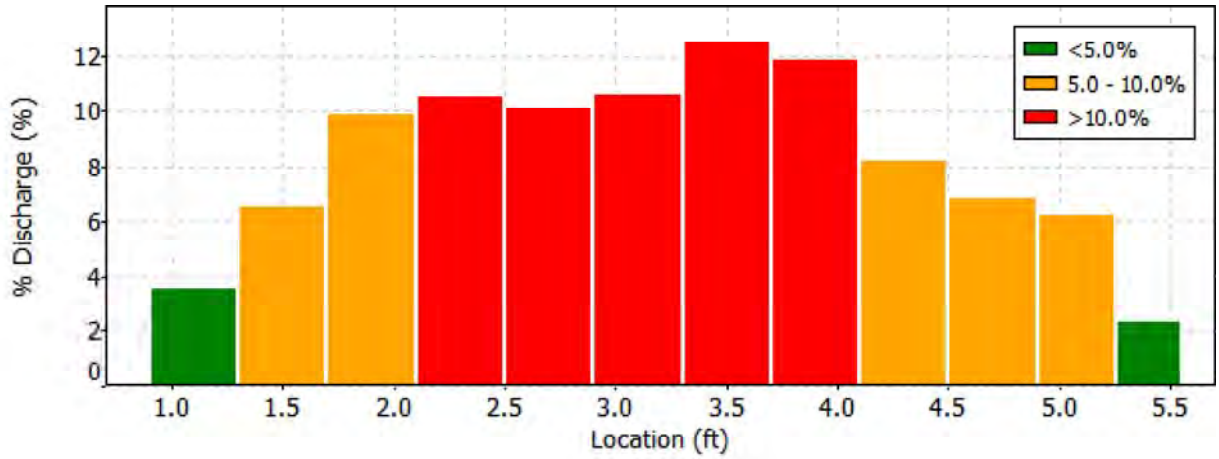
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

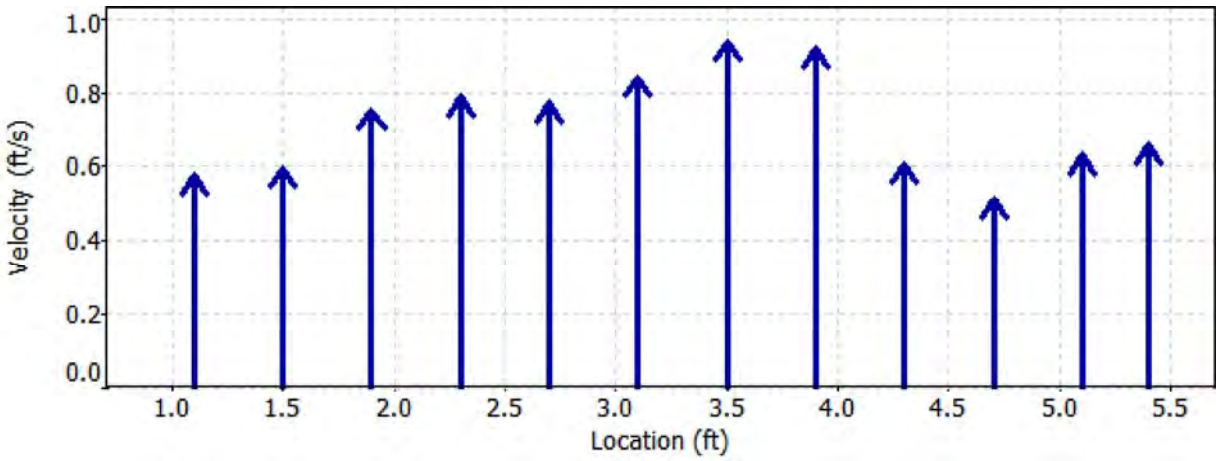
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

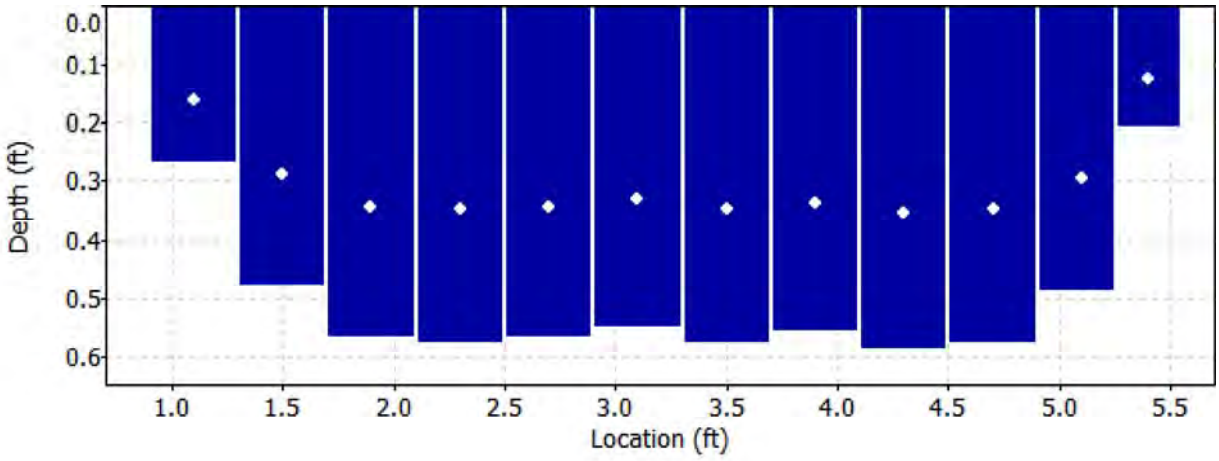
Discharge Measurement Summary

Date Generated: Thu Feb 12 2015

File Information		Site Details	
File Name	SCAMHCTG.004.WAD	Site Name	SAND CR TEMP GAGE
Start Date and Time	2015/02/06 14:20:12	Operator(s)	BRIAN EPSTEIN







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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Thu Feb 12 2015

File Information

File Name	SCAMHCTG.004.WAD
Start Date and Time	2015/02/06 14:20:12

Site Details

Site Name	SAND CR TEMP GAGE
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
9	4.30	0.6	High standard error: 0.032
10	4.70	0.6	High standard error: 0.031
11	5.10	0.6	High angle: -178
		0.6	High standard error: 0.032
12	5.40	0.6	High angle: -169
		0.6	High standard error: 0.035

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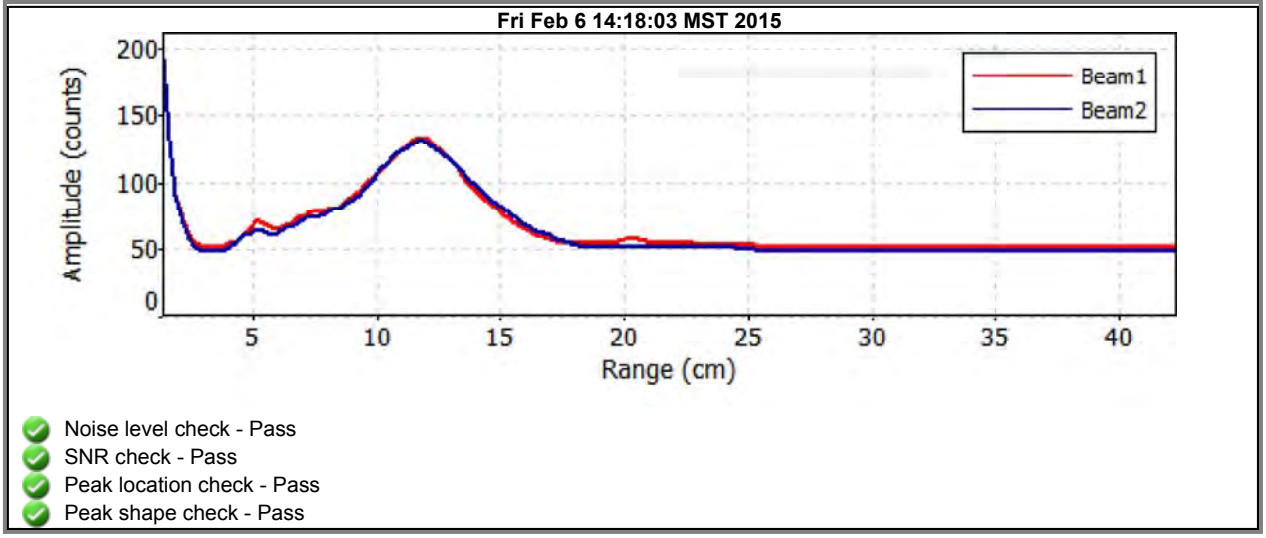
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Thu Feb 12 2015

File Information		Site Details	
File Name	SCAMHCTG.004.WAD	Site Name	SAND CR TEMP GAGE
Start Date and Time	2015/02/06 14:20:12	Operator(s)	BRIAN EPSTEIN

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: Mon Dec 15 2014

File Information

File Name	SCAMHCTG.003.WAD
Start Date and Time	2014/11/06 11:51:07

Site Details

Site Name	SAND CR AT 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	0.4%	2.0%
Velocity	1.0%	2.7%
Width	0.1%	0.1%
Method	2.1%	-
# Stations	3.1%	-
Overall	**4.0%**	**3.5%**

Summary

Averaging Int.	40	# Stations	16
Start Edge	REW	Total Width	5.000
Mean SNR	29.8 dB	Total Area	2.645
Mean Temp	47.96 °F	Mean Depth	0.529
Disch. Equation	Mid-Section	Mean Velocity	0.8409
		Total Discharge	**2.2241**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	11:51	1.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	11:51	1.70	0.6	0.460	0.6	0.184	0.8862	1.00	0.8862	0.184	0.1630	7.3
2	11:52	2.00	0.6	0.650	0.6	0.260	0.9081	1.00	0.9081	0.195	0.1770	8.0
3	11:53	2.30	0.6	0.660	0.6	0.264	1.0197	1.00	1.0197	0.198	0.2018	9.1
4	11:56	2.60	0.6	0.610	0.6	0.244	1.0630	1.00	1.0630	0.183	0.1944	8.7
5	11:57	2.90	0.6	0.650	0.6	0.260	0.9547	1.00	0.9547	0.195	0.1861	8.4
6	11:58	3.20	0.6	0.630	0.6	0.252	0.7874	1.00	0.7874	0.189	0.1487	6.7
7	12:04	3.50	0.6	0.640	0.6	0.256	0.8409	1.00	0.8409	0.192	0.1614	7.3
8	12:05	3.80	0.6	0.640	0.6	0.256	0.7854	1.00	0.7854	0.192	0.1508	6.8
9	12:06	4.10	0.6	0.620	0.6	0.248	0.9669	1.00	0.9669	0.186	0.1798	8.1
10	*12:07*	*4.40*	*0.6*	*0.640*	*0.6*	*0.256*	*0.9925*	*1.00*	*0.9925*	*0.192*	*0.1905*	*8.6*
11	12:08	4.70	0.6	0.650	0.6	0.260	0.7287	1.00	0.7287	0.195	0.1420	6.4
12	12:10	5.00	0.6	0.640	0.6	0.256	0.8346	1.00	0.8346	0.192	0.1602	7.2
13	12:11	5.30	0.6	0.650	0.6	0.260	0.5846	1.00	0.5846	0.195	0.1139	5.1
14	12:13	5.60	0.6	0.350	0.6	0.140	0.3451	1.00	0.3451	0.158	0.0545	2.4
15	12:13	6.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

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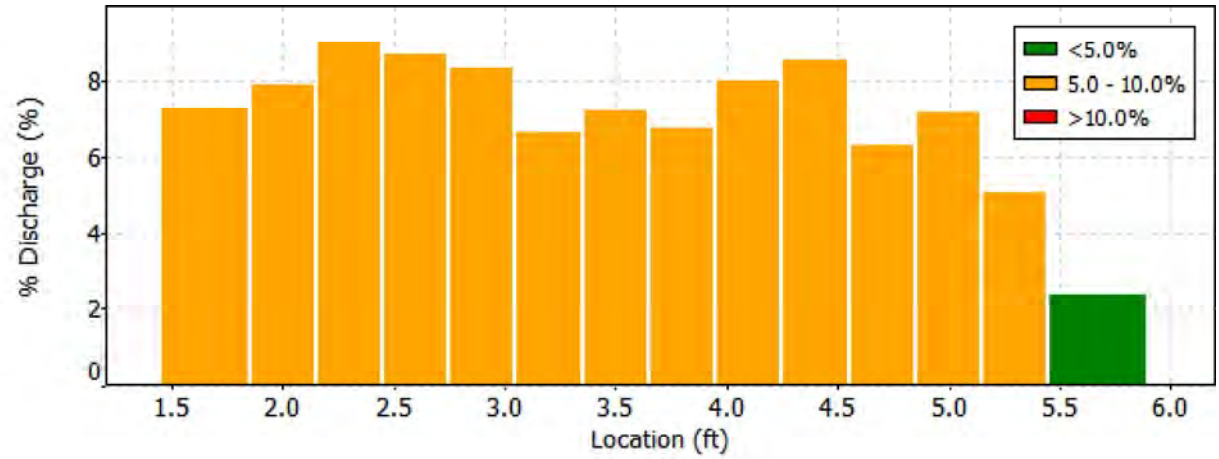
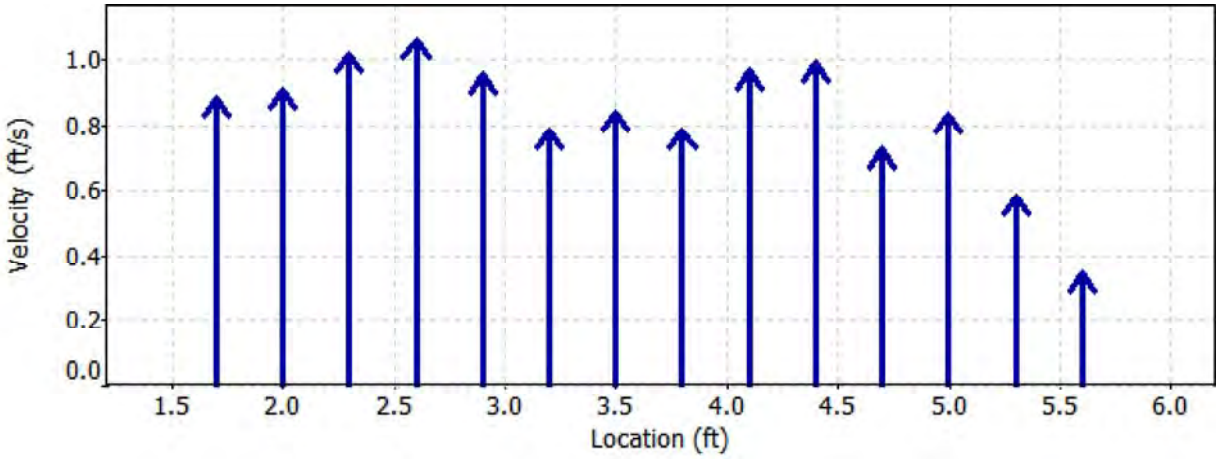
Colorado Water Conservation Board
Department of Natural Resources

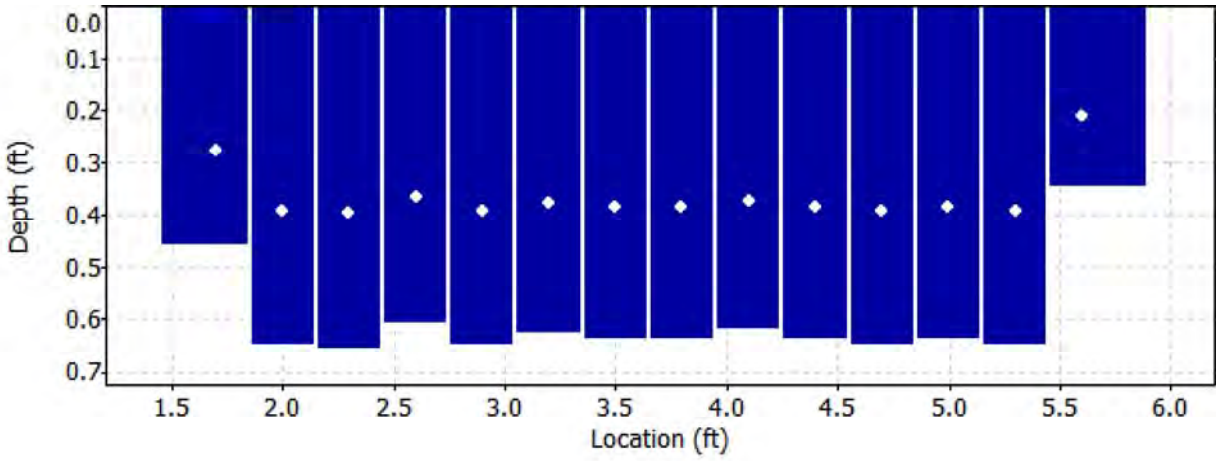
Discharge Measurement Summary

Date Generated: Mon Dec 15 2014

File Information		Site Details	
File Name	SCAMHCTG.003.WAD	Site Name	SAND CR AT TEMP GAGE
Start Date and Time	2014/11/06 11:51:07	Operator(s)	BJE







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Discharge Measurement Summary

Date Generated: Mon Dec 15 2014

File Information

File Name	SCAMHCTG.003.WAD
Start Date and Time	2014/11/06 11:51:07

Site Details

Site Name	SAND CR AT TEMP GAGE
Operator(s)	BJE

Quality Control

St	Loc	%Dep	Message
10	4.40	0.6	High SNR variation during measurement: 6.9,6.5

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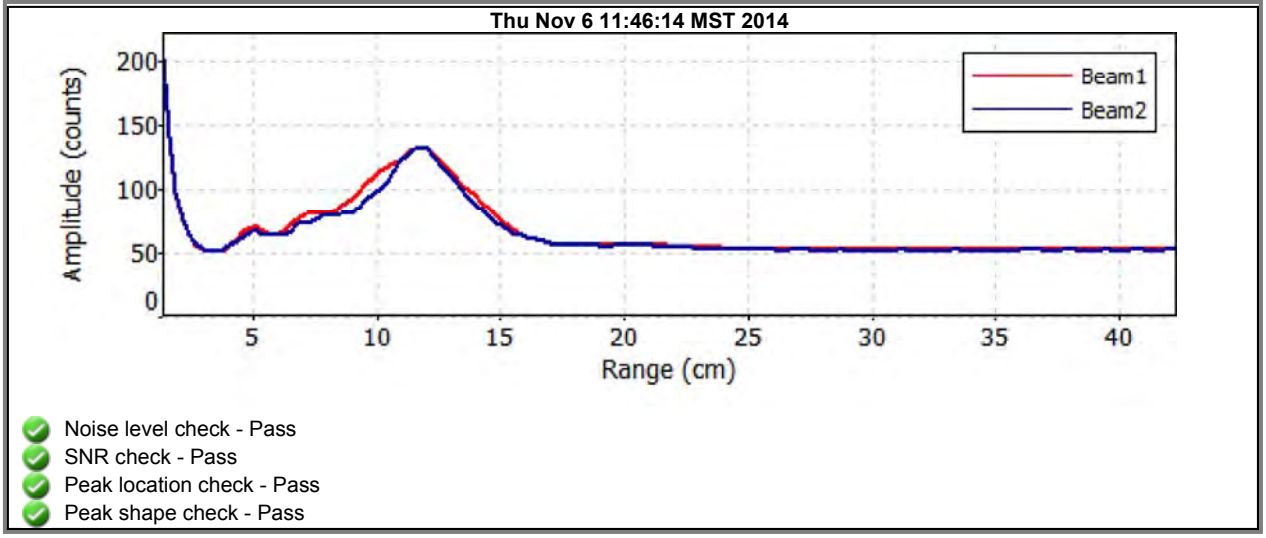
Discharge Measurement Summary

Date Generated: Mon Dec 15 2014

File Information		Site Details	
File Name	SCAMHCTG.003.WAD	Site Name	SAND CR AT TEMP GAGE
Start Date and Time	2014/11/06 11:51:07	Operator(s)	BJE

Automatic Quality Control Test (BeamCheck)



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

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Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information

File Name	SCAMHCTG.002.WAD
Start Date and Time	2014/09/29 13:55:42

Site Details

Site Name	SAND CR A MTH HAYGD
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%	1.6%
Velocity	1.0%	3.0%
Width	0.2%	0.2%
Method	2.4%	-
# Stations	3.6%	-
Overall	**4.6%**	**3.6%**

Summary

Averaging Int.	40	# Stations	14
Start Edge	REW	Total Width	5.203
Mean SNR	36.2 dB	Total Area	3.266
Mean Temp	55.15 °F	Mean Depth	0.628
Disch. Equation	Mid-Section	Mean Velocity	1.2602
		Total Discharge	**4.1159**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	13:55	1.80	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*13:55*	*2.20*	*0.6*	*0.580*	*0.6*	*0.232*	*1.2313*	*1.00*	*1.2313*	*0.232*	*0.2859*	*6.9*
2	13:56	2.60	0.6	0.700	0.6	0.280	1.2051	1.00	1.2051	0.280	0.3377	8.2
3	14:02	3.00	0.6	0.750	0.6	0.300	1.5732	1.00	1.5732	0.300	0.4723	11.5
4	14:03	3.40	0.6	0.750	0.6	0.300	1.6798	1.00	1.6798	0.300	0.5043	12.3
5	14:04	3.80	0.6	0.820	0.6	0.328	1.3921	1.00	1.3921	0.328	0.4568	11.1
6	14:05	4.20	0.6	0.800	0.6	0.320	1.3950	1.00	1.3950	0.320	0.4466	10.9
7	14:06	4.60	0.6	0.760	0.6	0.304	1.2070	1.00	1.2070	0.304	0.3671	8.9
8	14:08	5.00	0.6	0.800	0.6	0.320	1.4974	1.00	1.4974	0.320	0.4794	11.6
9	14:09	5.40	0.6	0.800	0.6	0.320	1.3871	1.00	1.3871	0.320	0.4441	10.8
10	14:10	5.80	0.6	0.600	0.6	0.240	0.9715	1.00	0.9715	0.240	0.2333	5.7
11	14:12	6.20	0.6	0.500	0.6	0.200	0.4423	1.00	0.4423	0.200	0.0885	2.2
12	*14:13*	*6.60*	*0.6*	*0.300*	*0.6*	*0.120*	*-0.0010*	*1.00*	*-0.0010*	*0.120*	*-0.0001*	*0.0*
13	14:13	7.00	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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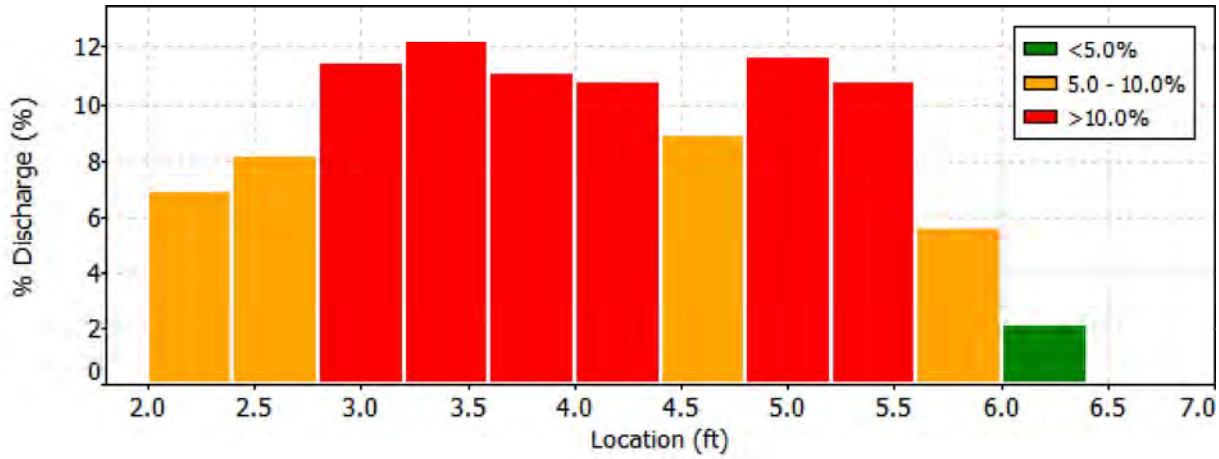
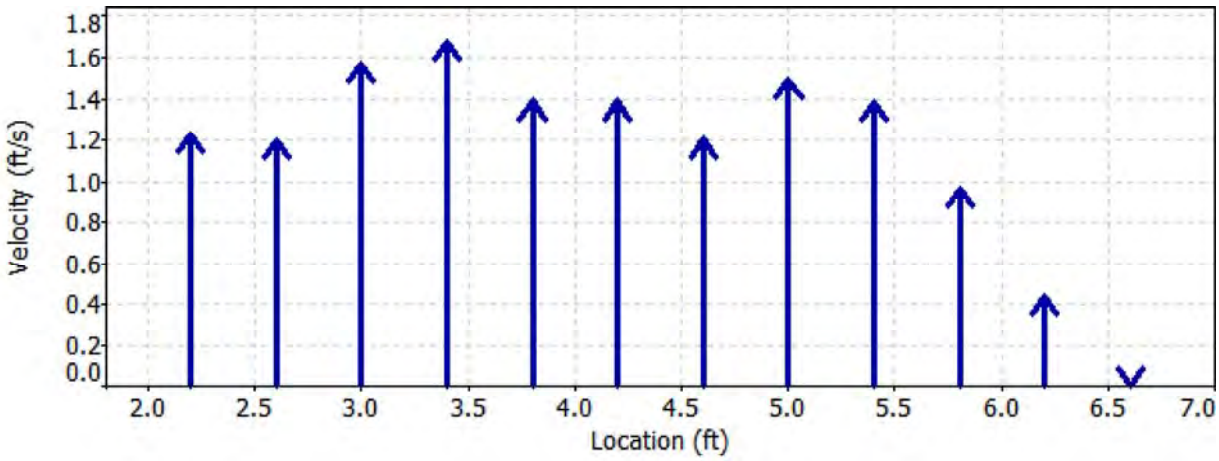
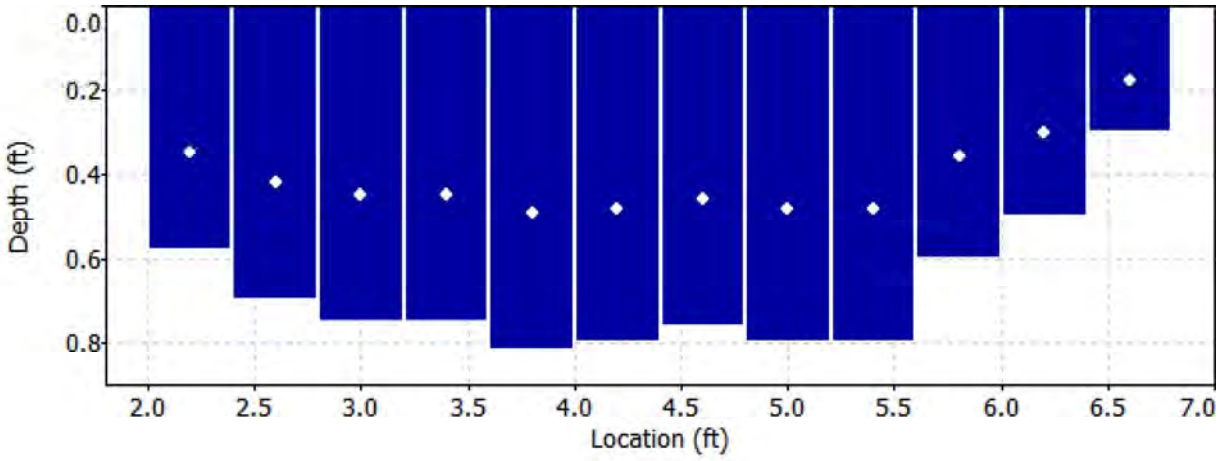
Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information		Site Details	
File Name	SCAMHCTG.002.WAD	Site Name	SAND CR A MTH HAYGD
Start Date and Time	2014/09/29 13:55:42	Operator(s)	BJE







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Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information		Site Details	
File Name	SCAMHCTG.002.WAD	Site Name	SAND CR A MTH HAYGD
Start Date and Time	2014/09/29 13:55:42	Operator(s)	BJE

Quality Control

St	Loc	%Dep	Message
1	2.20	0.6	High number of spikes: 5
12	6.60	0.6	SNR (50.7) is different from typical SNR (36.2)
		0.6	High SNR variation during measurement: 5.6,6.0

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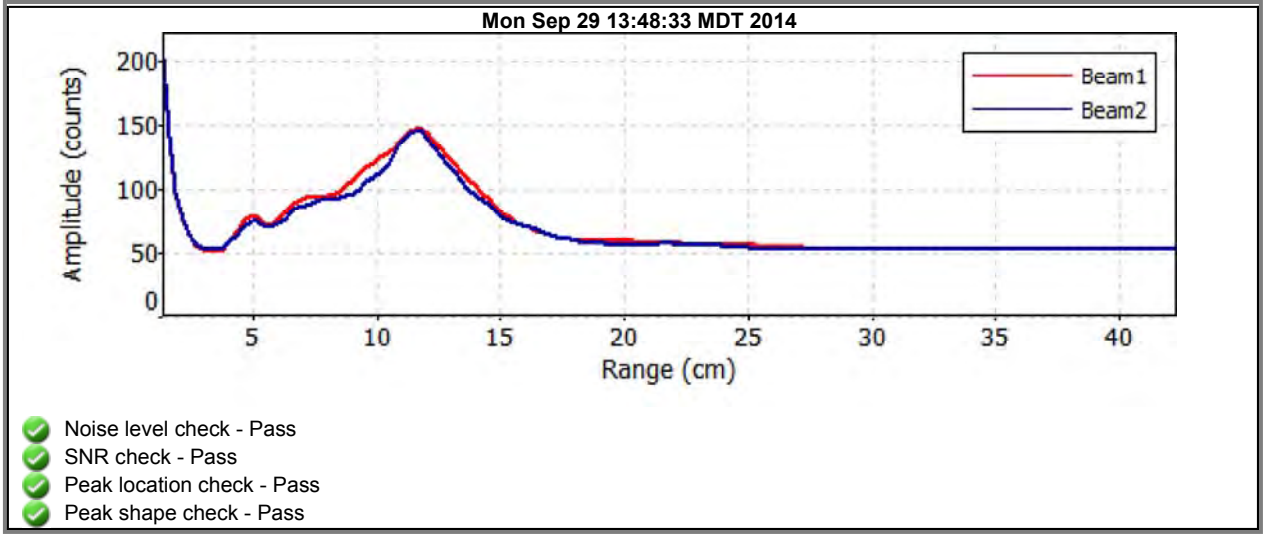
Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information		Site Details	
File Name	SCAMHCTG.002.WAD	Site Name	SAND CR A MTH HAYGD
Start Date and Time	2014/09/29 13:55:42	Operator(s)	BJE

Automatic Quality Control Test (BeamCheck)



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

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Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information

File Name	SCAMHCTG.001.WAD
Start Date and Time	2014/09/04 16:23:21

Site Details

Site Name	SAND CR AT MTG HG CN
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%	1.2%
Velocity	1.2%	6.8%
Width	0.2%	0.2%
Method	2.6%	-
# Stations	4.6%	-
Overall	**5.5%**	**7.0%**

Summary

Averaging Int.	40	# Stations	11
Start Edge	LEW	Total Width	5.200
Mean SNR	29.1 dB	Total Area	2.794
Mean Temp	54.61 °F	Mean Depth	0.537
Disch. Equation	Mid-Section	Mean Velocity	0.7931
		Total Discharge	**2.2157**

Supplemental Data

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Thu Sep 4 16:34:10 MDT 2014	6.600			REV MTR COR NEG 1

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	16:23	2.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	16:23	2.60	0.6	0.620	0.6	0.248	0.7149	1.00	0.7149	0.341	0.2438	11.0
2	16:25	3.10	0.6	0.640	0.6	0.256	0.9196	1.00	0.9196	0.320	0.2943	13.3
3	16:26	3.60	0.6	0.620	0.6	0.248	0.8983	1.00	0.8983	0.310	0.2785	12.6
4	16:27	4.10	0.6	0.600	0.6	0.240	0.8209	1.00	0.8209	0.300	0.2463	11.1
5	16:28	4.60	0.6	0.600	0.6	0.240	0.9324	1.00	0.9324	0.300	0.2798	12.6
6	16:29	5.10	0.6	0.600	0.6	0.240	0.9505	1.00	0.9505	0.300	0.2852	12.9
7	16:30	5.60	0.6	0.600	0.6	0.240	0.9199	1.00	0.9199	0.300	0.2760	12.5
8	*16:31*	*6.10*	*0.6*	*0.640*	*0.6*	*0.256*	*0.3586*	*1.00*	*0.3586*	*0.320*	*0.1148*	*5.2*
9	*16:35*	*6.60*	*0.6*	*0.550*	*0.6*	*0.220*	*-0.6516*	*-1.00*	*0.6516*	*0.302*	*0.1971*	*8.9*
10	16:35	7.20	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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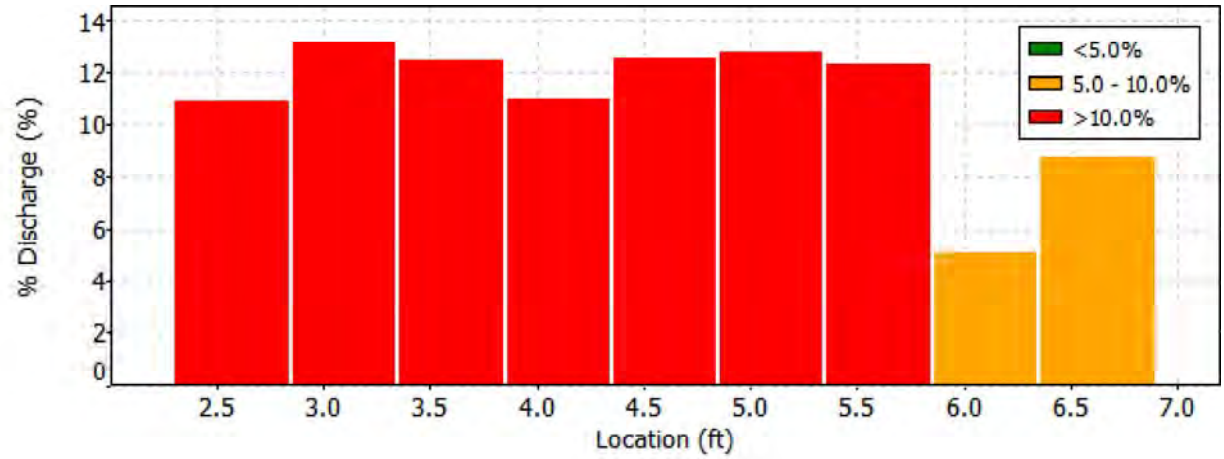
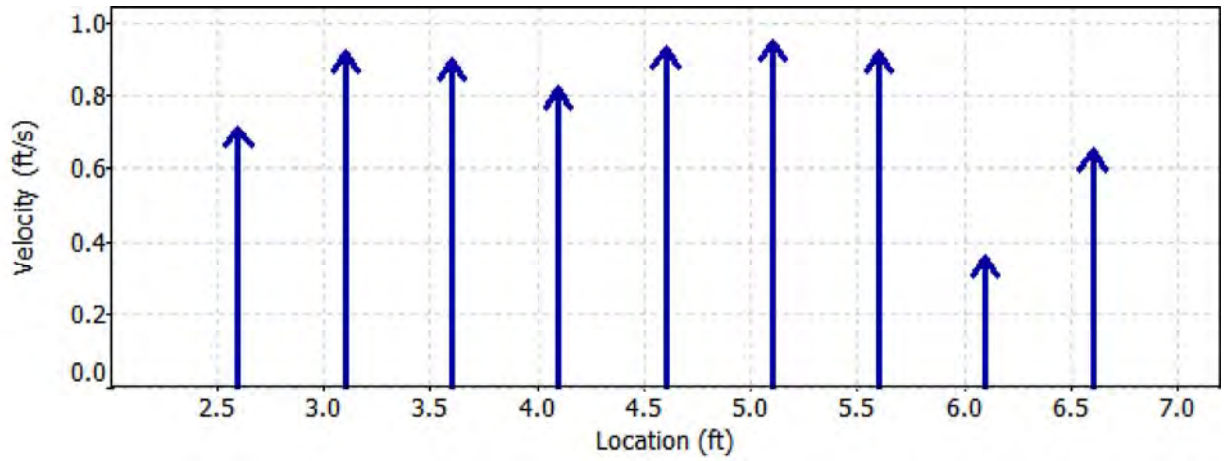
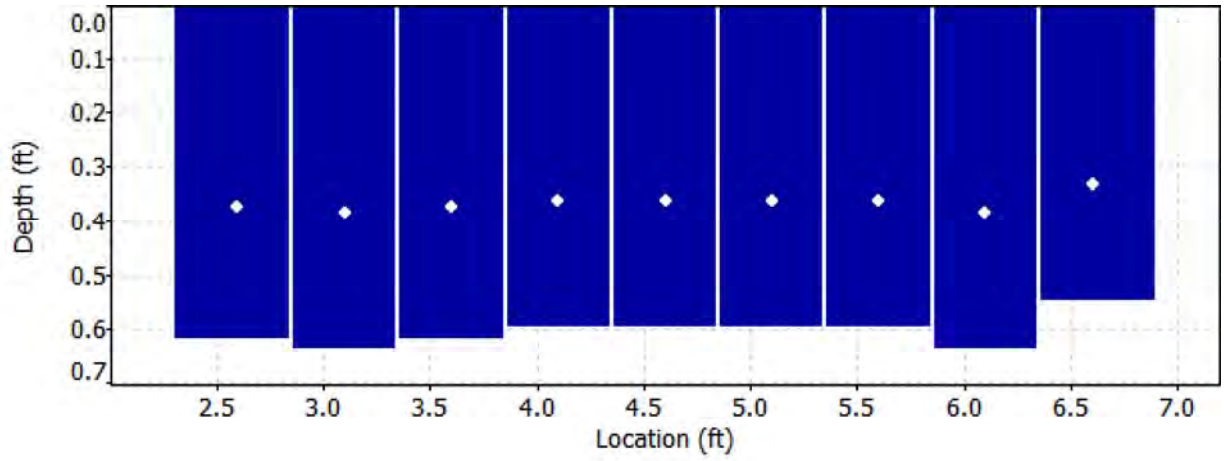
Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information		Site Details	
File Name	SCAMHCTG.001.WAD	Site Name	SAND CR AT MTG HG CN
Start Date and Time	2014/09/04 16:23:21	Operator(s)	BJE







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Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information

File Name	SCAMHCTG.001.WAD
Start Date and Time	2014/09/04 16:23:21

Site Details

Site Name	SAND CR AT MTG HG CN
Operator(s)	BJE

Quality Control

St	Loc	%Dep	Message
8	6.10	0.6	High SNR variation during measurement: 9.0,8.6
		0.6	High standard error: 0.050
9	6.60	0.6	High angle: -169

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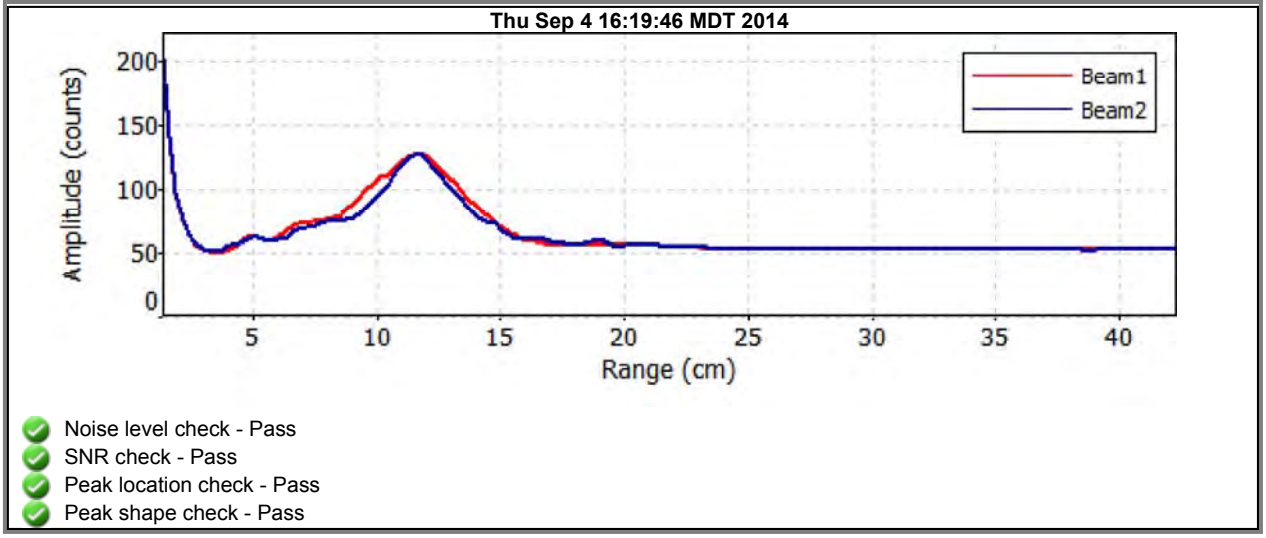
Discharge Measurement Summary

Date Generated: Fri Nov 21 2014

File Information		Site Details	
File Name	SCAMHCTG.001.WAD	Site Name	SAND CR AT MTG HG CN
Start Date and Time	2014/09/04 16:23:21	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	SCR2XNPL.002.WAD
Start Date and Time	2014/07/10 10:46:51

Site Details

Site Name	SND CR NR PRK
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%	1.9%
Velocity	1.2%	3.8%
Width	0.1%	0.1%
Method	2.1%	-
# Stations	2.8%	-
Overall	**3.9%**	**4.3%**

Summary

Averaging Int.	40	# Stations	18
Start Edge	LEW	Total Width	8.500
Mean SNR	27.6 dB	Total Area	5.330
Mean Temp	63.12 °F	Mean Depth	0.627
Disch. Equation	Mid-Section	Mean Velocity	0.6602
		Total Discharge	**3.5185**

Measurement Results

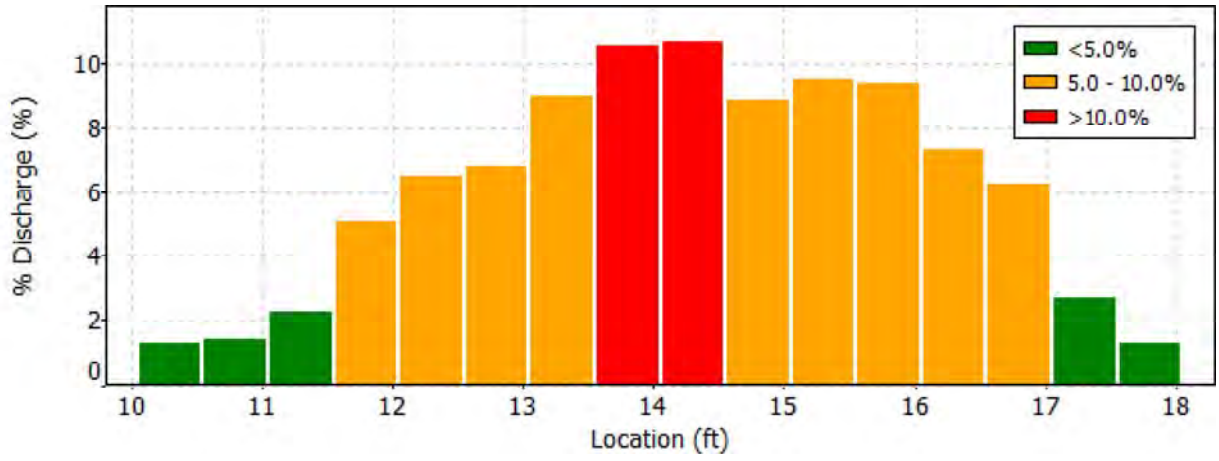
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	10:46	18.30	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*10:49*	*17.80*	*0.6*	*0.370*	*0.6*	*0.148*	*0.2510*	*1.00*	*0.2510*	*0.185*	*0.0464*	*1.3*
2	10:51	17.30	0.6	0.460	0.6	0.184	0.4199	1.00	0.4199	0.230	0.0966	2.7
3	10:53	16.80	0.6	0.470	0.6	0.188	0.9472	1.00	0.9472	0.235	0.2227	6.3
4	10:54	16.30	0.6	0.570	0.6	0.228	0.9134	1.00	0.9134	0.285	0.2603	7.4
5	10:56	15.80	0.6	0.680	0.6	0.272	0.9760	1.00	0.9760	0.340	0.3319	9.4
6	*11:02*	*15.30*	*0.6*	*0.810*	*0.6*	*0.324*	*0.8330*	*1.00*	*0.8330*	*0.405*	*0.3374*	*9.6*
7	11:04	14.80	0.6	0.860	0.6	0.344	0.7336	1.00	0.7336	0.430	0.3154	9.0
8	11:07	14.30	0.6	0.930	0.6	0.372	0.8143	1.00	0.8143	0.465	0.3787	10.8
9	11:08	13.80	0.6	0.800	0.6	0.320	0.9373	1.00	0.9373	0.400	0.3749	10.7
10	11:10	13.30	0.6	0.920	0.6	0.368	0.6913	1.00	0.6913	0.460	0.3180	9.0
11	11:12	12.80	0.6	0.900	0.6	0.360	0.5384	1.00	0.5384	0.450	0.2423	6.9
12	11:13	12.30	0.6	0.840	0.6	0.336	0.5531	1.00	0.5531	0.420	0.2323	6.6
13	11:14	11.80	0.6	0.760	0.6	0.304	0.4741	1.00	0.4741	0.380	0.1801	5.1
14	11:16	11.30	0.6	0.530	0.6	0.212	0.3091	1.00	0.3091	0.265	0.0819	2.3
15	11:19	10.80	0.6	0.460	0.6	0.184	0.2251	1.00	0.2251	0.230	0.0518	1.5
16	11:20	10.30	0.6	0.300	0.6	0.120	0.3199	1.00	0.3199	0.150	0.0480	1.4
17	11:20	9.80	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

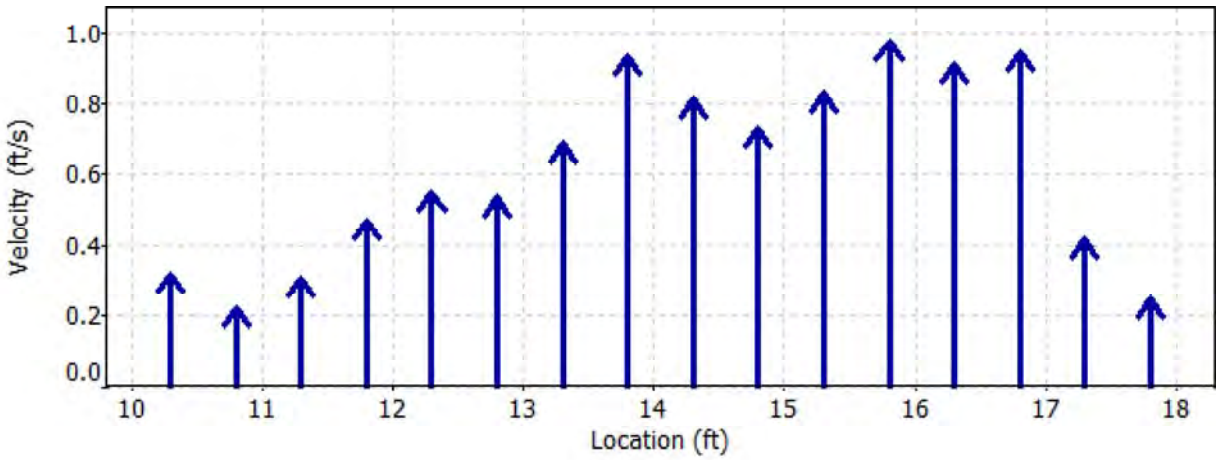
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

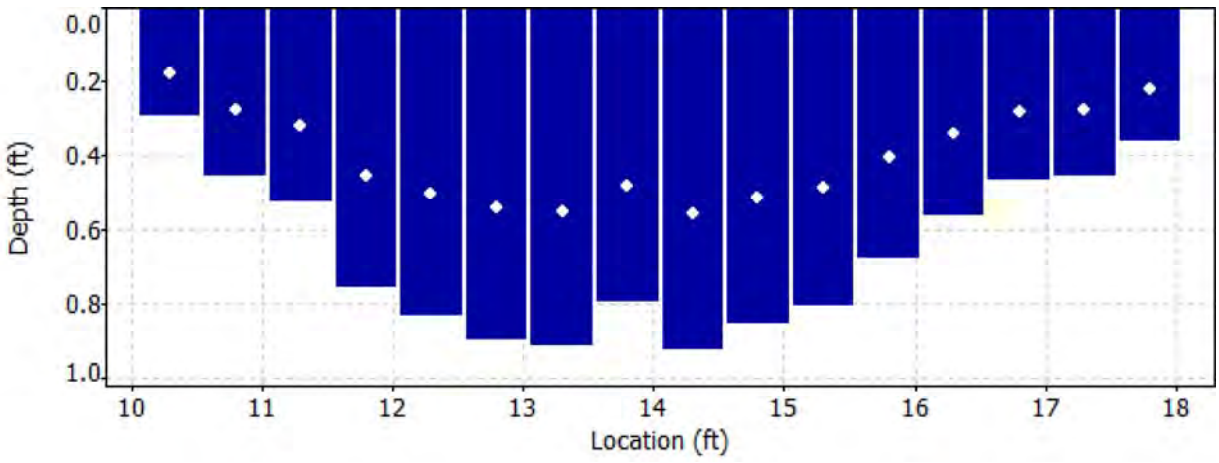
Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information		Site Details	
File Name	SCR2XNPL.002.WAD	Site Name	SND CR NR PRK
Start Date and Time	2014/07/10 10:46:51	Operator(s)	BJE







Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information		Site Details	
File Name	SCR2XNPL.002.WAD	Site Name	SND CR NR PRK
Start Date and Time	2014/07/10 10:46:51	Operator(s)	BJE

Quality Control

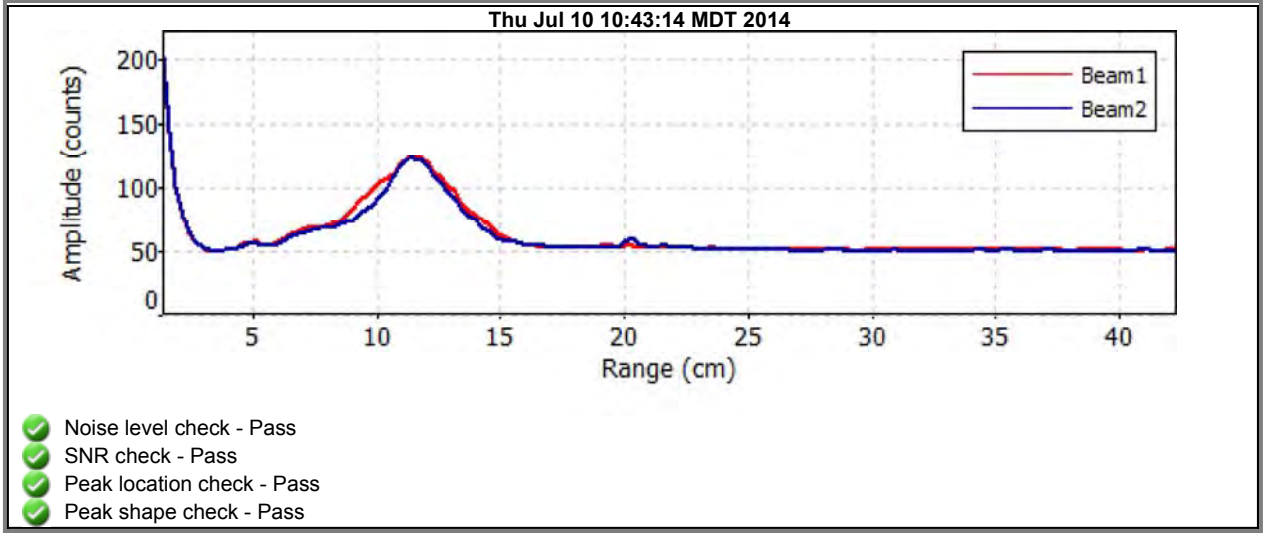
St	Loc	%Dep	Message
1	17.80	0.6	High angle: 24
6	15.30	0.6	High standard error: 0.043

Discharge Measurement Summary

Date Generated: Tue Jul 15 2014

File Information		Site Details	
File Name	SCR2XNPL.002.WAD	Site Name	SND CR NR PRK
Start Date and Time	2014/07/10 10:46:51	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	SNCRUR2X.001.WAD
Start Date and Time	2014/03/26 12:47:18

Site Details

Site Name	SAND CR UPPER R2X
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%	1.7%
Velocity	1.9%	7.0%
Width	0.1%	0.1%
Method	2.2%	-
# Stations	3.1%	-
Overall	**4.4%**	**7.3%**

Summary

Averaging Int.	40	# Stations	16
Start Edge	REW	Total Width	6.300
Mean SNR	34.0 dB	Total Area	3.608
Mean Temp	45.51 °F	Mean Depth	0.573
Disch. Equation	Mid-Section	Mean Velocity	1.3971
		Total Discharge	**5.0407**

Supplemental Data

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Wed Mar 26 12:50:05 MDT 2014	12.100			0 VELOCITY
2	Wed Mar 26 12:52:20 MDT 2014	11.300			IN EDDY

Measurement Results

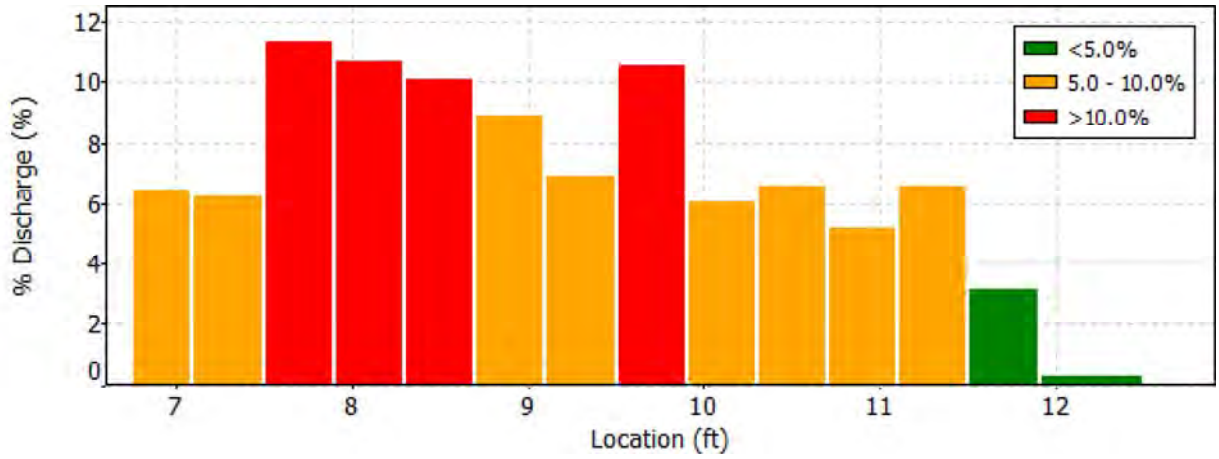
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:47	12.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*12:50*	*12.10*	*0.6*	*0.360*	*0.6*	*0.144*	*0.0886*	*1.00*	*0.0886*	*0.216*	*0.0191*	*0.4*
2	*12:53*	*11.70*	*0.6*	*0.480*	*0.6*	*0.192*	*0.8376*	*1.00*	*0.8376*	*0.192*	*0.1608*	*3.2*
3	12:54	11.30	0.6	0.520	0.6	0.208	1.6102	1.00	1.6102	0.208	0.3349	6.6
4	12:55	10.90	0.6	0.520	0.6	0.208	1.2785	1.00	1.2785	0.208	0.2659	5.3
5	*12:57*	*10.50*	*0.6*	*0.630*	*0.6*	*0.252*	*1.3314*	*1.00*	*1.3314*	*0.252*	*0.3354*	*6.7*
6	12:58	10.10	0.6	0.680	0.6	0.272	1.1312	1.00	1.1312	0.272	0.3077	6.1
7	12:59	9.70	0.6	0.700	0.6	0.280	1.9065	1.00	1.9065	0.280	0.5338	10.6
8	13:00	9.30	0.6	0.700	0.6	0.280	1.2615	1.00	1.2615	0.280	0.3532	7.0
9	13:03	8.90	0.6	0.660	0.6	0.264	1.7110	1.00	1.7110	0.264	0.4517	9.0
10	*13:04*	*8.50*	*0.6*	*0.790*	*0.6*	*0.316*	*1.6230*	*1.00*	*1.6230*	*0.316*	*0.5128*	*10.2*
11	13:05	8.10	0.6	0.840	0.6	0.336	1.6122	1.00	1.6122	0.336	0.5415	10.7
12	13:07	7.70	0.6	0.800	0.6	0.320	1.8012	1.00	1.8012	0.320	0.5762	11.4
13	13:08	7.30	0.6	0.740	0.6	0.296	1.0725	1.00	1.0725	0.296	0.3179	6.3
14	*13:12*	*6.90*	*0.6*	*0.480*	*0.6*	*0.192*	*-1.9606*	*-1.00*	*1.9606*	*0.168*	*0.3297*	*6.5*
15	13:12	6.60	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

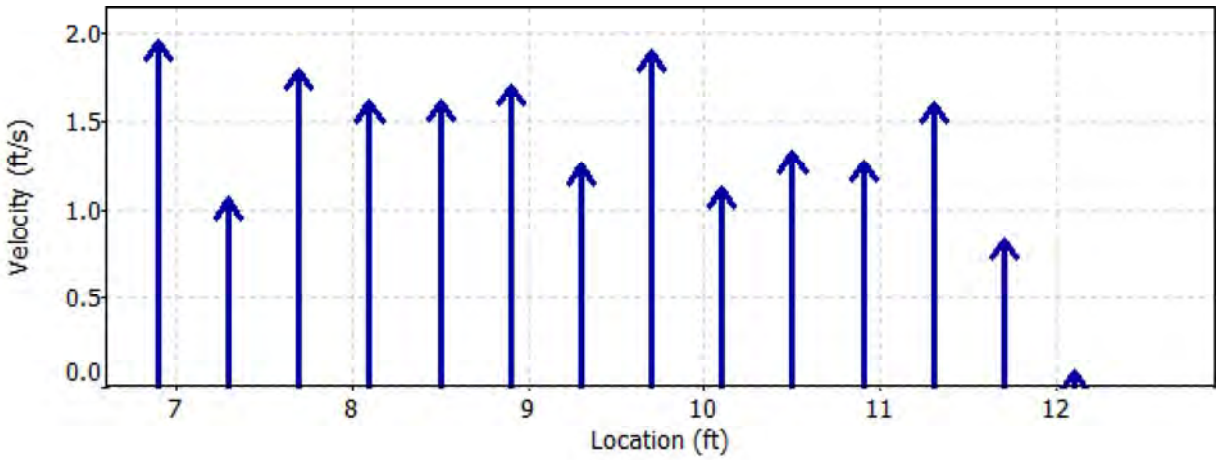
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

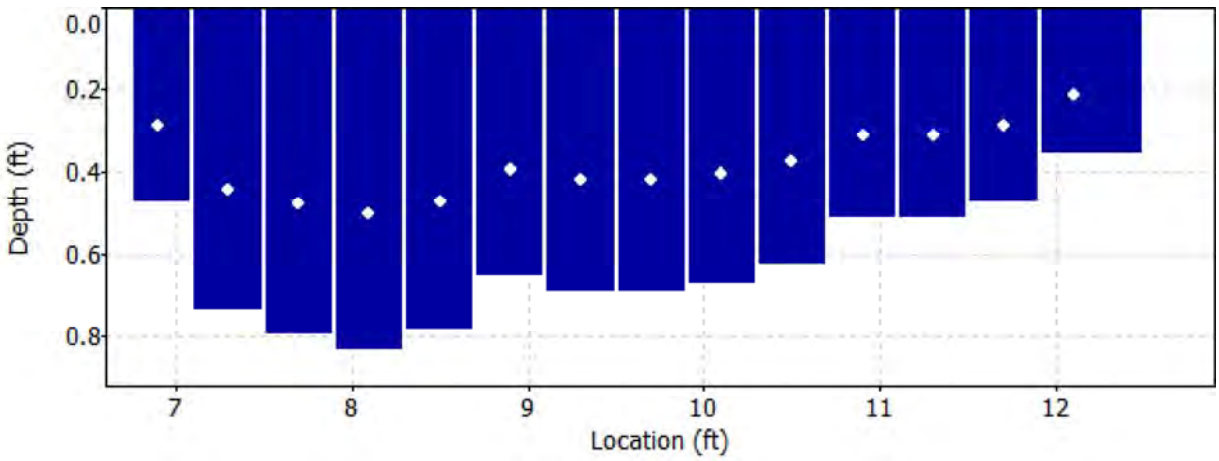
Discharge Measurement Summary

Date Generated: Fri Apr 11 2014

File Information		Site Details	
File Name	SNCRUR2X.001.WAD	Site Name	SAND CR UPPER R2X
Start Date and Time	2014/03/26 12:47:18	Operator(s)	BRIAN EPSTEIN







Discharge Measurement Summary

Date Generated: Fri Apr 11 2014

File Information	
File Name	SNCRUR2X.001.WAD
Start Date and Time	2014/03/26 12:47:18

Site Details	
Site Name	SAND CR UPPER R2X
Operator(s)	BRIAN EPSTEIN

Quality Control

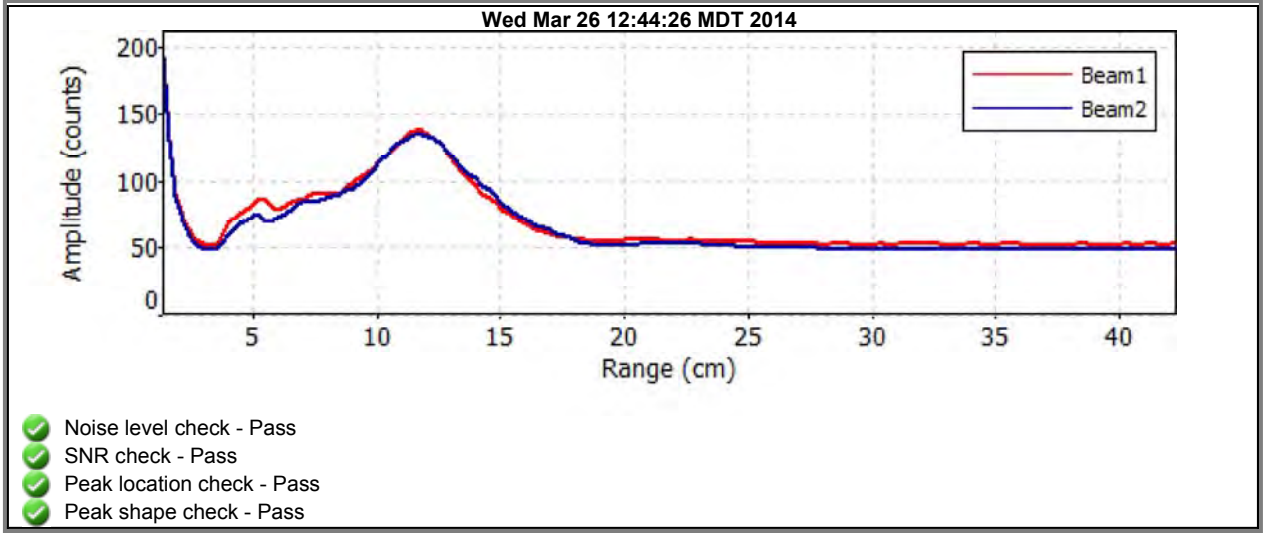
St	Loc	%Dep	Message
1	12.10	0.6	High angle: 52
2	11.70	0.6	High angle: 20
5	10.50	0.6	High standard error: 0.122
10	8.50	0.6	High standard error: 0.125
14	6.90	0.6	High angle: -170

Discharge Measurement Summary

Date Generated: Fri Apr 11 2014

File Information		Site Details	
File Name	SNCRUR2X.001.WAD	Site Name	SAND CR UPPER R2X
Start Date and Time	2014/03/26 12:47:18	Operator(s)	BRIAN EPSTEIN

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: Mon Apr 14 2014

File Information

File Name	SNCRLR2X.001.WAD
Start Date and Time	2014/03/26 14:06:37

Site Details

Site Name	SAND CR LOWER R2X
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%	2.1%
Velocity	0.7%	4.4%
Width	0.1%	0.1%
Method	1.6%	-
# Stations	1.8%	-
Overall	**2.7%**	**5.0%**

Summary

Averaging Int.	40	# Stations	28
Start Edge	LEW	Total Width	14.100
Mean SNR	29.8 dB	Total Area	5.123
Mean Temp	50.25 °F	Mean Depth	0.363
Disch. Equation	Mid-Section	Mean Velocity	0.9697
		Total Discharge	**4.9677**

Measurement Results

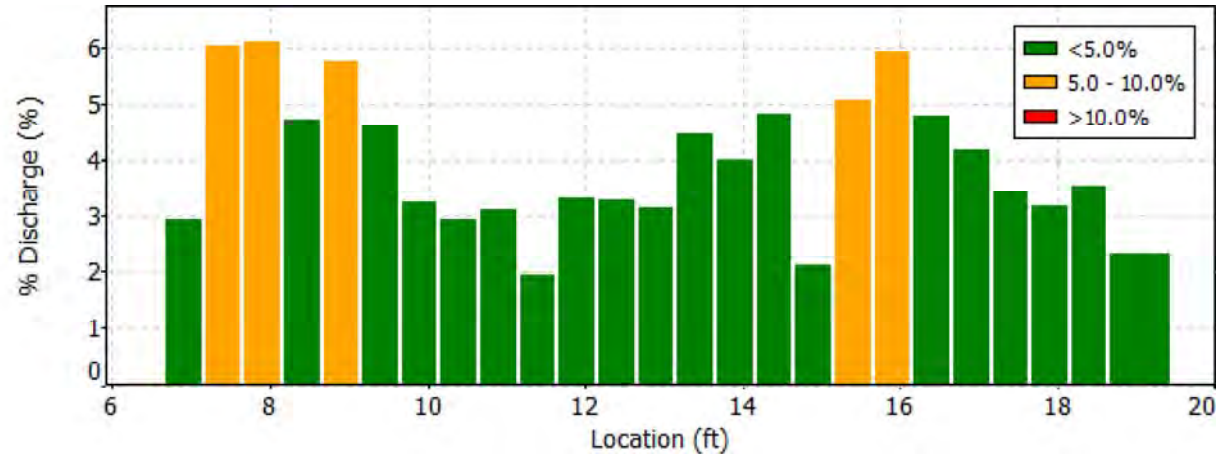
St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	14:06	5.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*14:06*	*6.40*	*0.6*	*0.290*	*0.6*	*0.116*	*0.0007*	*1.00*	*0.0007*	*0.145*	*0.0001*	*0.0*
2	14:08	6.90	0.6	0.420	0.6	0.168	0.7073	1.00	0.7073	0.210	0.1485	3.0
3	14:09	7.40	0.6	0.500	0.6	0.200	1.2090	1.00	1.2090	0.250	0.3022	6.1
4	14:10	7.90	0.6	0.630	0.6	0.252	0.9698	1.00	0.9698	0.315	0.3055	6.1
5	14:12	8.40	0.6	0.660	0.6	0.264	0.7133	1.00	0.7133	0.330	0.2354	4.7
6	14:13	8.90	0.6	0.580	0.6	0.232	0.9895	1.00	0.9895	0.290	0.2870	5.8
7	14:14	9.40	0.6	0.470	0.6	0.188	0.9839	1.00	0.9839	0.235	0.2313	4.7
8	14:15	9.90	0.6	0.310	0.6	0.124	1.0591	1.00	1.0591	0.155	0.1642	3.3
9	14:16	10.40	0.6	0.350	0.6	0.140	0.8438	1.00	0.8438	0.175	0.1477	3.0
10	14:18	10.90	0.6	0.320	0.6	0.128	0.9731	1.00	0.9731	0.160	0.1556	3.1
11	*14:21*	*11.40*	*0.6*	*0.350*	*0.6*	*0.140*	*0.5614*	*1.00*	*0.5614*	*0.175*	*0.0983*	*2.0*
12	14:22	11.90	0.6	0.310	0.6	0.124	1.0764	1.00	1.0764	0.155	0.1669	3.4
13	14:23	12.40	0.6	0.330	0.6	0.132	1.0016	1.00	1.0016	0.165	0.1653	3.3
14	14:25	12.90	0.6	0.320	0.6	0.128	0.9875	1.00	0.9875	0.160	0.1579	3.2
15	14:26	13.40	0.6	0.400	0.6	0.160	1.1230	1.00	1.1230	0.200	0.2246	4.5
16	14:27	13.90	0.6	0.310	0.6	0.124	1.2963	1.00	1.2963	0.155	0.2009	4.0
17	14:29	14.40	0.6	0.380	0.6	0.152	1.2667	1.00	1.2667	0.190	0.2406	4.8
18	*14:31*	*14.90*	*0.6*	*0.420*	*0.6*	*0.168*	*0.5108*	*1.00*	*0.5108*	*0.210*	*0.1073*	*2.2*
19	14:32	15.40	0.6	0.420	0.6	0.168	1.2113	1.00	1.2113	0.210	0.2543	5.1
20	14:33	15.90	0.6	0.400	0.6	0.160	1.4790	1.00	1.4790	0.200	0.2958	6.0
21	14:35	16.40	0.6	0.350	0.6	0.140	1.3717	1.00	1.3717	0.175	0.2401	4.8
22	14:36	16.90	0.6	0.290	0.6	0.116	1.4442	1.00	1.4442	0.145	0.2094	4.2
23	14:37	17.40	0.6	0.370	0.6	0.148	0.9357	1.00	0.9357	0.185	0.1731	3.5
24	14:38	17.90	0.6	0.420	0.6	0.168	0.7641	1.00	0.7641	0.210	0.1604	3.2
25	14:39	18.40	0.6	0.390	0.6	0.156	0.9098	1.00	0.9098	0.195	0.1774	3.6
26	14:41	18.90	0.6	0.160	0.6	0.064	0.9193	1.00	0.9193	0.128	0.1178	2.4
27	14:41	20.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

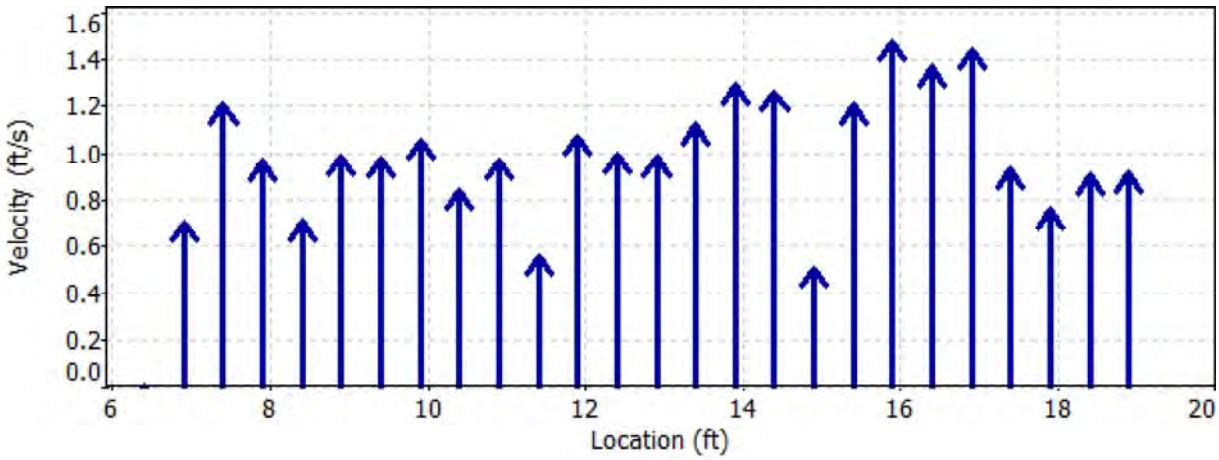
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

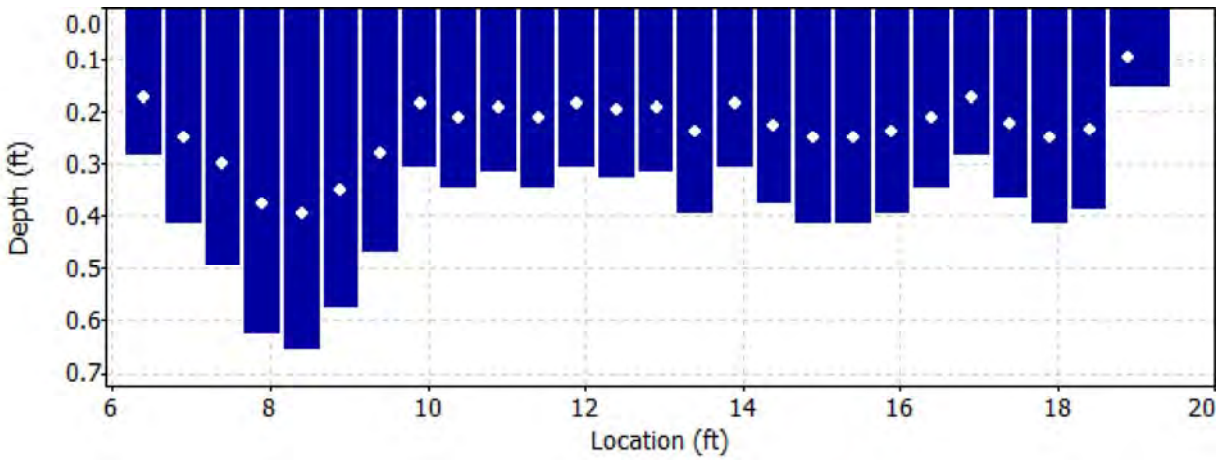
Discharge Measurement Summary

Date Generated: Mon Apr 14 2014

File Information		Site Details	
File Name	SNCRLR2X.001.WAD	Site Name	SAND CR LOWER R2X
Start Date and Time	2014/03/26 14:06:37	Operator(s)	BRIAN EPSTEIN







Discharge Measurement Summary

Date Generated: Mon Apr 14 2014

File Information	
File Name	SNCRLR2X.001.WAD
Start Date and Time	2014/03/26 14:06:37

Site Details	
Site Name	SAND CR LOWER R2X
Operator(s)	BRIAN EPSTEIN

Quality Control

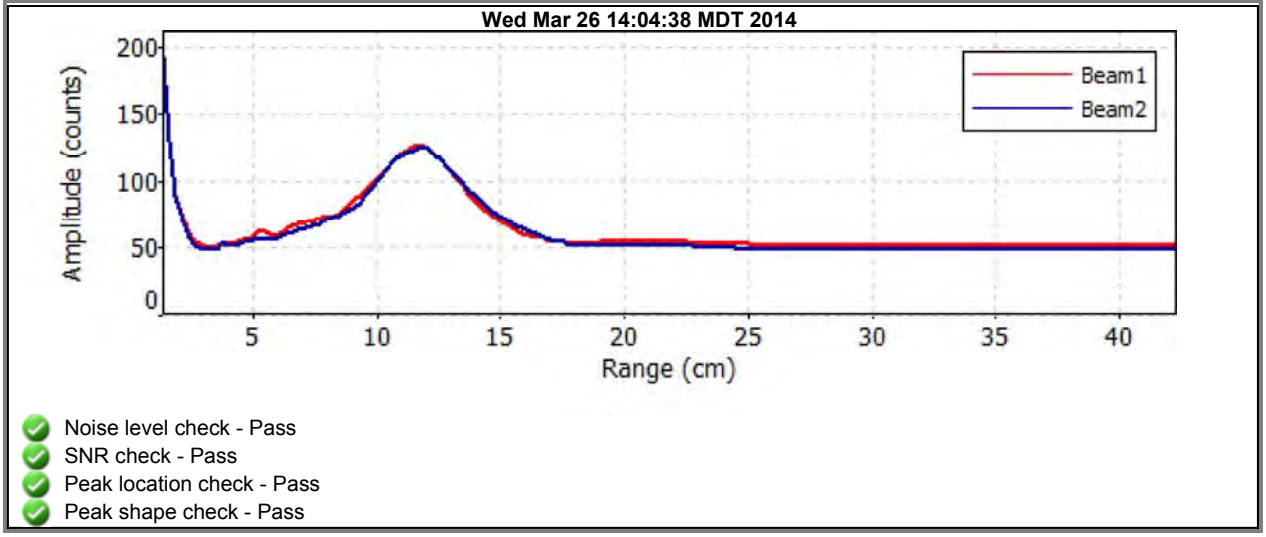
St	Loc	%Dep	Message
1	6.40	0.6	SNR (61.2) is different from typical SNR (29.8)
11	11.40	0.6	High standard error: 0.049
18	14.90	0.6	High standard error: 0.084

Discharge Measurement Summary

Date Generated: Mon Apr 14 2014

File Information		Site Details	
File Name	SNCRLR2X.001.WAD	Site Name	SAND CR LOWER R2X
Start Date and Time	2014/03/26 14:06:37	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

Sand Creek
Temporary Gage

14:57 arrive at temp gage (iPhone photo staff)
14:59 clean staff plate
15:00 Staff = 0.44'
15:12 Pic 429 site overview from downstream
- water flow toward camera
- control lower left of photo
- debris build up on right edge of control
- staff and PT center of photo

15:12 Pic 430 from left bank, control
15:12 Pic 431 from left bank PT & staff
15:12 Pic 432 from right bank PT & staff, the area where water leaves out of bank to pond is on the left bank, five feet downstream of gage
15:13 Pic 433 from right bank control and backwater area
15:20 Pic 434 from upstream left bank overview of site, ponded area left side, channel past gage site right side
15:21 Pic 438 (same as above Pic)
15:24 Staff plate = 0.44' (bounce ± 0.02')
15:25-15:26 removed debris from control
15:27 Staff plate = 0.42' (bounce +/- 0.02')

Control Survey
4.81' water level at staff (staff reading 0.42')
4.81' water level at PT
4.90' water level when water begins to spill out of channel on left bank, just downstream of gage (~5') and upstream of control
5.57' point of zero flow on natural rock control
5.30' point of zero flow on riffle at toe of overflow zone (between normal control & gage)

Notes By: Brian Lepsteln YYYY-MM-DD: 2015-12-07 Page 1 of 2

Sand Creek (control)
16:14 connected to data logger
16:15 Staff = 0.40' (± 0.02')
16:16:30 computer time equals 17:15:26 logger time
16:17 downloaded logger
F6: 20151207-AH7_SandCreekTempGage.CSV
16:18 cleared logger history
16:19:19 synchronized logger to computer
(previously in day computer = iPhone = Airborne)
16:22 disconnected from logger
16:26 replaced batteries
16:27 connected to logger
16:27 downloaded logger
16:28 synchronized logger to computer time
16:28 cleared logger history
16:29 programed logger to begin sampling 16:30
and sample every 15 minutes
✓ Started at 16:30
16:30 disconnected from logger
16:32 departed site

Page 1 of 2	State of Colorado	Meas. No.: 008
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 09-28	ADV Discharge Measurement Notes	District: 3

Station Name: SCAMHGTG

Sand River, Creek, Canal, Ditch

At, Near, Above, Below Mouth Haygood Canyon Temp Gage

Latitude: Longitude:

Party: Brian Epsten

Conditions

Weather: storm blowing in from west

Wind Spd / Dir: gusty / downstream Water Temp:

X-Sec Desc: aquatic veg on 30% of rocks, sand/cobble bed

Flow Conds: Parallel flowlines perpendicular to tagline

Control Desc.: natural rock bank, leafy debris and aquatic veg deposited

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.
13:15	0.40 ± 0.02	1.00			
14:25	0.40 ± 0.02				

Pressure Transducer Download		Weighted MGH		
File Name:		GH Corr.		
Time:	13:11	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:	SCAMHGTG_008		
Meas Type:	Wading / Boat / Bridge / Cableway			Method:	0.6
	~70 ft or mi / upstream or downstream of gage				
Start Edge:	REW 2.2	End Edge:	LEW 7.2	Total Width:	5.0
Start Time:	14:05	End Time:	14:20		
Discharge:	2.67	Unsertainty:	4.8	# Stations:	13
Mean v:	0.98	Width	5.0	Mean d:	0.54
Max v:	1.35	Area:	2.72	Max d:	0.70
Mean SNR:	32.0	σv:	0.038	Mean Temp:	55.9

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

Remarks:

12:54 arrive Sand Creek temp gage site
13:00 staff plate = 0.40' ± 0.02'
13:02 Pic 387 staff plate
13:04 Pic 388 gage site overview, from ds-rb
- foreground rock control (natural)
- picture right trees failing and alternate channel

13:09:30 computer time and verizon time are equal
13:10:30 computer time = 13:10:22 logger time
13:11 downloaded logger file name:
20150928-1311_SandCreekTempGage.csv
13:13:21 synchronized logger time to computer time
13:13 cleared logger history
13:15 pressure transducer = 1.00' and staff = 0.40' ± 0.02
13:16 disconnected from logger

General Notes
- spider lives under the cap of logger housing
- expedited measurement because of threat of rain
- rain never arrived, storm brewing

14:25 staff plate 0.40' ± 0.02
14:30 departed site

14:33 storm began

13:57 Pic 389 cross section

Page 2 of 2	State of Colorado	Meas. No.:	021
YYYY: 2015	**Colorado Water Conservation Board**	Division:	1
MM-DD: 08-27	ADV Discharge Measurement Notes	District:	3

Station Name:	Sand Creek		SCAMHCTG
	Sand	River, (Creek), Canal, Ditch	
(At), Near, Above, Below	mouth Hayground Canyon		
Latitude:		Longitude:	
Party:	Brian Epstein		

Conditions

Weather:	~74° Partly Cloudy		
Wind Spd / Dir:	light / downstream	Water Temp:	
X-Sec Desc:	cobble / sand bed, square shaped		
Flow Conds:	mostly parallel flow paths		
Control Desc.:	rock bank ~15 ft DS gage, debris build up		

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.
13:35	0.40 ± 0.02				
15:03	0.40 ± 0.02				

Pressure Transducer Download		Weighted MGH	
File Name:	20150827-1350_SandCreekTempGage	GH Corr.	
Time:	13:50	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:	SCAMHCTG.021		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	~15	(ft) or mi / upstream or (downstream) of gage			
Start Edge:	LEW 9.9	End Edge:	LEW 14.1	Total Width:	5.2
Start Time:	14:16	End Time:	14:50		
Discharge:	3.17	Unsertainty:	3.2	# Stations:	22
Mean v:	1.13	Width	5.2	Mean d:	0.54
Max v:	1.44	Area:	2.8	Max d:	0.70
Mean SNR:	33.9	σv:	0.042	Mean Temp:	58.3

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

Remarks: Sand Creek

13:15 arrive at Temporary Gage Site
13:35 Pic 348 overview of gage site, from downstream left bank, looking upstream
- control bottom picture, left corner - plant debris build up
13:35 Pic 349 close up of control, from ds lb, looking U.S.
13:35 Pic 350 temporary gage
13:36 Pic 351 & Vid 352 Staff plate 0.40' ± 0.02
13:37 Pic 353 control from temp gage looking downstream
13:48 connect to logger
13:49:10 computer time (= Verizon Time) equals 13:49:04 logger time
13:50:21 synchronize logger time to computer
13:50 download logger: 20150827-1350_Sand Creek Temp Gage
13:53 clear history
13:54 disconnect from logger
14:12:00 Synchronized FlowTracker Time to Verizon Time

Measurement Rating
→ discharge excellent
- great uniformity in depth
- straight us & ds
- similar velocities
- velocity profile near theoretical
- parallel flow lines

→ stage good
- bounce of ± 0.02 dropped to good from excelent

→ ∴ overall rating good

14:04 Pic 354 x-section from LWW
14:05 Pic 355 x-section from ds

Page 1 of 2	State of Colorado	Meas. No.: 006
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 07-15	ADV Discharge Measurement Notes	District: 3

Station Name: SCAMHCTG

Scad River, (Creek) Canal, Ditch

(At) Near, Above, Below Mouth of Itzygood Canyon

Latitude: Longitude:

Party: Brian Eastern

Conditions

Weather: mostly cloudy ~70°F

Wind Spd / Dir: 0mph Water Temp:

X-Sec Desc: sand & gravel with a few cobbles

Flow Conds: mostly parallel flowlines

Control Desc.:

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.
12:11	0.44				
13:25	0.44				

Pressure Transducer Download		Weighted MGH		
File Name:		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:	SCAMHCTG.006		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	QC
	~200	(ft.) or mi / upstream or (downstream) of gage			
Start Edge:	REW 1.0	End Edge:	LEW 6.20	Total Width:	5.20
Start Time:	12:32	End Time:	13:09		
Discharge:	6.00	Unsertainty:	2.9	# Stations:	25
Mean v:	1.797	Width	5.20	Mean d:	0.64
Max v:	2.094	Area:	3.340	Max d:	0.80
Mean SNR:	38.4	σv:	0.60	Mean Temp:	59.6

Meas. By:	BDE	Notes By:	BDE
Processed By:		Reviewed By:	

Remarks: Sand Creek

09:43 Arrive at Temp Gauge site
10:30 set up x-section
10:35 Pic 183 temp gage upon arrival, seconds
10:36 Pic 184 "
10:37 began removing debris built up on staff
10:39 1.47 feet = staff (w/ removed some debris)
10:41 Pic 185 shows amount of debris removed before staff obs.
10:46 debris full removed
staff = 1.38 feet +/- 0.02
10:47 Pic 186 shows completed debris removal
10:54:00 computer time = 10:53:50 logger time
10:55:01 synchronized logger time to computer time
10:55 downloaded logger
20150715-1055_SCAMHCTG.CSV
10:57 cleared logger history
10:58 disconnected
11:24 staff 1.40 feet +/- 0.02
11:25 began removing staff plate from channel center
12:10 completed replacing removed staff plate on ~~left~~ right edge of water
12:11 187 & 188 staff plate = 0.44' +/- 0.02
12:12 189 site overview
12:17 Pic 190 from ds, x-section
12:17 Pic 191 from * lb, x-section
13:08 light rain began
13:17 light rain ended
13:25 staff = 0.44' +/- 0.02
13:27 connected to logger
13:28 downloaded logger: 20150715-1329_SCAMHCTG.CSV
13:34 disconnect

* staff plate was adjusted

Page 2 of 2	State of Colorado	Meas. No.: 005
YYYY: 2015	**Colorado Water Conservation Board**	Division: X 1
MM-DD: 05-12	ADV Discharge Measurement Notes	District: 3

Station Name: SCAMHCTG

Sand — River, (Creek), Canal, Ditch

At, Near, Above, (Below) Hayford Canyon

Latitude: Longitude:

Party: Brian Epstein

Conditions

Weather: ~55°F Partly Cloudy

Wind Spd / Dir: 0 mph Water Temp:

X-Sec Desc: mostly sand & cobble

Flow Conds: mostly laminar

Control Desc.:

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.

Pressure Transducer Download

File Name: 20150512-1442_SCAMHCTG.CSV

Time:

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:	SCAMHCTG.005		
Meas Type:	Wading / Boat / Bridge / Cableway			Method:	0.6
		125	(ft) or mi / upstream or downstream of gage		
Start Edge: LEW	2.2	End Edge:	7.2	Total Width:	5.0
Start Time:	19:15	End Time:	19:27		
Discharge:	2.678	Unsertainty:	5.2	# Stations:	12
Mean v:	2.163	Width	4.999	Mean d:	0.71
Max v:	2.738	Area:	3.549	Max d:	0.90
Mean SNR:	42.4	σv:	0.077	Mean Temp:	49.6

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

Sand Creek May 12, 2015

Remarks: 17:48 arrive at kmp gage

17:48 Pic 104-0005 Temp Gage debris build up changing water level between PT green and downstream side of staff plate

17:48 Pic 006 older control now has log across the rocks

17:48 Pic 007 from normal control up at gage with staff and debris controlling water height

17:49 Pic 008 " (close up)

17:49 Pic 009 left bank breached below staff plate

17:50 Pic 010 close up debris affected

17:50 Pic 011 close up staff plate, bouncing between ~~0.~~ 1.54' and 1.56'

17:52 Pic 012 close up upstream side of staff

18:01 began clearing debris from staff

18:14 finished " " " "

18:16 began removing debris from rock hard control

18:19 finished " " " " "

19:15 Pic 013 & 014 Vid 015 staff after cleared 1.50' ± 0.04

19:19 Vid 016 staff after old control cleared 1.44' ± 0.04

19:19 Pic 017 Site overview from downstream

19:49 changed Battery in logger

19:51 ~~log~~ connected to logger

19:52:00 computer time = 17:50:32 logger time

19:52 downloaded logger 20150512-1952_SCAMHCTG.CSV

19:56 clear logger history

19:57:10 synchronized logger time to computer time

19:57 Programmed log every 5 minutes starting 19:00

19:35 Staff 1.40' ± 0.04'

19:40 connected / downloaded / cleared history of logger

19:41 programmed log every 15 minutes starting 19:45

19:48 departed site

Page 1 of 2	State of Colorado	Meas. No.: ~~003~~ 004
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 02-06	ADV Discharge Measurement Notes	District: 76

Station Name: SCAMHCTG

Sand River, (Creek), Canal, Ditch

(At), Near, Above, Below Mouth Hayward Canyon

Latitude: Longitude:

Party: Brian Epstein

Conditions

Weather: Sunny w/ Scattered Clouds

Wind Spd / Dir: gusts up to 2mph downstream Water Temp:

X-Sec Desc: boulder, cobble, sand bed, square profile

Flow Conds: laminar, steady

Control Desc.: rock band, natural, ~15 ds staff plate

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.
12:45	1.30' *	1.29'			
13:25	1.30' *				
14:48	1.30' *	1.29'			
15:00	1.30' *				
* water levels have down to 1.28'					

Pressure Transducer Download		Weighted MGH		
File Name:	20150206-1454_SCAMHCTG_PT.csv	GH Corr.		
Time:	14:54	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:	SCAMHCTG.~~003~~ 004		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	~150	(ft) or mi / upstream or (downstream) of gage			
Start Edge:	REW 0.7	End Edge:	LEW 5.7	Total Width:	5.0
Start Time:	14:19	End Time:	14:43		
Discharge:	1.74	Unsertainty:	4.5	# Stations:	14
Mean v:	0.733	Width	5.00	Mean d:	0.47
Max v:	0.942	Area:	2.36	Max d:	0.59
Mean SNR:	30.0	σv:	0.027	Mean Temp:	46°F

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

Remarks:

12:07 Arrive Sand Creek Gauge Site
12:25 Pic 866 Staff reading 1.28'
12:26 Pic 867 Overview of gage site
- Tumbleweed and other debris built up on staff plate, minimal water elevation disturbance
12:26 Pic 868 Overview of site, lower right natural rock hard control, center staff plate and PT
12:26 Pic 869 close up of rock control
12:26 Pic 870 close up of staff and PT
12:27 Pic 871 close up head of PT
12:30 Staff Plate 1.28'
12:38 to 12:44 removed debris from around staff
12:45 Pic 873 Staff Plate 1.30' (bouncing down to 1.28')
12:53 logged into Data Logger
12:54:00 computer time = 13:51:24 logger time
12:54 down load data logger
20150206-1254_SCAMHCTG_PT.CSV
13:22:02 Synchronize logger to PC time
13:22:30 disconnect from logger
13:25 Staff Plate 1.30' (bouncing down to 1.28')
14:11 Pic 874 X-section for Q meas from ds
14:12 Pic 875 " " " " " " left bank
14:48 Staff Plate 1.30' (bouncing down to 1.28'
14:54 connected to logger and downloading 20150206-1454_SCAMHCTG_PT.CSV
14:57 clear history 1458 Program logger to begin at 15:00

Driving In Before Arrival at Site:
11:46 0861 Pic Red Mountain open space sign
12:00 0862 Pic You're Here sign ("sign")
12:00 0863 Pic Sand Creek road crossing, flowing
12:00 0864 Pic Sand Creek from "sign" downstream
12:01 0865 Pic " " " " cross to gulch

15:00 Staff Plate 1.30' (bouncing to 1.28')
15:00 check logger and recording has commenced
15:02 departed site

Staff plate debris removed

Page 1 of 2	State of Colorado	Meas. No.: 003
YYYY: 2014	**Colorado Water Conservation Board**	Division: 1
MM-DD: 11-06	ADV Discharge Measurement Notes	District: 76

Station Name: SCAMHCTG

Scad River, (Creek), Canal, Ditch

At, Near, Above, Below mouth Hayseed Canyon Temp Gage

Latitude: Longitude:

Party: Brian Epstein

Conditions

Weather: ~50°F sunny

Wind Spd / Dir: 0mph Water Temp:

X-Sec Desc: cobble bed

Flow Conds: laminar flow

Control Desc.: riffle natural

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.
11:45	~~0~~ 1.30				
12:00	1.30				
12:15	1.30				
12:30	1.30				

Pressure Transducer Download

File Name: Not downloaded

Time:

Weighted MGH

GH Corr.

Correct MGH

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	P2354 / (P2358)
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	SCAMHCTG.003		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	~ 60	(ft) or mi / upstream or (downstream) of gage			
Start Edge:	REW 1.2	End Edge:	LEW 6.2	Total Width:	5.0
Start Time:	11:49	End Time:	12:17		
Discharge:	2.224	Unsertainty:	4.0	# Stations:	16
Mean v:	0.841	Width	5.0	Mean d:	0.53
Max v:	1.063	Area:	2.645	Max d:	0.60
Mean SNR:	29.7	σv:	0.032	Mean Temp:	48.0

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

Remarks:

11:30 arrive at site
11:23 staff surround by leafy debris and tumble weed, plate reads 1.34'
11:25 gage natural riffle control has leaf debris in it
11:26 cleared gage & control of debris
11:29 staff plate reads 1.30'
* local time has changed. Re logger will read 1 hour ahead + drift

12:29 dunked edge of computer in creek
→ computer started but then shut off
→ could not download logger, sync time

Page 1 of 2	State of Colorado	Meas. No.: 002
YYYY: 2014	**Colorado Water Conservation Board**	Division: 1
MM-DD: 09-29	ADV Discharge Measurement Notes	District: 76

Station Name: SCAMHCTG

Sand — River, (Creek), Canal, Ditch

(At), Near, Above, Below — Mouth Hayground Canyon

Latitude: Longitude:

Party: Byron Epstein

Conditions

Weather: Partly Cloudy ~68°F

Wind Spd / Dir: light variable Water Temp:

X-Sec Desc: cobbles with sand, U shaped

Flow Conds: laminar

Control Desc.: natural boulder bend 15 feet d/s from 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.
1330	1.41 (+/- 0.01)				
1352	1.41 (+/- 0.01)				
1400	1.41 (+/- 0.01)				
1415	1.41 (+/- 0.01)				
1430	1.41 (+/- 0.01)				

Pressure Transducer Download		Weighted MGH		
File Name:	20140929 - SCAMHTG.CSV	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:	SCAMHCTG.002		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	264	(ft) or mi / upstream or (downstream) of gage			
Start Edge:	REW 1.8	End Edge:	LEW 7.0	Total Width:	~~14~~ 5.2
Start Time:	1355	End Time:	1414		
Discharge:	4.12	Uncertainty:	4.6%	# Stations:	14
Mean v:	1.26	Width	5.2	Mean d:	0.63
Max v:	1.68	Area:	3.27	Max d:	0.82
Mean SNR:	36.1	σv:	0.038	Mean Temp:	55.2

Meas. By:		Notes By:	
~~Processed~~ By:		Reviewed By:	

Remarks:

13:44:30 Synchronized FlowTracker to iPhone
- Previously 20 seconds ahead of iPhone

14:24 download data logger
14:32:00 computer time equals 14:31:55 logger time
14:32:37 synchronized logger to computer time
14:33 download data logger
14:34 clear logger history
14:43 departed site

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: Sand River (Creek, Canal, Ditch)

At (Near) Above, Below: Parking Lot

Date: 7/10/14 Party: Brian Epsten (see below)

Conditions

Weather:	Clear, sunny		
Wind Spd / Dir:	3mph / west	Water Temp:	
X-Sec Desc:	Sandy, cobbly, u-shaped		
Flow Conds:	Laminar, steady		
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					
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:	SCRTXNPL.002	
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6
	n/a		ft. or mi / upstream or downstream of gage		n/a
Start Edge:	LEW 18.3	Total Width:	8.5	# Sections:	18
Start Time:	10:42 am		End Time:	11:24 am	
Discharge:	3.518	Uncertainty:	3.9%		
Mean v:	0.660	Width	8.5	Mean d:	0.63
Max v:	0.976	Area:	5.33	Max d:	0.93
Mean SNR:	27.6	cv:	0.025	Mean Temp:	63.1

Remarks: Jay Skinner, Jeff Nagessler, Amy Laughlin, Carly Jacobs, Mollie Albert

12:00 light rain started

Page 1 of 2	State of Colorado	Meas. No.: 001
YYYY: 2014	**Colorado Water Conservation Board**	Division: 1
MM-DD: 03-26	ADV Discharge Measurement Notes	District: 3

Station Name: Sand Creek Upper

River , Creek, Canal, Ditch

At, Near, Above, Below

Latitude: N 40° 58' 42.48" Longitude: W 105° 10' 54.86" NAD83

Party: Brian Epstein & Jay Steiner

Conditions

Weather: Cloudy, ~ 52°F

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

X-Sec Desc: GPS: SandCrUpR2X

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: SNCRUR2X.001

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

N/A ft. or mi / upstream or downstream of gage

Start Edge: ↗ End Edge: LEW 6.6 Total Width: 6.3

Start Time: REW 12.9 ~~End~~ Time: 12:43 → 13:12

Discharge: 5.041 Unsertainty: 4.4 # Stations: 16

Mean v: 1.397 Width 6.3 Mean d: 0.57

Max v: 1.961 Area: 3.608 Max d: 0.84

Mean SNR: 34.0 σv: 0.099 Mean Temp: 45.5°F

Meas. By: BJE Notes By: BJE

Processed By: Reviewed By:

Remarks:

Pictures:

952 X-section for R2CH05 from upstream at beginning of slope measurement, Jay Skinner at right, Eric with rod

953 Video walking slope measurement

954 R2X section

Note - very much aquatic growth, cleared before measurement

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: Sand Creek Lower near trail head
River , Creek, Canal, Ditch

At, Near, Above, Below

Latitude: N 40°57'26.4" Longitude: W 105°10'00.67" NAD 83

Party: Brian Epstein & Jay Skinner

Conditions

Weather: Partly Cloudy, ~ 57°F
Wind Spd / Dir: 0° / 0 mph Water Temp:
X-Sec Desc: mostly laminar, GPS: SandCrLowerR2X
Flow Conds:
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: SNRLR2X.001
Meas Type: (Wading) / Boat / Bridge / Cableway Method: 0.6
N/A ft. or mi / upstream or downstream of gage

Start Edge:	LEW 5.9	End Edge:	20.0	Total Width:	14.1
Start Time:	14:06	End Time:	14:41		
Discharge:	4.968	Unsertainty:	2.7%	# Stations:	28
Mean v:	0.970	Width	14.1	Mean d:	0.36
Max v:	1.479	Area:	5.123	Max d:	0.66
Mean SNR:	29.8	σv:	0.027	Mean Temp:	50.2°F

Meas. By: BDE Notes By: BDE
Processed By: Reviewed By:

State of Colorado

Colorado Water Conservation Board

Field Notes

Sand Creek

Trial Head

Red Mountain Open Space by ~~camping~~ area

GPS: Sand Cr. Nr Parking Lot N 40° ~~26'~~ 57' 26.15"
W 105° 09' 58.72"

Picture

102-942 Sand Cr Linda and Larimer County Reps

943 Sand Cr looking upstream

944 video Sand Cr from downstream to upstream

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

Send Completed Reports to: mailto:Andrew.T

Any questions or issues about reporting data, please call:

Andrew Treble
Aquatic Research Data Analyst
970-472-4372

***Required Fields:**

End-o

Water:	Sand Creek	
CPW Water Code:	*10639*	CPW Scientific Collector Permit #:
CPW Station Code:	SP4476	Survey Purpose:
Date:	7/29/2015	
Location Dscrptn:	0.4 miles US of road end	Target Species:
Drainage:	SP	
UTM Zone:	13T	*(NAD83, Zone 13)*
UTM X:	484408	m
UTM Y:	4536597	m
Station Length:	250	ft
Station Width:	7.95	ft
Crew:	Fletcher, Heim, Nowlin, Wright	
Notes:	Temp logger installed within reach, UTM's in Boyd's little black book. E1 effo 200V 30 Hz 20%. Fish preserved for WD sample	

Species	Count	Length (mm)	Weight (g)	Status	Mark
BRK	1	286	290	E1	
BRK	1	111	14	E1	
BRK	1	109	14	E1	
BRK	1	147	37	E1	
BRK	1	145	39	E1	
BRK	1	114	15	E1	
BRK	1	93	8	E1	
BRK	1	110	13	E1	
BRK	1	102	11	E1	
BRK	1	114	16	E1	
BRK	1	104	13	E1	
BRK	1	107	12	E1	
BRK	1	103	12	E1	
BRK	1	103	11	E1	
BRK	1	133	22	E1	
BRK	1	115	15	E1	
BRK	1	111	13	E1	
BRK	1	113	14	E1	
BRK	1	103	11	E1	
BRK	1	105	12	E1	
BRK	1	95	8	E1	

reble@state.co.us

CPW Contacted Prior to Sa
Date of Contact:

f-Year Aquatic Scientific Collector's Data Submission

	Protocol:	TWO-PASS REMOVAL	
Standard Survey or Population Estimate			Units
	Water Temp:	14	C
	Air Temp:		F
	Gear:	BPEF	
	Time:		
Top of Station:	UTM X:	484346	
	UTM Y:	4536626	
	Flow:		cfs
	Wet/Dry:	W	

rt - 562 seconds. E2 effort - 622 seconds.

Observed YOY L

TagID	Species	YOY

mpling:

Field Chemistry from Hach kit

pH:				
DO:		mg/L		% Sat.
Hardness:		mg/L		Units
1st conductivity:		µs @		F
2nd conductivity:		µs @		F
Salinity:		ppt @		F
Phen Alkalinity:		mg/L		
Total Alkalinity:		mg/L		

Length

Length (mm)

Send Completed Reports to: mailto:Andrew.Tr

Any questions or issues about reporting data, please call:

Andrew Treble
Aquatic Research Data Analyst
970-472-4372

***Required Fields:**

End-o

Water:	Sand Creek	
CPW Water Code:	*10639*	CPW Scientific Collector Permit #:
CPW Station Code:	SP7811	Survey Purpose:
Date:	7/29/2015	
Location Dscrptn:	1.0 miles US of road end	Target Species:
Drainage:	SP	
UTM Zone:	13T	*(NAD83, Zone 13)*
UTM X:	483300	m
UTM Y:	4537420	m
Station Length:	375	ft
Station Width:	8.52	ft
Crew:	Fletcher, Heim, Nowlin, Wright	
Notes:	E1 effort - 887 seconds. E2 effort - 823 seconds. 9 BRK preserved for WD san	

Species	Count	Length (mm)	Weight (g)	Status	Mark
BRK	1	335	445	E1	
BRK	1	262	240	E1	
BRK	1	95	9	E1	
BRK	1	97	13	E1	
BRK	1	117	17	E1	
BRK	1	110	15	E1	
BRK	1	112	13	E1	
BRK	1	102	11	E1	
BRK	1	97	10	E1	
FMW	1	67		E1	
FMW	1	65		E1	
FMW	1	70		E1	
FMW	1	68		E1	
FMW	1	63		E1	
FMW	1	70		E1	
FMW	1	62		E1	
FMW	1	66		E1	
FMW	1	72		E1	
FMW	1	68		E1	
FMW	1	75		E1	
FMW	1	66		E1	

FMW	1	74		E1	
FMW	1	70		E1	
FMW	1	76		E1	
FMW	1	67		E1	
FMW	1	68		E1	
FMW	1	67		E1	
FMW	1	59		E1	
FMW	1	72		E1	
FMW	1	78		E1	
BRK	1	34		E1	
BRK	1	30		E1	
FMW	1	58		E1	
FMW	1	62		E2	
FMW	1	67		E2	
BRK	1	92	9	E2	
FMW	1	61		E2	
FMW	1	60		E2	
FMW	1	76		E2	
BRK	1	82	7	E2	
FMW	1	57		E2	
FMW	1	75		E2	
FMW	1	61		E2	
FMW	1	60		E2	

reble@state.co.us

CPW Contacted Prior to Sa
Date of Contact:

f-Year Aquatic Scientific Collector's Data Submission

	Protocol:	TWO-PASS REMOVAL	
Standard Survey or Population Estimate			Units
	Water Temp:	17.5	F
	Air Temp:		F
	Gear:	BPEF	
	Time:		
Top of Station:	UTM X:	483228	
	UTM Y:	4537489	
	Flow:		cfs
	Wet/Dry:	W	

nple

Observed YOY L

TagID	Species	YOY

mpling:

Field Chemistry from Hach kit

pH:				
DO:		mg/L		% Sat.
Hardness:		mg/L		Units
1st conductivity:		µs @		F
2nd conductivity:		µs @		F
Salinity:		ppt @		F
Phen Alkalinity:		mg/L		
Total Alkalinity:		mg/L		

Length

Length (mm)


RED MOUNTAIN OPEN SPACE
A Larimer County Open Space


1.62
1.58
1.50
1.54
1.56
1.52
1.48
1.40
1.44
1.46
1.42
1.38
1.30
1.34
1.32
1.28
1.24
1.26
1.18
1.14
1.08
1.04
.98
.94


3.30
3.20
3.10
3.00
2.90
2.80
2.70
2.60
2.50
2.40
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2.10
2.00
1.90
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1.60


3.30
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1.18


3.30
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3.10
3.00
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2.80
2.70
2.60
2.40


3.20
3.10
3.00
2.90
2.70
2.60
2.50
2.00
1.90


1.80
1.74
1.72
1.70
1.68
1.66
1.64
1.62
1.60
1.58
1.56


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