Stream: Elkhead Creek
(North Fork of Elkhead Creek to USGS Streamgage above Long Gulch)

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Introduction:

This document contains the necessary information to form the scientific and biological basis for an instream flow (ISF) recommendation for Elkhead Creek in Routt County, Colorado. This recommendation, along with two other 2017 ISF recommendations in the Elkhead Creek basin, represents a continuation of a multi-year effort by Colorado Parks and Wildlife (CPW) to secure ISF protection for important streams in the Elkhead Creek basin. This ISF effort was initiated many years ago (in the 1970s) and was recently renewed in 2006 and 2015; these efforts resulted in several ISF water rights on numerous segments in the basin. CWCB currently has ISF water rights on two segments of Elkhead Creek (6-06CW034 and 6-15CW0352) and a number of headwater tributaries including Torso Creek (6-77W1343), Circle Creek (6-77W1344), Jokodowski Creek (77W1345), Armstrong Creek (6-77W1345), and First Creek (77W1348). The Elkhead Creek basin supports a high value fishery that has been designated by both CPW and the US Forest Service (the primary land management agency in the basin) as a prime location for native species conservation. CPW believes that the information provided in this document provides the basis for the findings necessary for an ISF appropriation stated in the ISF statutes and in ISF Program Rule 5(i).

The State of Colorado's Instream Flow and Natural Lake Level Program (ISF/NLL Program) was created in 1973 when the Colorado General Assembly passed Senate Bill 97. This bill recognized, "the need to correlate the activities of mankind with some reasonable preservation of the natural environment (C.R.S. §37-92-102 (3))." Creation of this state program identified the CWCB as the only state agency with the ability to appropriate and acquire instream flow and natural lake level water rights. In an effort to promote participation in the ISF/NLL Program by other entities, the state statute requires the Board to consider instream flow recommendations by local, state, or federal agencies. CPW is recommending this reach of Elkhead Creek for inclusion in the ISF/NLL Program because we believe that there is a natural environment that can be preserved to a reasonable degree with an instream flow water right.

CPW is sending this instream flow recommendation to the Board in order to meet CPW's legislative declaration, "… 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 it's visitors… and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities (C.R.S. § 33-1-101 (1)),” and, “… that the natural, scenic, scientific, and outdoor recreation areas of this state are to be protected, preserved, enhanced and managed for the use, benefit, and enjoyment of the people of this state and visitors of this state… and that to carry such program and policy there shall be a continuous operation of acquisition, development, and management of outdoor recreation lands, waters, and facilities (C.R.S. §33-10-101 (1)).”

In addition to these broad statutory guidelines, CPW's current strategic planning document (*CPW Strategic Plan*, 2015) explains current agency goals to, “[c]onserve wildlife and habitat to ensure healthy sustainable populations and ecosystems.” In order to, “protect and enhance water resources for fish and wildlife populations,” by pursuing, “partnerships and agreements to enhance instream flows, protect reservoir levels, and influence water management activities,” and to, “[a]dvocate for water quality and quantities to conserve aquatic resources.” In addition to the CPW strategic plan, the agency's fish and wildlife conservation activities are also directed by the State Wildlife Action Plan (2002, Revised 2015). The goals and priorities from these documents direct CPW to advocate for the preservation of the state's fish and wildlife resources and natural environment, and therefore link CPW's mission to the goals and priorities of CWCB's ISF/NLL Program.

Stream Reach and Location Information

Recommended Reach: Elkhead Creek, from the confluence with the North Fork of Elkhead Creek to the USGS streamgage (Site Number 09246200, Elkhead Creek above Long Gulch near Hayden, CO)

Upper Terminus: Confluence with the North Fork of Elkhead Creek
UTM North: 4504451.44952 UTM East: 306665.084031
Elevation: 6, 833 feet

Lower terminus: USGS streamgage 09246200 Elkhead Creek above Long Gulch near Hayden, CO
UTM North: 4496025.75446 UTM East: 303600.625512
Elevation: 6,408 feet

Water Division: 6
Water District: 44
CPW Water Code: 23153
Approximate segment length in miles: 15.8 miles
County: Routt County
Major Drainage Basin: Yampa River
Name of USGS quad maps: Slide Mountain and Rock Spring Gulch

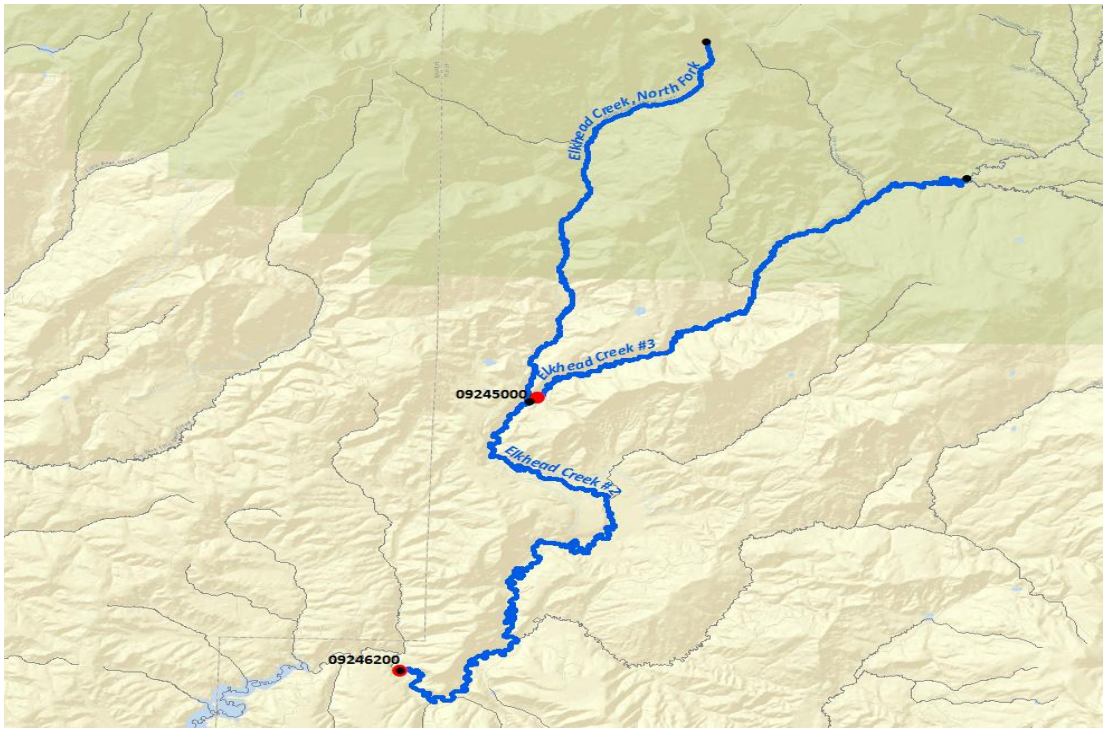

Figure 1. Map showing the location of the 2017 Elkhead Creek ISF recommendations. Black dots represent the reach termini. The red dots are gaging stations within or near the recommended reaches.

Natural Environment

In 2001, CPW entered into a multi-state and multi-agency conservation agreement and strategy concerning Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*). Colorado's partners in this plan and agreement include the natural resource management agencies from Utah and Wyoming, and a number of federal agencies including the USFS, USFWS, BLM, and NPS. The Ute Indian Tribe of the Uintah and Ouray Reservation has also signed onto the agreement and plan for conservation. This conservation agreement and strategy was developed in order to encourage cooperation and collaboration on conservation measures among various natural resource management agencies to minimize threats to Colorado River cutthroat trout that might result in actions under the Endangered Species Act of 1973. Essentially, the parties to the overall plan agreed that in order to prevent listing of the subspecies, and to reach desired recovery goals without hindering further development of our state resources, continued implementation of the conservation strategy was necessary. The stated goal of the conservation strategy is as follows:

> "To assure the long-term viability of CRCT throughout their historic range, areas that currently support CRCT will be maintained, while other areas will be managed for increased abundance. New populations will be established where ecologically and economically feasible, while the genetic diversity of the species is maintained. The

cooperators envision a future where threats to wild CRCT are either eliminated or reduced to the greatest extent possible." (CRCT Conservation Team, 2006)

One of the main threats to Colorado River cutthroat trout conservation is the depletion of stream flows that results in degradation of habitat and the overall health of the subspecies. Another major threat to cutthroat fisheries is the fragmentation of habitat. CPW believes that both of these threats can be partially addressed with an ISF water right held by the Colorado Water Conservation Board.

Elkhead Creek basin:

The Elkhead Creek Basin is located in CPW's Northwest Region, Water Division 6, northwest of Steamboat Springs, CO, and north of Hayden, CO. The headwaters of Elkhead Creek are located at an elevation of around 8,900 feet, and the creek's confluence with the Yampa River is found at an elevation of 6,200 feet approximately 56 miles downstream. Hydrology of the creek is primarily snow melt driven with perennial flow; the average annual precipitation in the basin is approximately 26 inches. The mean basin elevation is 7,660 feet. The total basin area is 223 square miles. The physical environment of the Elkhead Creek basin is mostly a sage-brush shrub community. Overall, the aquatic environment and fishery of Elkhead Creek is quite diverse from the headwaters all the way down to Elkhead Reservoir.

Recommended Segment:

The reach that is the subject of this ISF recommendation is Elkhead Creek above Elkhead Reservoir – more specifically, from the confluence with the North Fork down to the USGS stream gage above Long Gulch, a distance of approximately 15.8 miles (see Stream Reach and Location Information section, above). This reach of Elkhead Creek is a third order stream and as such, has attributes associated with higher order streams (in contract to the attributes of smaller headwater tributaries). The main channel is mostly in a single thread and the surrounding valley is unconfined. The land use in the Elkhead Creek valley ranges from natural habitat conditions on public lands to agricultural uses on private lands. The channel has a well connected and fairly intact floodplain with a healthy riparian corridor. The riparian community consists of cottonwood galleries and willows. In the downstream sections of this reach, the habitat gradually changes – this section of Elkhead Creek is an excellent example of a transitional stream. The stream substrate is highly variable – small cobble to boulders; in the lower reach, sand and finer sediments are more common.

Table 1. Estimate of the percentage of public and private land within the recommended reach of Elkhead Creek.

Upper Terminus	Lower Terminus	Total Length (miles)	Approximate Land Ownership	
			%Private	%Public
Confluence with North Fork	Streamgage site# 09246200	15.8	≥95	≤5

Aquatic Environment

As noted earlier, the Elkhead Creek Basin has been designated both by CPW and U.S. Forest Service (USFS) as a priority basin for native species conservation projects. The target fish species in upper Elkhead Creek basin is the Colorado River cutthroat trout (CRCT) (Table 2). Also, CPW and the USFS are engaged in small scale habitat protection projects for boreal toad (*Bufo boreas boreas*), a state endangered species in the Elkhead basin. The Colorado River cutthroat trout has been designated by Colorado, Wyoming, and Utah State fish and wildlife management agencies and various federal agencies as either "sensitive" or "of concern" (CRCT Conservation Team 2006). While CRCT is the main species of concern in this basin, other native species (listed in Table 2) should also benefit from the conservation efforts towards Colorado River cutthroat trout (CRCT Conservation Team 2006). Other native species in this recommended reach include mottled sculpin (*Cottus bairdi*), speckled dace (*Rhinichthys osculus*), mountain sucker (*Catostomus playtrhynchus)*, bluehead sucker (*Catostomus discobolus)*, and flannelmouth sucker *(Catostomus latipinnis).* The entire Elkhead Creek basin upstream from the confluence with the North Fork of Elkhead creek, including all of the tributary streams, is being enhanced through a variety of interagency projects to restore both cutthroat trout and boreal toad habitat. The Elkhead metapopulation of CRCT was identified in the conservation planning documents as a population of high genetic purity (Purity A- meaning pure, but slightly different from norm) (see Appendix A). This genetic purity means that the Elkhead CRCT population is considered at least a conservation population (CRCT Task Force 2001).

Since this reach is highly characteristic of a transition zone, the aquatic environment near the upper terminus is going to differ from the aquatic environment near the lower terminus. Near the upper terminus the aquatic environment is cold-water habitat; at the lower terminus, the aquatic environment is cool-water habitat. Fish sampling records in this reach are indicative of these changes in the aquatic environment. Simply stated, the upstream sites have cold water species, and the lower sites have more cool water species including a number of species that have relocated into Elkhead Creek from Elkhead Reservoir. The most upstream fish sample in CPW's records dates back to 1977 (this sample is located very close to the upstream terminus of this ISF segment); here Colorado River cutthroat trout and rainbow trout were sampled. The next sample downstream (above Routt CR 56) was sampled in 2011 and had good numbers of cutthroat trout and one black bullhead catfish (*Ameiurus melas*). CPW has several fish samples collected in the vicinity of "Brome Pasture" (these sites are near the middle of the ISF segment);

in 2011, a variety of species were collected at these sites including Colorado River cutthroat trout, bluehead sucker, creek chub (*Semotilus atromaculatus*), mountain sucker, fathead minnow *(Pimephales promelas*), white sucker (*Catostomus commersonii*), mottled sculpin, redside shiner (*Richardsonius balteatus*), and speckled dace were all present. The most downstream sampling station on Elkhead Creek (near the lower terminus of the ISF reach) was near the CR 76 bridge crossing; here, in 2011, we collected black crappie (*Pomoxis nirgomaculatus*), bluegill (*Lepomis macrochirus*), creek chub, fathead minnow, largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), mountain sucker, mottled sculpin, northern pike (*Esox lucius*), rainbow trout (*Oncorhynchus mykiss*), speckled dace, and white sucker.

Table 2. Natural environment information for Elkhead Creek (all are native to western Colorado rivers and streams).

Species Name	Scientific Name	Status
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*	State Species of Special Concern Federal Sensitive Species
mottled sculpin	*Cottus bairdi*	none
speckled dace	*Rhinichthys osculus*	none
mountain sucker	*Catostomus playtrhynchus*	State Species of Special Concern
bluehead sucker	*Catostomus discobolus*	None*
flannelmouth sucker	*Catostomus latipinnis*	Sate Species of Special Concern

*= Bluehead suckers not listed in Colorado but are “special concern” in Utah and Wyoming

ISF Quantification

R2Cross Results:

In 2015, CPW and CWCB staff collected stream cross-section data, at five sites on Elkhead Creek (four of these sites were within the ISF reach). Initial biological instream flow recommendations were developed utilizing the standard application of the R2CROSS methodology (Espegren 1996). R2CROSS uses field data that has been collected in riffle stream habitat types; riffles are the limiting habitat type in streams during low flow events. The field data includes a survey of stream channel geometry, a longitudinal slope of the water surface, and a streamflow measurement at the designated cross section. After processing this data with R2CROSS, winter and summer flow recommendations are developed utilizing the R2CROSS criteria described in Nehring (1979) and Espergren (1996); the R2CROSS hydraulic criteria of interest are average depth, average velocity, and wetted perimeter. Maintaining these hydraulic parameters at adequate levels in riffles will also maintain adequate aquatic habitat in pools and runs for most life stages of fish and aquatic invertebrates (Nehring 1979). Table 3 (below) summarizes the R2CROSS results for the five sites within this segment of Elkhead Creek.

Table 3. Summary of R2CROSS transect measurements and the resulting flow recommendations for Elkhead Creek. Q measured is the discharge measured in the field, 40%-250% is the confidence interval in which flow criteria should be met, flow meeting two criteria means a winter flow recommendation, and flow meeting three criteria is a summer recommendation.

Entity	Date Measured	Q measured	40%-250%	Flow Meeting Two Criteria	Flow Meeting Three Criteria
CPW/CWCB	10/27/2015	11.15 cfs	4.5-27.9 cfs	24.5 cfs	27.9[2] cfs
CPW/CWCB*	10/27/2015	11.00 cfs	4.4-27.5 cfs	7.2 cfs	14.1 cfs
CPW/CWCB	10/27/2015	11.08 cfs	4.4-27.7 cfs	39.3[1]	27.7[2] cfs
CPW/CWCB	10/27/2015	14.33 cfs	5.7-35.8 cfs	13.7 cfs	20 cfs
CPW/CWCB	10/27/2015	12.55 cfs	5.0-31.4 cfs	17.7 cfs	31.4[2] cfs
			Mean	**15.8 cfs**	**24.2 cfs**

1 = Flow recommendation falls outside the range of accuracy for R2CROSS's estimate for Manning's n; these values cannot be used in the calculation of the recommended flow (winter season only).
2 = Flow recommendation falls outside the range of accuracy for R2CROSS's estimate for Manning's n; highest flow that R2CROSS can predict with accuracy used for averaging purposes (summer season only).
*= Cross section located slightly downstream (approximately 700 feet) from lower terminus for this ISF recommendation; data from this cross section was used in ISF calculations because the stream channel geometry is still representative of the reach.

ISF Recommendation:

From the above table, the R2CROSS-based winter flow recommendation is 15.8 cubic feet per second - this flow is the average of the "in-range" results that meet two of the three hydraulic criteria. Similarly, the R2CROSS-based summer flow recommendation is 24 cubic feet per second - this flow is the average of the "in-range" results that meet all three of the hydraulic criteria and the flow that represents the upper limit of R2CROSS accuracy for a given site (see table footnote, above). CPW believes that the Elkhead Creek natural environment is important enough for CRCT conservation, that an ISF water right is critical at this point in time. If future data collection efforts yield usable in-range data, CPW reserves the right to initiate an enlargement recommendation for the summer season.

Preliminary Water Availability Analysis:

In order to make a preliminary determination whether water is available for the R2CROSS-based flow recommendations and to determine the appropriate seasonal transition dates, CPW examines basic hydrologic data and basic water rights information for the basin in question.

We found one relevant stream gage near the lower terminus of this ISF segment. This stream gage, Elkhead Creek above Long Gulch, near Hayden, Colorado (USGS 09246200) has a period of record from 1994 to 2016. This stream gage provides relevant information with respect to year-round water availability for this ISF recommendation. We also looked at a basin area apportionment of a gage near the upper terminus of the ISF segment (USGS 09245000 – Elkhead Creek near Elkhead, CO), and mean monthly flows generated by the on-line version of the StreamStats stream flow prediction tool.

CPW also researched Division of Water Resources data for active water rights within the recommended ISF segment. The DWR data indicates that there are only two water rights located within the proposed reach - the McKinlay Ditch No. 1 (structure ID: 699 decreed absolute for 8.33 cfs) and the McKinlay Ditch No. 2 (structure ID: 700decreed absolute for 25.66 cfs). Both of these water rights are for irrigation and are therefore used seasonally. The use of these water rights is reflected in the USGS stream gage records referenced above and is therefore reflected in the hydrograph below. DWR has good diversion records for these two ditches. There appears to be no other major diversion or storage structures that materially alter the hydrology of Elkhead Creek within the ISF reach. The stream gage data, StreamStats results, and the R2CROSS generated ISF recommendations are all depicted in the hydrograph below (Figure 2).

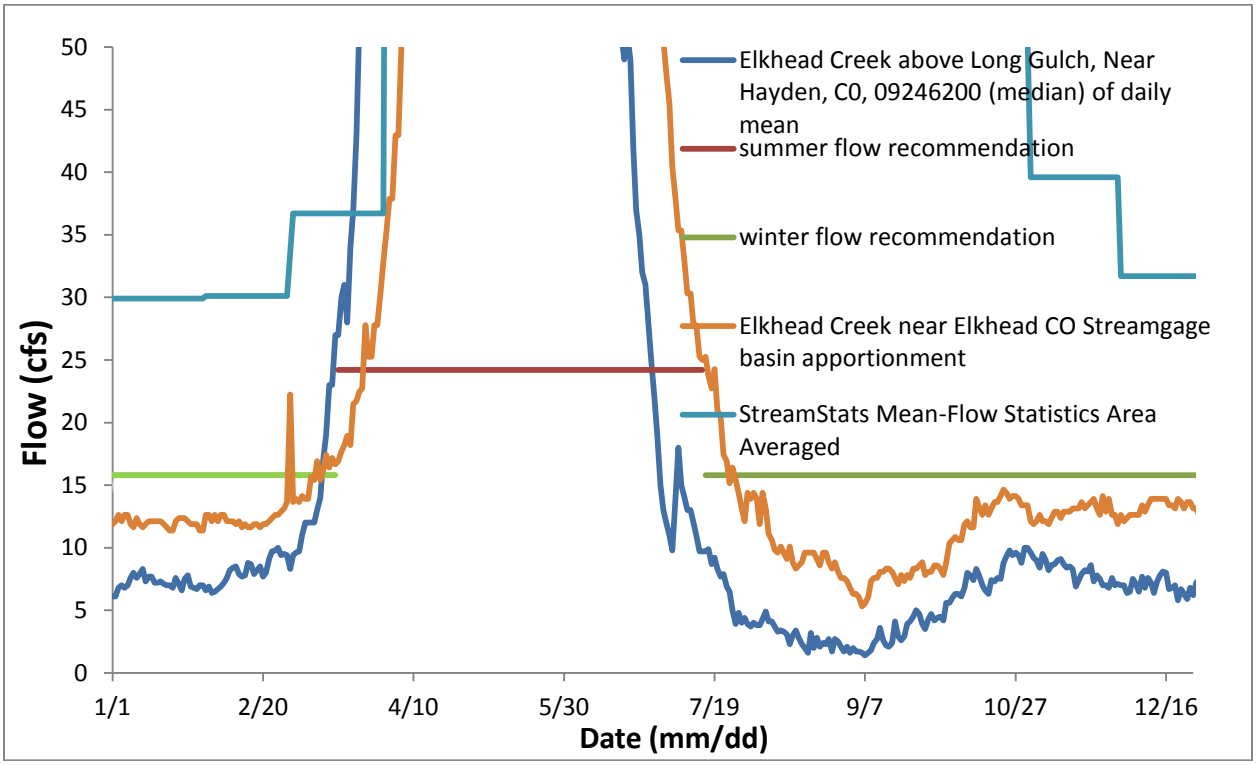

Figure 2. Hydrograph showing the average daily flows from the Elkhead Creek above Long Gulch gage, the mean monthly flows statistics from USGS StreamStats, and a basin area apportionment of the Elkhead Creek Near Elkhead, CO, USGS gage. Also plotted are the summer and winter flow recommendations from the R2CROSS analysis.

Seasonal ISF Recommendation

After considering the water availability information, CPW is able to determine that 24 cfs is appears to be available during the summer high flow season from March 16th through July 15th. The above hydrograph shows that the R2CROSS generated winter flow recommendation of 15.8 cfs may to not be available for the winter base flow period from July 16th to March 15th based on this preliminary examination of water availability. CPW will consult with CWCB staff on the

winter season ISF recommendations once detailed water availability analyses have been completed by CWCB staff. Due to the nature of this fishery, CPW will seek to protect flows as close to the R2CROSS recommendations as possible given water availability constraints.

Citations

Capesius, J.P. and V.C. Stephens, 2009, Regional regression equations for estimation of natural streamflow statistics in Colorado, Scientific Investigations Report 2009-5136. (USGS StreamStats)

CRCT Conservation Team. 2006. Conservation agreement for Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) in the states of Colorado, Utah, and Wyoming. Colorado Division of Wildlife, Fort Collins. 10p.

CRCT Conservation Team. 2006. Conservation strategy for Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) in the states of Colorado, Utah, and Wyoming. Colorado Division of Wildlife, Fort Collins. 24p.

CRCT Task Force. 2001. Conservation agreement and strategy for Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) in the states of Colorado, Utah, and Wyoming. Colorado Division of Wildlife, Fort Collins. 87p.

Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Appendices

Appendix A: Information regarding the known and potential Colorado River Cutthroat Trout Populations in Colorado, Utah, and Wyoming.

Appendix B: R2Cross output for three cross-sections collected and analyzed for this reach of Elkhead Creek.

Photos:

Figure 3. Elkhead Creek cross-section number four (2015) looking across tape.

Figure 4. Elkhead Creek cross-section number four (2015) looking downstream.

Figure 5. Elkhead Creek cross-section number four (2015) looking downstream.

Figure 6. Elkhead Creek cross-section number four (2015) looking upstream.

Figure 7. Elkhead Creek cross-section number four (2015) looking upstream.

Figure 8. Elkhead Creek cross-section number five (2015) looking across tape.

Figure 9. Elkhead Creek cross-section number five (2015) looking downstream.

Figure 10. Elkhead Creek cross-section number five (2015) looking downstream.

Figure 11. Elkhead Creek cross-section number five (2015) looking upstream.

Figure 12. Elkhead Creek cross-section number five (2015) looking upstream.

Figure 13. Elkhead Creek looking downstream from bridge at lower Terminus.

Figure 14. Site of Elkhead Creek streamgage near lower terminus of ISF reach.

Figure 15. Natural Environment of Elkhead Creek Basin.

Figure 16. Natural Environment of Elkhead Creek Basin.

Figure 17. Natural Environment of Elkhead Creek Basin.

Figure 17. Natural Environment of Elkhead Creek Basin.

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

LOCATION INFORMATION

STREAM NAME:	Elkhead Creek Lower
XS LOCATION:	Bel county road bridge @ gage
XS NUMBER:	1
DATE:	27-Oct-15
OBSERVERS:	rv js sm
1/4 SEC:	0
SECTION:	0
TWP:	40 35 29.36
RANGE:	107 19 16.52
PM:	0
COUNTY:	0
WATERSHED:	0
DIVISION:	0
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

		*** NOTE ***
		Leave TAPE WT and TENSION
		at defaults for data collected
TAPE WT:	0.0106	with a survey level and rod
TENSION:	99999	

CHANNEL PROFILE DATA

SLOPE:	0.017

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

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

STREAM NAME: Elkhead Creek Lower
XS LOCATION: Bel county road bridge @ gage
XS NUMBER: 1

DATA POINTS= 34

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	s	0.50	9.20			0.00		0.00	0.00	0.0%
		2.00	9.60			0.00		0.00	0.00	0.0%
		4.00	9.45			0.00		0.00	0.00	0.0%
1	gl	4.50	10.47			0.00		0.00	0.00	0.0%
		5.50	10.79			0.00		0.00	0.00	0.0%
	wl	6.50	10.85	0.00	0.00	0.00		0.00	0.00	0.0%
		8.00	11.17	0.25	1.15	1.53	0.25	0.44	0.50	4.5%
		10.00	10.99	0.15	1.18	2.01	0.15	0.30	0.35	3.2%
		12.00	11.13	0.35	1.00	2.00	0.35	0.70	0.70	6.3%
		14.00	11.15	0.30	1.28	2.00	0.30	0.60	0.77	6.9%
		16.00	11.25	0.45	1.11	2.00	0.45	0.90	1.00	9.0%
		18.00	11.33	0.50	0.50	2.00	0.50	1.00	0.50	4.5%
		20.00	11.01	0.40	0.92	2.03	0.40	0.80	0.74	6.6%
		22.00	11.23	0.35	0.44	2.01	0.35	0.70	0.31	2.8%
		24.00	11.26	0.40	0.57	2.00	0.40	0.80	0.46	4.1%
		26.00	11.14	0.50	0.70	2.00	0.50	1.00	0.70	6.3%
		28.00	11.19	0.35	0.07	2.00	0.35	0.70	0.05	0.4%
		30.00	11.08	0.20	0.23	2.00	0.20	0.40	0.09	0.8%
		32.00	11.10	0.20	0.37	2.00	0.20	0.40	0.15	1.3%
		34.00	11.14	0.20	0.92	2.00	0.20	0.40	0.37	3.3%
		36.00	11.21	0.30	0.44	2.00	0.30	0.60	0.26	2.4%
		38.00	11.35	0.40	0.62	2.00	0.40	0.80	0.50	4.4%
		40.00	11.20	0.40	1.02	2.01	0.40	0.80	0.82	7.3%
		42.00	11.30	0.35	0.48	2.00	0.35	0.70	0.34	3.0%
		44.00	11.21	0.20	0.00	2.00	0.20	0.40	0.00	0.0%
		46.00	11.32	0.40	0.72	2.00	0.40	0.80	0.58	5.2%
		48.00	11.29	0.40	0.86	2.00	0.40	0.80	0.69	6.2%
		50.00	11.30	0.35	0.41	2.00	0.35	0.70	0.29	2.6%
		52.00	11.19	0.45	0.98	2.00	0.45	0.90	0.88	7.9%
		54.00	11.05	0.20	0.42	2.00	0.20	0.30	0.13	1.1%
	wl	55.00	10.95	0.00	0.00	1.00		0.00	0.00	0.0%
		57.50	10.58			0.00		0.00	0.00	0.0%
1	gl	59.50	9.97			0.00		0.00	0.00	0.0%
	s	62.50	8.76			0.00		0.00	0.00	0.0%
TOTALS ----------						48.63	0.5	15.94	11.15	100.0%
							(Max.)			

Manning's n = 0.1316
Hydraulic Radius= 0.32773765

STREAM NAME: Elkhead Creek Lower
XS LOCATION: Bel county road bridge @ gage
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	15.94	13.84	-13.2%
10.65	15.94	26.46	66.0%
10.67	15.94	25.42	59.5%
10.69	15.94	24.39	53.0%
10.71	15.94	23.36	46.5%
10.73	15.94	22.33	40.1%
10.75	15.94	21.31	33.7%
10.77	15.94	20.29	27.3%
10.79	15.94	19.28	21.0%
10.81	15.94	18.27	14.6%
10.83	15.94	17.27	8.4%
10.85	15.94	16.28	2.2%
10.86	15.94	15.79	-0.9%
10.87	15.94	15.30	-4.0%
10.88	15.94	14.81	-7.0%
10.89	15.94	14.33	-10.1%
10.90	15.94	13.84	-13.2%
10.91	15.94	13.35	-16.2%
10.92	15.94	12.87	-19.2%
10.93	15.94	12.39	-22.3%
10.94	15.94	11.91	-25.3%
10.95	15.94	11.42	-28.3%
10.97	15.94	10.47	-34.3%
10.99	15.94	9.51	-40.3%
11.01	15.94	8.57	-46.2%
11.03	15.94	7.65	-52.0%
11.05	15.94	6.75	-57.6%
11.07	15.94	5.88	-63.1%
11.09	15.94	5.03	-68.4%
11.11	15.94	4.25	-73.4%
11.13	15.94	3.51	-77.9%
11.15	15.94	2.85	-82.1%

WATERLINE AT ZERO
AREA ERROR = 10.857

STREAM NAME: Elkhead Creek Lower
XS LOCATION: Bel county road bridge @ gage
XS NUMBER: 1

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	10.47	53.36	0.67	0.88	35.95	53.58	100.0%	0.67	40.55	1.13
	10.51	53.12	0.64	0.84	33.97	53.34	99.5%	0.64	37.03	1.09
	10.56	52.80	0.59	0.79	31.33	53.00	98.9%	0.59	32.48	1.04
	10.61	52.39	0.55	0.74	28.70	52.57	98.1%	0.55	28.21	0.98
	10.66	51.89	0.50	0.69	26.09	52.07	97.2%	0.50	24.23	0.93
	10.71	51.40	0.46	0.64	23.51	51.56	96.2%	0.46	20.50	0.87
	10.76	50.91	0.41	0.59	20.95	51.06	95.3%	0.41	17.03	0.81
	10.81	50.18	0.37	0.54	18.42	50.32	93.9%	0.37	13.87	0.75
WL	10.86	49.09	0.32	0.49	15.94	49.23	91.9%	0.32	11.06	0.69
	10.91	48.52	0.28	0.44	13.50	48.65	90.8%	0.28	8.45	0.63
	10.96	47.93	0.23	0.39	11.09	48.04	89.7%	0.23	6.14	0.55
	11.01	46.76	0.19	0.34	8.71	46.87	87.5%	0.19	4.18	0.48
	11.06	44.00	0.15	0.29	6.44	44.09	82.3%	0.15	2.63	0.41
	11.11	38.17	0.11	0.24	4.36	38.25	71.4%	0.11	1.51	0.35
	11.16	29.42	0.09	0.19	2.64	29.48	55.0%	0.09	0.78	0.29
	11.21	22.26	0.06	0.14	1.36	22.29	41.6%	0.06	0.31	0.23
	11.26	12.83	0.04	0.09	0.47	12.85	24.0%	0.04	0.08	0.16
	11.31	3.00	0.01	0.04	0.04	3.01	5.6%	0.01	0.00	0.08

STREAM NAME: Elkhead Creek Lower
XS LOCATION: Bel county road bridge @ gage
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	11.15	cfs
CALCULATED FLOW (Qc)=	11.06	cfs
(Qm-Qc)/Qm * 100 =	0.8	%
MEASURED WATERLINE (WLm)=	10.90	ft
CALCULATED WATERLINE (WLc)=	10.86	ft
(WLm-WLc)/WLm * 100 =	0.4	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.49	ft
(Dm-Dc)/Dm * 100	1.4	%
MEAN VELOCITY=	0.69	ft/sec
MANNING'S N=	0.132	
SLOPE=	0.017	ft/ft
.4 * Qm =	4.5	cfs
2.5 * Qm=	27.9	cfs

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

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

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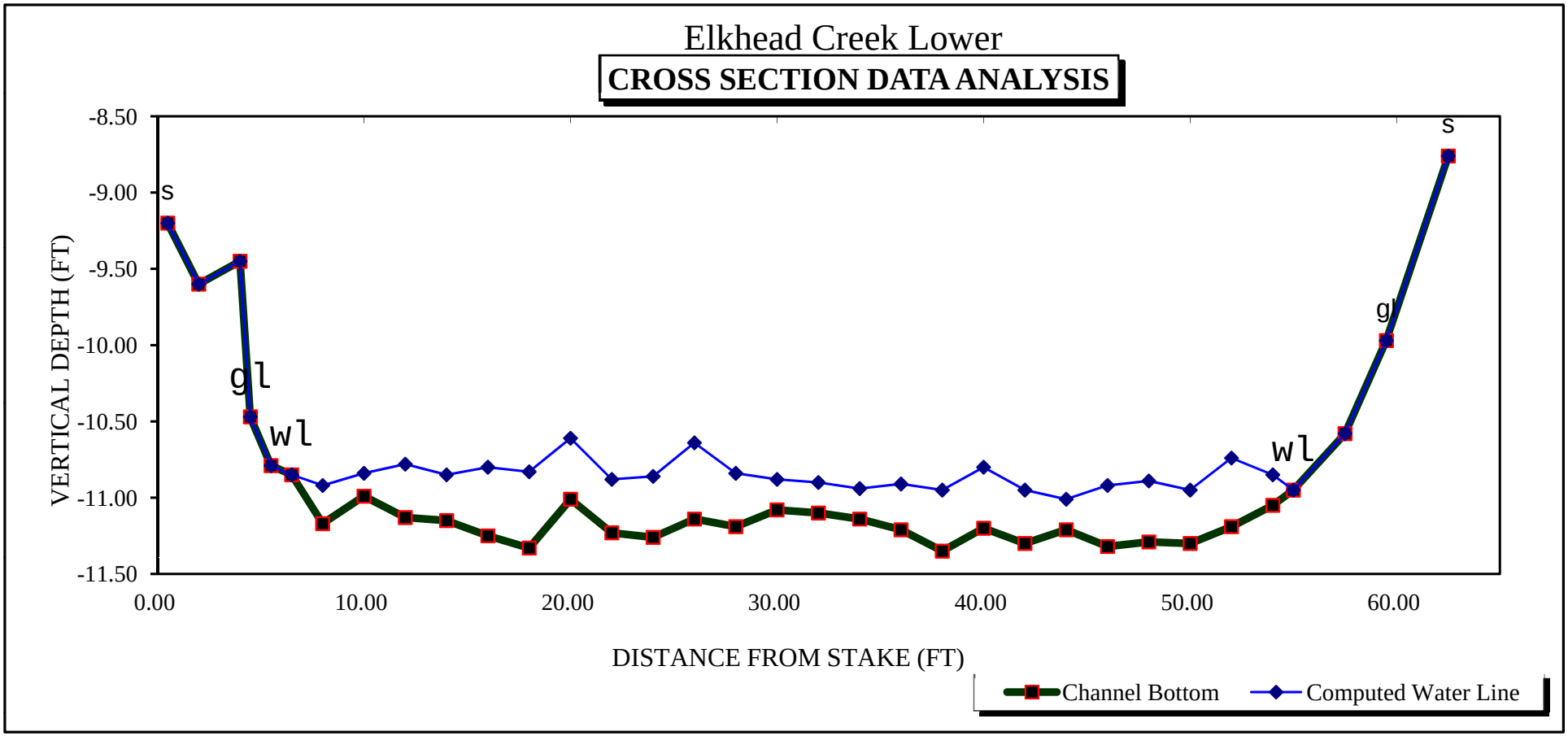
RECOMMENDATION BY: ………………...………..……............................... AGENCY..………………………......……...…...…….…..... DATE:......…...…......……………

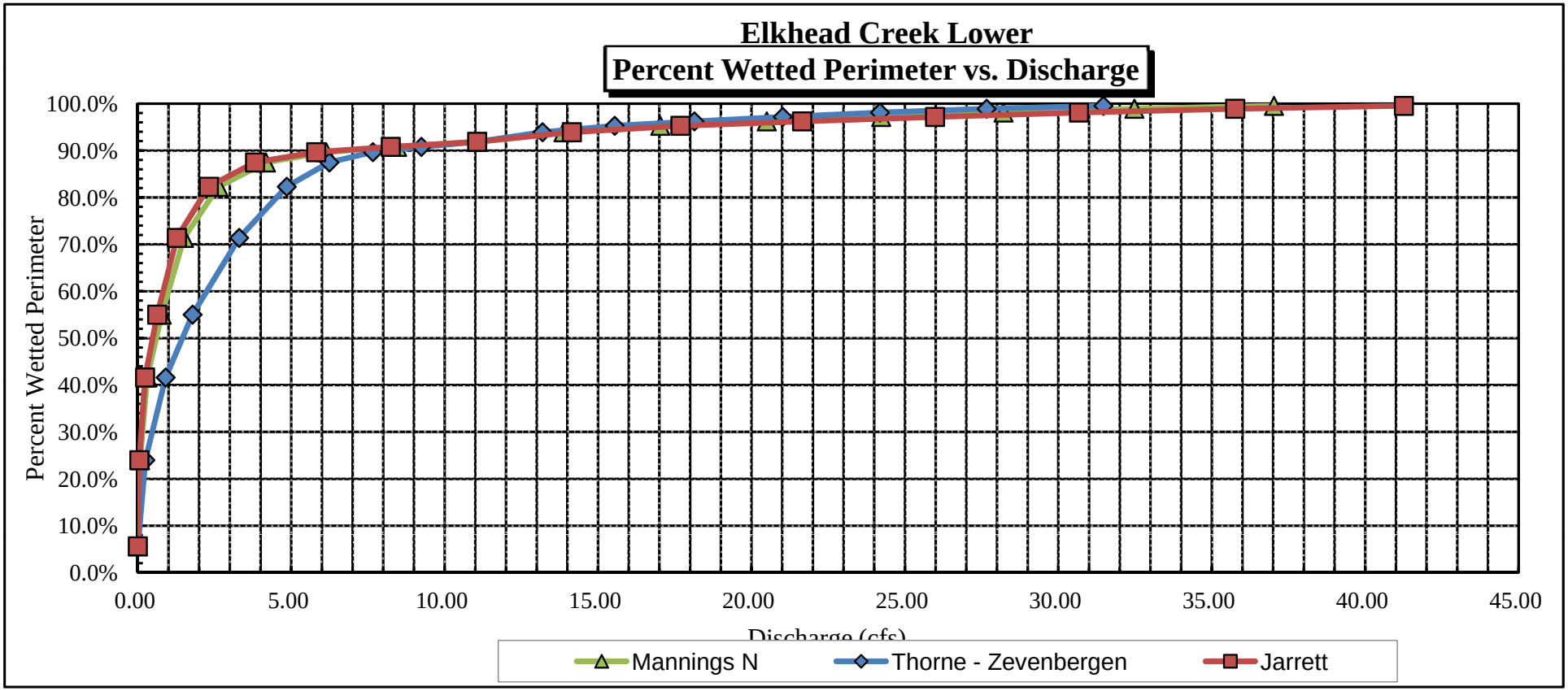
CWCB REVIEW BY: ..…………………………....………………………………………………...…............. DATE:.................…………….....

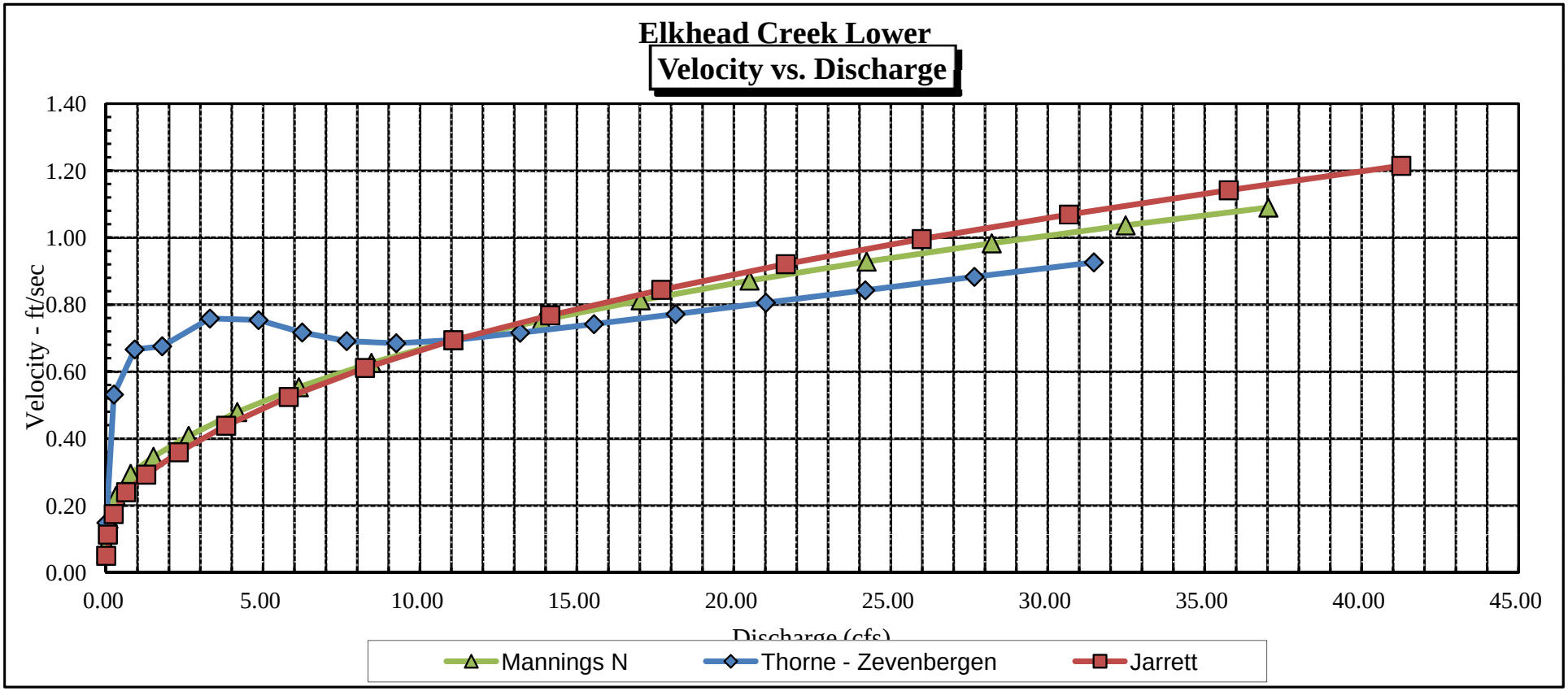
STREAM NAME: Elkhead Creek Lower
XS LOCATION: Bel county road bridge @ gage
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

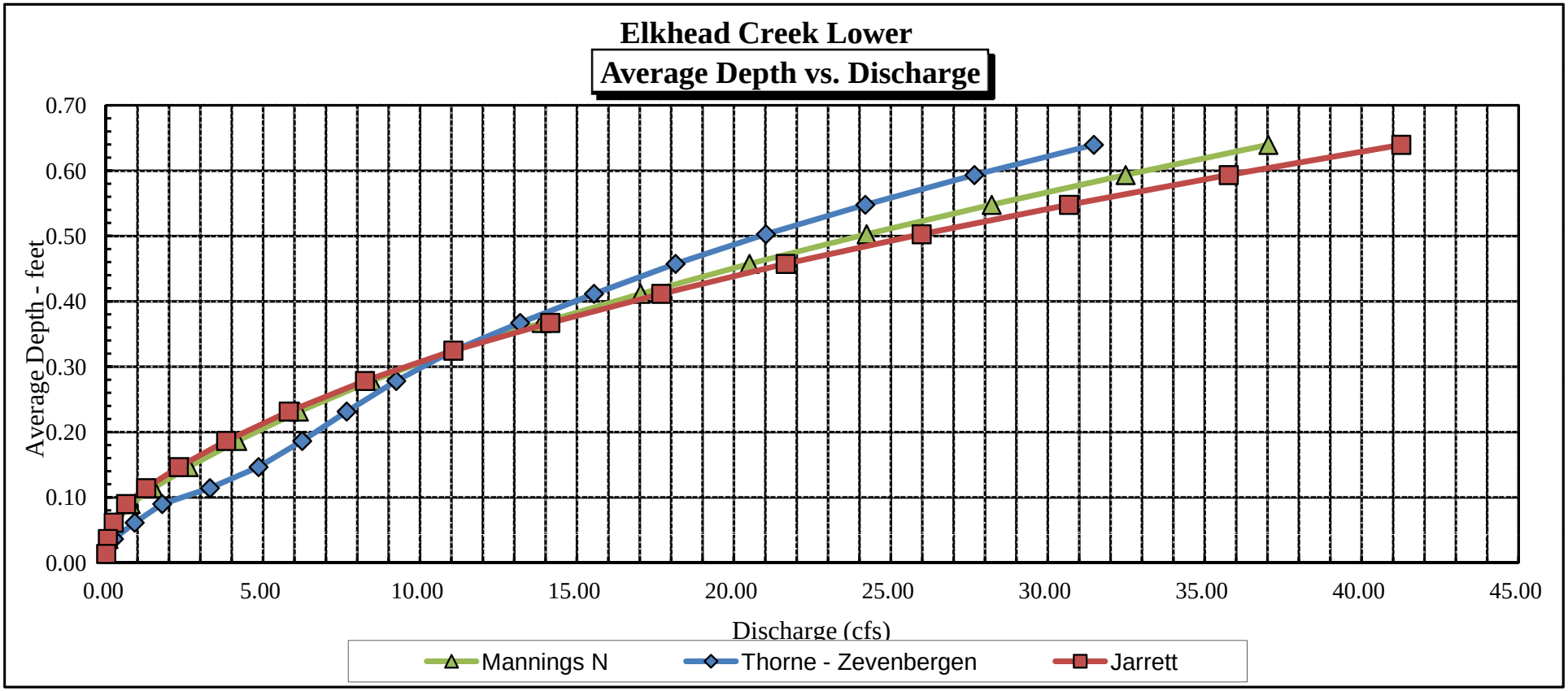
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

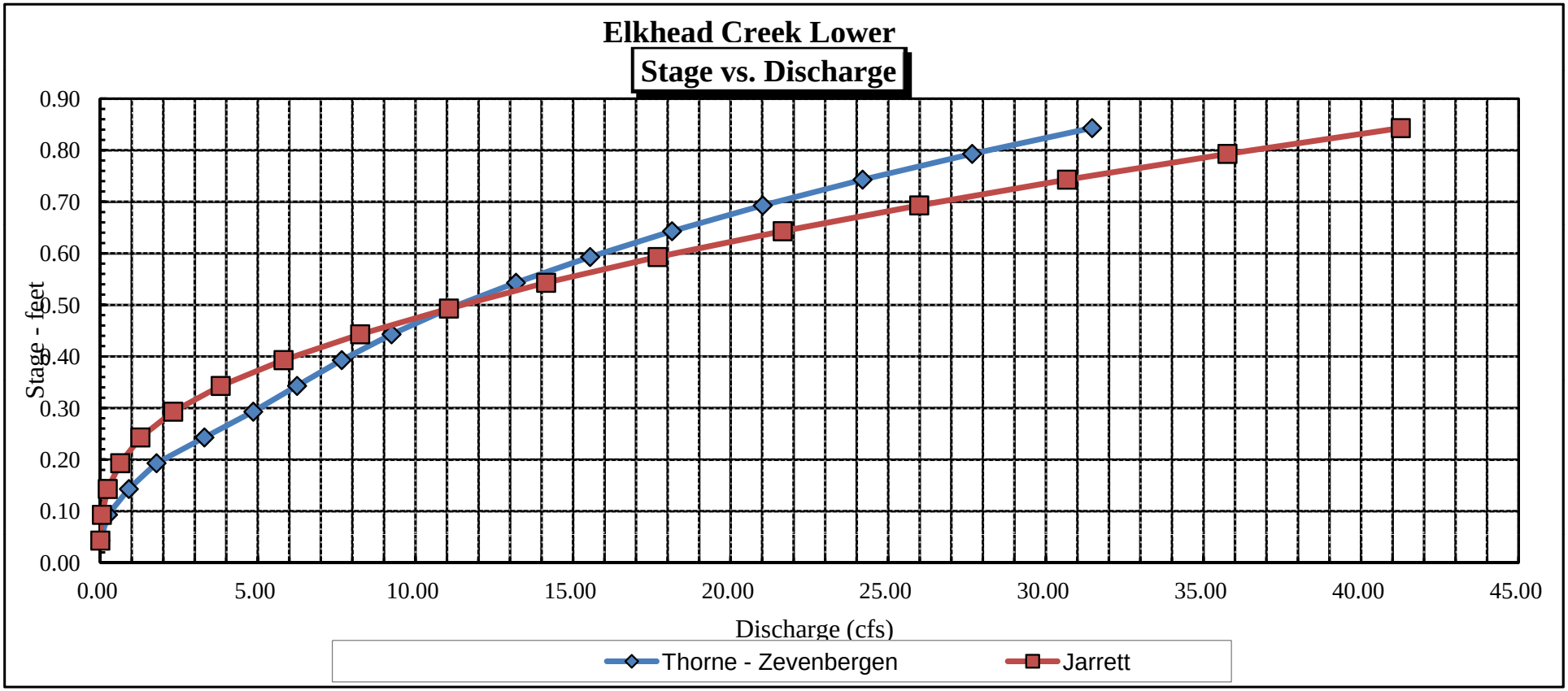
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	10.47	53.36	0.67	0.88	35.95	53.58	100.0%	0.67	45.57	1.27
	10.51	53.12	0.64	0.84	33.97	53.34	99.5%	0.64	41.26	1.21
	10.56	52.80	0.59	0.79	31.33	53.00	98.9%	0.59	35.76	1.14
	10.61	52.39	0.55	0.74	28.70	52.57	98.1%	0.55	30.67	1.07
	10.66	51.89	0.50	0.69	26.09	52.07	97.2%	0.50	25.98	1.00
	10.71	51.40	0.46	0.64	23.51	51.56	96.2%	0.46	21.65	0.92
	10.76	50.91	0.41	0.59	20.95	51.06	95.3%	0.41	17.69	0.84
	10.81	50.18	0.37	0.54	18.42	50.32	93.9%	0.37	14.15	0.77
WL	10.86	49.09	0.32	0.49	15.94	49.23	91.9%	0.32	11.06	0.69
	10.91	48.52	0.28	0.44	13.50	48.65	90.8%	0.28	8.25	0.61
	10.96	47.93	0.23	0.39	11.09	48.04	89.7%	0.23	5.81	0.52
	11.01	46.76	0.19	0.34	8.71	46.87	87.5%	0.19	3.82	0.44
	11.06	44.00	0.15	0.29	6.44	44.09	82.3%	0.15	2.31	0.36
	11.11	38.17	0.11	0.24	4.36	38.25	71.4%	0.11	1.27	0.29
	11.16	29.42	0.09	0.19	2.64	29.48	55.0%	0.09	0.63	0.24
	11.21	22.26	0.06	0.14	1.36	22.29	41.6%	0.06	0.24	0.18
	11.26	12.83	0.04	0.09	0.47	12.85	24.0%	0.04	0.05	0.11
	11.31	3.00	0.01	0.04	0.04	3.01	5.6%	0.01	0.00	0.05


Elkhead Creek Lower
CROSS SECTION DATA ANALYSIS
-8.50
-9.00
-9.50
-10.00
-10.50
-11.00
-11.50
VERTICAL DEPTH (FT)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
DISTANCE FROM STAKE (FT)
s
gl
wl
wl
gl
s
Channel Bottom
Computed Water Line


Elkhead Creek Lower
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
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Velocity vs. Discharge
Velocity - ft/sec
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
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Average Depth vs. Discharge
Average Depth - feet
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Stage vs. Discharge
Stage - feet
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
5.00
10.00
15.00
20.00
25.00
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:	Elkhead Creek lower
XS LOCATION:	1/8 mile d/s of gage
XS NUMBER:	2
DATE:	27-Oct-15
OBSERVERS:	js rv sm
1/4 SEC:	0
SECTION:	0
TWP:	40 35 31.97
RANGE:	107 19 21.69
PM:	0
COUNTY:	0
WATERSHED:	0
DIVISION:	0
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

		*** NOTE ***
		Leave TAPE WT and TENSION
		at defaults for data collected
TAPE WT:	0.0106	with a survey level and rod
TENSION:	99999	

CHANNEL PROFILE DATA

SLOPE:	0.009

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

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

STREAM NAME: Elkhead Creek lower
XS LOCATION: 1/8 mile d/s of gage
XS NUMBER: 2

DATA POINTS= 36

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	s	0.00	9.75			0.00		0.00	0.00	0.0%
1	gl	3.00	10.35			0.00		0.00	0.00	0.0%
		7.00	10.31			0.00		0.00	0.00	0.0%
		9.00	10.68			0.00		0.00	0.00	0.0%
	wl	12.00	10.75	0.00	0.00	0.00		0.00	0.00	0.0%
		13.00	11.30	0.60	0.46	1.14	0.60	0.60	0.28	2.5%
		14.00	11.50	0.70	1.34	1.02	0.70	0.70	0.94	8.5%
		15.00	11.55	0.75	0.95	1.00	0.75	0.75	0.71	6.5%
		16.00	11.45	0.70	1.32	1.00	0.70	0.70	0.92	8.4%
		17.00	11.51	0.70	1.22	1.00	0.70	0.70	0.85	7.8%
		18.00	11.43	0.70	1.06	1.00	0.70	0.70	0.74	6.7%
		19.00	11.58	0.80	0.95	1.01	0.80	0.80	0.76	6.9%
		20.00	11.44	0.70	0.77	1.01	0.70	0.70	0.54	4.9%
		21.00	11.20	0.50	0.88	1.03	0.50	0.50	0.44	4.0%
		22.00	11.10	0.50	1.13	1.00	0.50	0.50	0.57	5.1%
		23.00	11.06	0.45	1.06	1.00	0.45	0.45	0.48	4.3%
		24.00	11.21	0.40	0.76	1.01	0.40	0.40	0.30	2.8%
		25.00	10.90	0.30	0.09	1.05	0.30	0.30	0.03	0.2%
		26.00	11.17	0.40	0.00	1.04	0.40	0.40	0.00	0.0%
		27.00	10.90	0.30	0.39	1.04	0.30	0.30	0.12	1.1%
		28.00	11.13	0.45	1.79	1.03	0.45	0.45	0.81	7.3%
		29.00	11.08	0.45	1.55	1.00	0.45	0.45	0.70	6.3%
		30.00	11.22	0.45	1.58	1.01	0.45	0.45	0.71	6.5%
		31.00	11.05	0.40	1.09	1.01	0.40	0.40	0.44	4.0%
		32.00	11.10	0.40	0.00	1.00	0.40	0.40	0.00	0.0%
		33.00	10.93	0.20	1.31	1.01	0.20	0.20	0.26	2.4%
		34.00	11.08	0.20	0.95	1.01	0.20	0.20	0.19	1.7%
		35.00	10.90	0.25	0.88	1.02	0.25	0.25	0.22	2.0%
		36.00	10.95	0.20	0.00	1.00	0.20	0.20	0.00	0.0%
		37.00	10.87	0.15	0.00	1.00	0.15	0.15	0.00	0.0%
		38.00	10.83	0.05	0.00	1.00	0.05	0.05	0.00	0.0%
		39.00	10.84	0.10	0.00	1.00	0.10	0.10	0.00	0.0%
	wl	40.00	10.67	0.00	0.00	1.01		0.00	0.00	0.0%
		41.00	10.40			0.00		0.00	0.00	0.0%
1	gl	44.50	10.15			0.00		0.00	0.00	0.0%
	s	49.50	9.00			0.00		0.00	0.00	0.0%
	TOTALS ----------					28.47	0.8 (Max.)	11.80	11.00	100.0%

Manning's n = 0.0841
Hydraulic Radius= 0.41445484

STREAM NAME: Elkhead Creek lower
XS LOCATION: 1/8 mile d/s of gage
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	11.80	12.15	3.0%
10.46	11.80	20.09	70.2%
10.48	11.80	19.43	64.7%
10.50	11.80	18.78	59.1%
10.52	11.80	18.13	53.6%
10.54	11.80	17.48	48.1%
10.56	11.80	16.84	42.7%
10.58	11.80	16.20	37.3%
10.60	11.80	15.56	31.9%
10.62	11.80	14.93	26.5%
10.64	11.80	14.30	21.2%
10.66	11.80	13.68	15.9%
10.67	11.80	13.37	13.3%
10.68	11.80	13.06	10.6%
10.69	11.80	12.75	8.0%
10.70	11.80	12.45	5.5%
10.71	11.80	12.15	3.0%
10.72	11.80	11.86	0.5%
10.73	11.80	11.57	-2.0%
10.74	11.80	11.29	-4.3%
10.75	11.80	11.01	-6.7%
10.76	11.80	10.73	-9.0%
10.78	11.80	10.19	-13.7%
10.80	11.80	9.64	-18.3%
10.82	11.80	9.10	-22.9%
10.84	11.80	8.57	-27.4%
10.86	11.80	8.06	-31.7%
10.88	11.80	7.57	-35.9%
10.90	11.80	7.08	-40.0%
10.92	11.80	6.60	-44.1%
10.94	11.80	6.15	-47.9%
10.96	11.80	5.72	-51.5%

WATERLINE AT ZERO
AREA ERROR = 10.722

STREAM NAME: Elkhead Creek lower
XS LOCATION: 1/8 mile d/s of gage
XS NUMBER: 2

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	10.35	34.48	0.69	1.23	23.78	35.02	100.0%	0.68	30.81	1.30
	10.37	34.06	0.68	1.21	23.03	34.59	98.8%	0.67	29.44	1.28
	10.42	33.31	0.64	1.16	21.35	33.84	96.6%	0.63	26.33	1.23
	10.47	32.86	0.60	1.11	19.69	33.38	95.3%	0.59	23.23	1.18
	10.52	32.40	0.56	1.06	18.06	32.91	94.0%	0.55	20.30	1.12
	10.57	31.95	0.52	1.01	16.45	32.44	92.6%	0.51	17.54	1.07
	10.62	31.49	0.47	0.96	14.87	31.98	91.3%	0.46	14.96	1.01
	10.67	31.03	0.43	0.91	13.30	31.50	90.0%	0.42	12.56	0.94
WL	10.72	28.90	0.41	0.86	11.80	29.36	83.8%	0.40	10.77	0.91
	10.77	27.36	0.38	0.81	10.41	27.82	79.4%	0.37	9.06	0.87
	10.82	26.98	0.34	0.76	9.05	27.41	78.3%	0.33	7.24	0.80
	10.87	24.75	0.31	0.71	7.76	25.18	71.9%	0.31	5.94	0.77
	10.92	23.15	0.28	0.66	6.55	23.54	67.2%	0.28	4.69	0.71
	10.97	20.59	0.27	0.61	5.47	20.93	59.8%	0.26	3.75	0.69
	11.02	18.85	0.24	0.56	4.48	19.14	54.6%	0.23	2.86	0.64
	11.07	16.15	0.22	0.51	3.59	16.39	46.8%	0.22	2.19	0.61
	11.12	11.80	0.25	0.46	2.90	11.98	34.2%	0.24	1.89	0.65
	11.17	9.51	0.25	0.41	2.38	9.65	27.5%	0.25	1.56	0.66
	11.22	8.05	0.24	0.36	1.94	8.15	23.3%	0.24	1.25	0.64
	11.27	7.75	0.20	0.31	1.55	7.83	22.4%	0.20	0.88	0.57
	11.32	7.38	0.16	0.26	1.17	7.45	21.3%	0.16	0.57	0.49
	11.37	6.92	0.12	0.21	0.81	6.98	19.9%	0.12	0.32	0.40
	11.42	6.47	0.07	0.16	0.47	6.51	18.6%	0.07	0.14	0.29
	11.47	4.52	0.04	0.11	0.19	4.55	13.0%	0.04	0.04	0.20
	11.52	1.64	0.02	0.06	0.04	1.65	4.7%	0.02	0.00	0.13
	11.57	0.11	0.00	0.01	0.00	0.11	0.3%	0.00	0.00	0.04

STREAM NAME: Elkhead Creek lower
XS LOCATION: 1/8 mile d/s of gage
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	11.00	cfs
CALCULATED FLOW (Qc)=	10.77	cfs
(Qm-Qc)/Qm * 100 =	2.0	%
MEASURED WATERLINE (WLm)=	10.71	ft
CALCULATED WATERLINE (WLc)=	10.72	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.80	ft
MAX CALCULATED DEPTH (Dc)=	0.86	ft
(Dm-Dc)/Dm * 100	-7.3	%
MEAN VELOCITY=	0.91	ft/sec
MANNING'S N=	0.084	
SLOPE=	0.009	ft/ft
.4 * Qm =	4.4	cfs
2.5 * Qm=	27.5	cfs

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

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

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

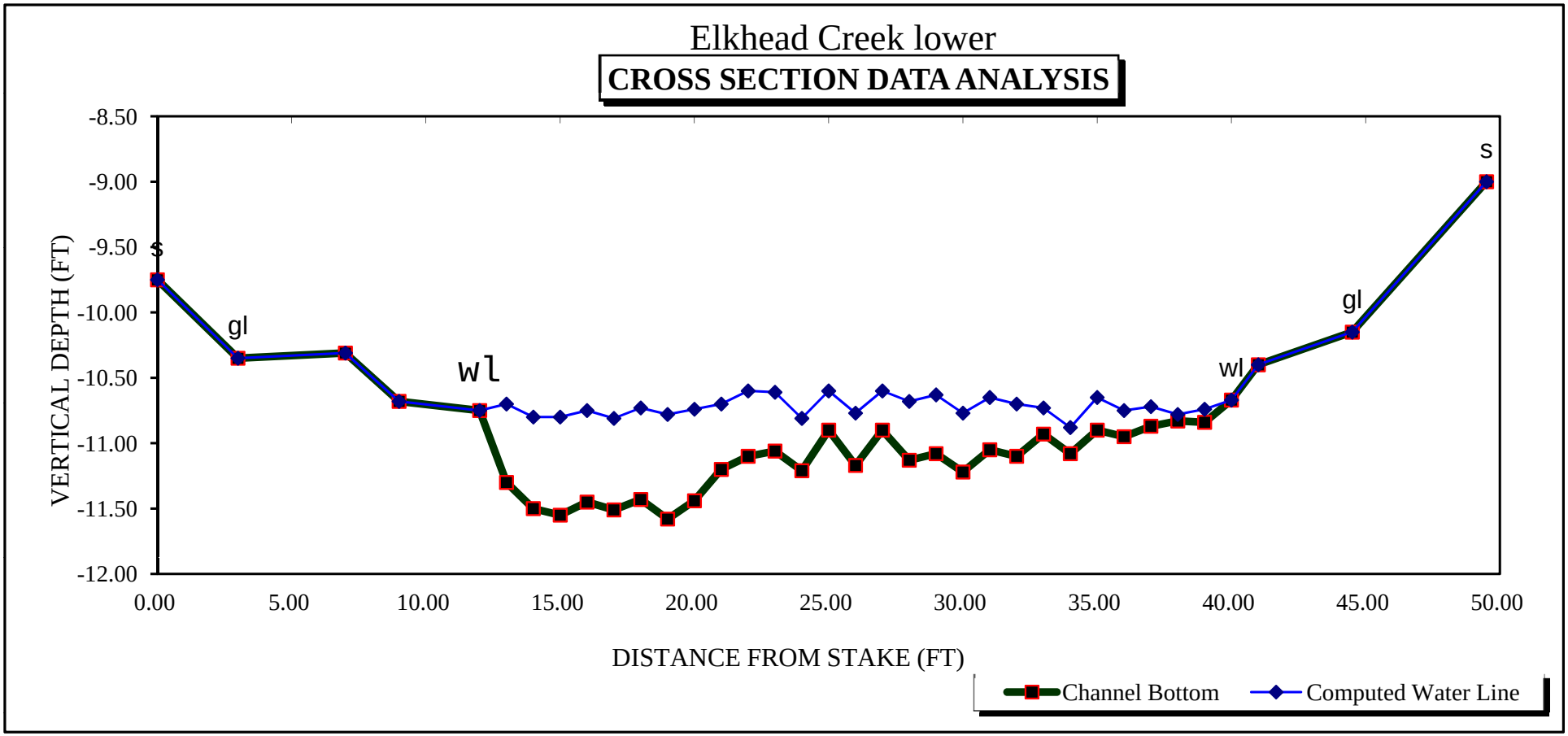
STREAM NAME: Elkhead Creek lower
XS LOCATION: 1/8 mile d/s of gage
XS NUMBER: 2

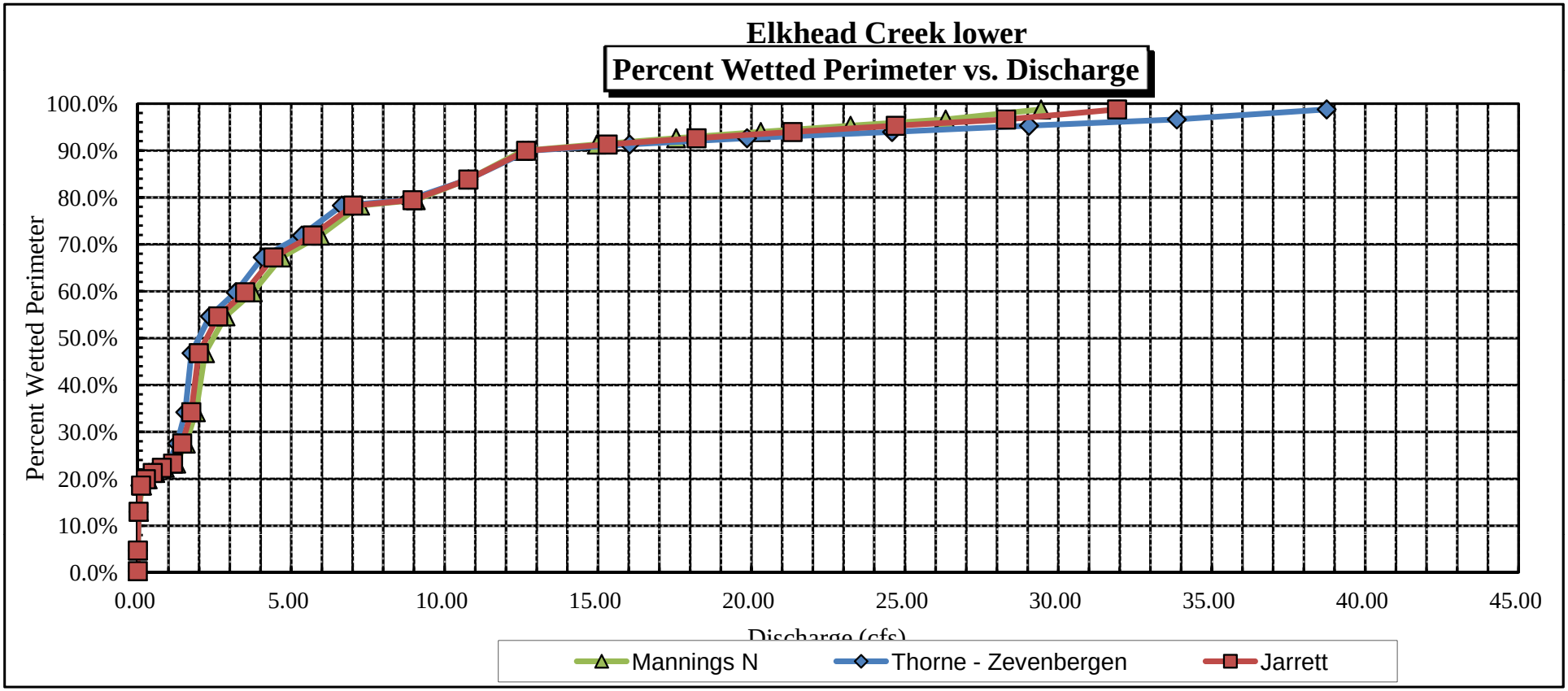
Jarrett Variable Manning's n Correction Applied

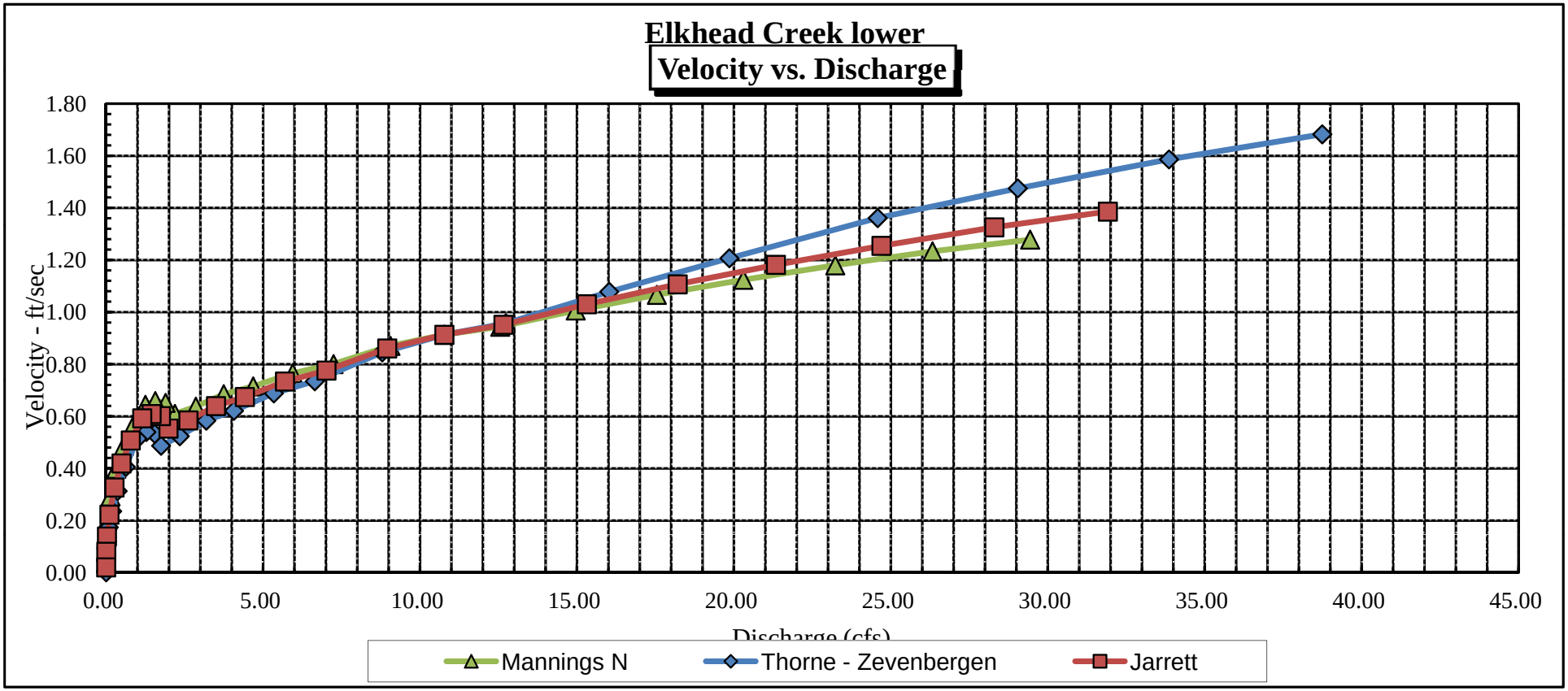
STAGING TABLE

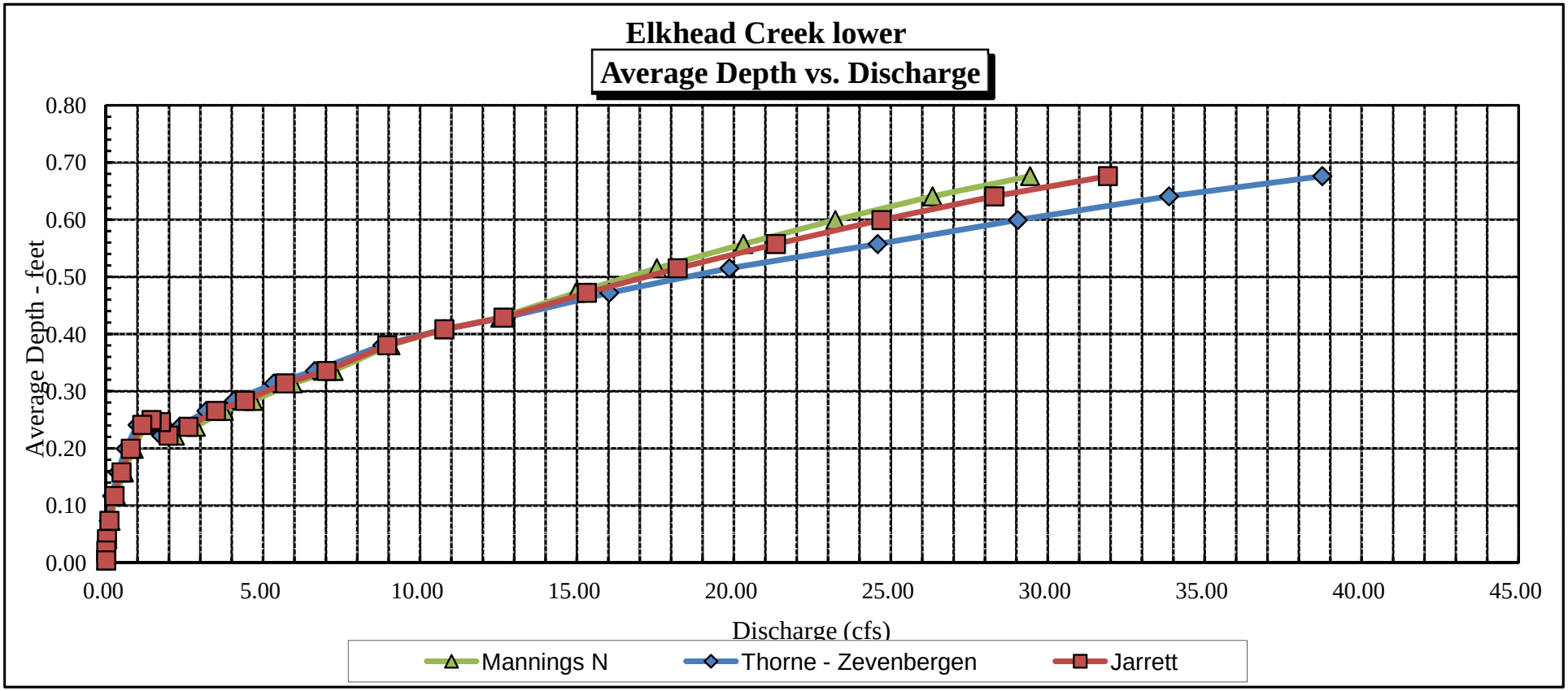
GL = lowest Grassline elevation corrected for sag
WL = Waterline corrected for variations in field measured water surface elevations and sag

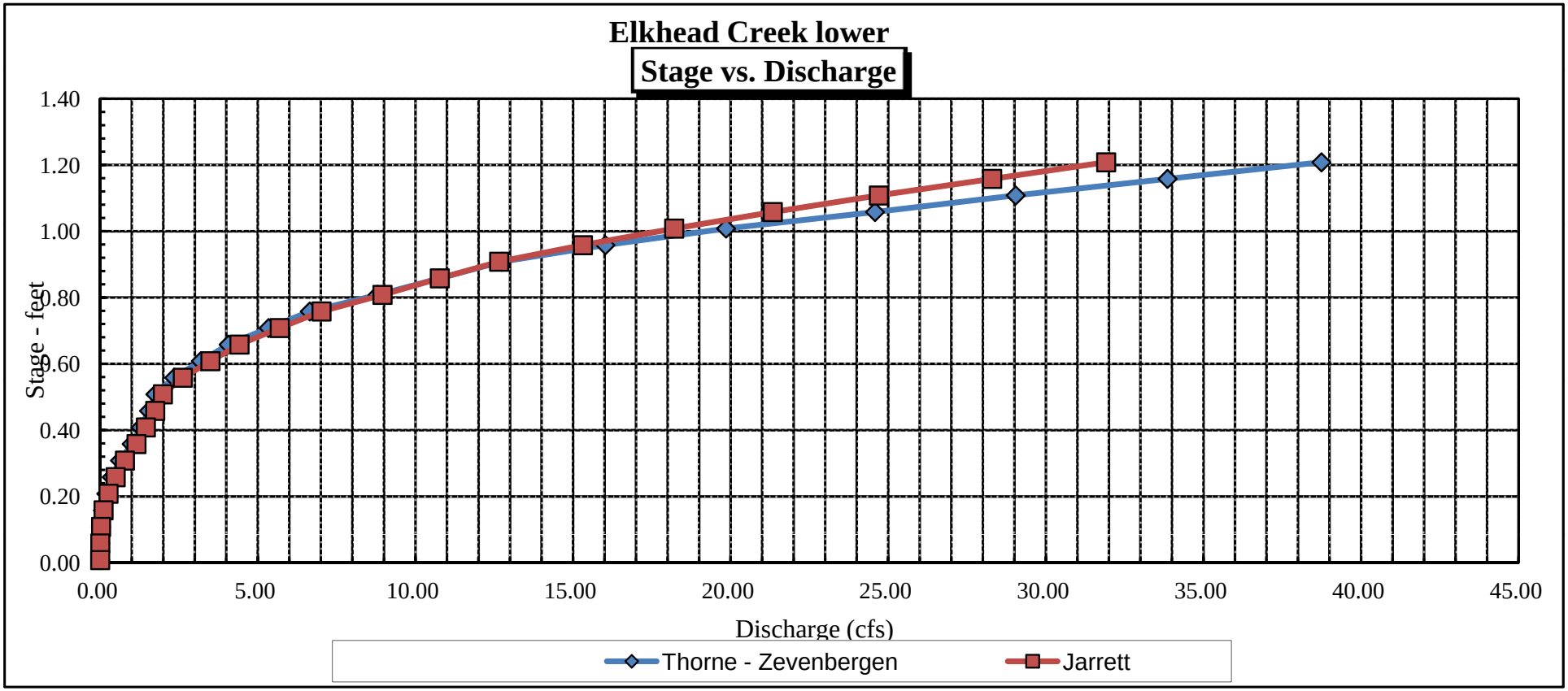
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	10.35	34.48	0.69	1.23	23.78	35.02	100.0%	0.68	33.50	1.41
	10.37	34.06	0.68	1.21	23.03	34.59	98.8%	0.67	31.91	1.39
	10.42	33.31	0.64	1.16	21.35	33.84	96.6%	0.63	28.30	1.33
	10.47	32.86	0.60	1.11	19.69	33.38	95.3%	0.59	24.70	1.25
	10.52	32.40	0.56	1.06	18.06	32.91	94.0%	0.55	21.34	1.18
	10.57	31.95	0.52	1.01	16.45	32.44	92.6%	0.51	18.21	1.11
	10.62	31.49	0.47	0.96	14.87	31.98	91.3%	0.46	15.31	1.03
	10.67	31.03	0.43	0.91	13.30	31.50	90.0%	0.42	12.66	0.95
WL	10.72	28.90	0.41	0.86	11.80	29.36	83.8%	0.40	10.77	0.91
	10.77	27.36	0.38	0.81	10.41	27.82	79.4%	0.37	8.95	0.86
	10.82	26.98	0.34	0.76	9.05	27.41	78.3%	0.33	7.02	0.78
	10.87	24.75	0.31	0.71	7.76	25.18	71.9%	0.31	5.70	0.73
	10.92	23.15	0.28	0.66	6.55	23.54	67.2%	0.28	4.42	0.67
	10.97	20.59	0.27	0.61	5.47	20.93	59.8%	0.26	3.50	0.64
	11.02	18.85	0.24	0.56	4.48	19.14	54.6%	0.23	2.62	0.58
	11.07	16.15	0.22	0.51	3.59	16.39	46.8%	0.22	1.99	0.55
	11.12	11.80	0.25	0.46	2.90	11.98	34.2%	0.24	1.75	0.60
	11.17	9.51	0.25	0.41	2.38	9.65	27.5%	0.25	1.45	0.61
	11.22	8.05	0.24	0.36	1.94	8.15	23.3%	0.24	1.15	0.59
	11.27	7.75	0.20	0.31	1.55	7.83	22.4%	0.20	0.78	0.51
	11.32	7.38	0.16	0.26	1.17	7.45	21.3%	0.16	0.49	0.42
	11.37	6.92	0.12	0.21	0.81	6.98	19.9%	0.12	0.26	0.33
	11.42	6.47	0.07	0.16	0.47	6.51	18.6%	0.07	0.11	0.22
	11.47	4.52	0.04	0.11	0.19	4.55	13.0%	0.04	0.03	0.14
	11.52	1.64	0.02	0.06	0.04	1.65	4.7%	0.02	0.00	0.08
	11.57	0.11	0.00	0.01	0.00	0.11	0.3%	0.00	0.00	0.02


Elkhead Creek lower
CROSS SECTION DATA ANALYSIS
-8.50
-9.00
-9.50
-10.00
-10.50
-11.00
-11.50
-12.00
VERTICAL DEPTH (FT)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
DISTANCE FROM STAKE (FT)
s
gl
wl
wl
gl
s
Channel Bottom
Computed Water Line


Elkhead Creek lower
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
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek lower
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
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek lower
Average Depth vs. Discharge
Average Depth - feet
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek lower
Stage vs. Discharge
Stage - feet
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
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:	Elkhead Creek Lower
XS LOCATION:	0.1 mile above gage
XS NUMBER:	3
DATE:	27-Oct-15
OBSERVERS:	js rv sm
1/4 SEC:	0
SECTION:	0
TWP:	40 35 27.94
RANGE:	107 19 6.15
PM:	0
COUNTY:	0
WATERSHED:	0
DIVISION:	0
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

		*** NOTE ***
		Leave TAPE WT and TENSION
		at defaults for data collected
TAPE WT:	0.0106	with a survey level and rod
TENSION:	99999	

CHANNEL PROFILE DATA

SLOPE:	0.045

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

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

STREAM NAME: Elkhead Creek Lower
XS LOCATION: 0.1 mile above gage
XS NUMBER: 3

DATA POINTS= 30

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 gl	-26.00	8.89			0.00		0.00	0.00	0.0%
	0.00	9.60			0.00		0.00	0.00	0.0%
wl	2.00	9.59	0.00	0.00	0.00		0.00	0.00	0.0%
	3.50	9.67	0.05	0.00	1.50	0.05	0.08	0.00	0.0%
	5.00	9.92	0.30	0.96	1.52	0.30	0.45	0.43	3.9%
	6.50	9.93	0.40	1.27	1.50	0.40	0.60	0.76	6.9%
	8.00	10.09	0.40	1.14	1.51	0.40	0.60	0.68	6.2%
	9.50	10.00	0.40	1.14	1.50	0.40	0.60	0.68	6.2%
	11.00	10.00	0.40	1.07	1.50	0.40	0.60	0.64	5.8%
	12.50	9.75	0.40	0.83	1.52	0.40	0.60	0.50	4.5%
	14.00	9.95	0.35	0.86	1.51	0.35	0.53	0.45	4.1%
	15.50	9.82	0.35	0.49	1.51	0.35	0.53	0.26	2.3%
	17.00	9.89	0.30	0.58	1.50	0.30	0.45	0.26	2.4%
	18.50	10.02	0.40	0.30	1.51	0.40	0.60	0.18	1.6%
	20.00	10.18	0.60	0.57	1.51	0.60	0.90	0.51	4.6%
	21.50	10.35	0.80	0.68	1.51	0.80	1.20	0.82	7.4%
	23.00	10.39	0.80	0.69	1.50	0.80	1.20	0.83	7.5%
	24.50	10.32	0.80	0.74	1.50	0.80	1.20	0.89	8.0%
	26.00	10.11	0.65	0.59	1.51	0.65	0.98	0.58	5.2%
	27.50	10.15	0.55	0.68	1.50	0.55	0.83	0.56	5.1%
	29.00	10.08	0.45	0.69	1.50	0.45	0.68	0.47	4.2%
	30.50	9.95	0.35	0.39	1.51	0.35	0.53	0.20	1.8%
	32.00	9.98	0.30	0.50	1.50	0.30	0.45	0.23	2.0%
	33.50	9.94	0.25	0.67	1.50	0.25	0.38	0.25	2.3%
	35.00	10.04	0.40	0.45	1.50	0.40	0.60	0.27	2.4%
	36.50	10.11	0.45	0.86	1.50	0.45	0.68	0.58	5.2%
	38.00	9.79	0.20	0.11	1.53	0.20	0.30	0.03	0.3%
	39.50	9.73	0.20	0.07	1.50	0.20	0.25	0.02	0.2%
wl	40.50	9.60	0.00	0.00	1.01		0.00	0.00	0.0%
1 s gl	42.30	8.65			0.00		0.00	0.00	0.0%
TOTALS ----------					38.67	0.8 (Max.)	15.78	11.08	100.0%

Manning's n = 0.2468
Hydraulic Radius= 0.40790982

STREAM NAME: Elkhead Creek Lower
XS LOCATION: 0.1 mile above gage
XS NUMBER: 3

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	15.78	15.40	-2.4%
9.35	15.78	26.77	69.7%
9.37	15.78	25.77	63.4%
9.39	15.78	24.79	57.1%
9.41	15.78	23.82	51.0%
9.43	15.78	22.87	45.0%
9.45	15.78	21.93	39.0%
9.47	15.78	21.01	33.2%
9.49	15.78	20.10	27.4%
9.51	15.78	19.21	21.8%
9.53	15.78	18.34	16.2%
9.55	15.78	17.48	10.8%
9.56	15.78	17.05	8.1%
9.57	15.78	16.63	5.4%
9.58	15.78	16.22	2.8%
9.59	15.78	15.80	0.2%
9.60	15.78	15.40	-2.4%
9.61	15.78	15.01	-4.8%
9.62	15.78	14.63	-7.3%
9.63	15.78	14.25	-9.7%
9.64	15.78	13.88	-12.0%
9.65	15.78	13.50	-14.4%
9.67	15.78	12.77	-19.1%
9.69	15.78	12.04	-23.7%
9.71	15.78	11.32	-28.3%
9.73	15.78	10.60	-32.8%
9.75	15.78	9.89	-37.3%
9.77	15.78	9.19	-41.7%
9.79	15.78	8.52	-46.0%
9.81	15.78	7.85	-50.2%
9.83	15.78	7.20	-54.3%
9.85	15.78	6.57	-58.4%

WATERLINE AT ZERO
AREA ERROR = 9.586

STREAM NAME: Elkhead Creek Lower
XS LOCATION: 0.1 mile above gage
XS NUMBER: 3

Constant Manning's n

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	8.89	67.85	0.79	1.50	53.66	68.20	100.0%	0.79	58.40	1.09
	8.94	66.08	0.77	1.45	50.59	66.43	97.4%	0.76	53.89	1.07
	8.99	64.16	0.74	1.40	47.34	64.49	94.6%	0.73	49.19	1.04
	9.04	62.23	0.71	1.35	44.18	62.55	91.7%	0.71	44.75	1.01
	9.09	60.31	0.68	1.30	41.11	60.62	88.9%	0.68	40.54	0.99
	9.14	58.38	0.65	1.25	38.15	58.68	86.0%	0.65	36.56	0.96
	9.19	56.46	0.62	1.20	35.28	56.74	83.2%	0.62	32.82	0.93
	9.24	54.53	0.60	1.15	32.50	54.80	80.3%	0.59	29.30	0.90
	9.29	52.61	0.57	1.10	29.82	52.86	77.5%	0.56	26.01	0.87
	9.34	50.68	0.54	1.05	27.24	50.92	74.7%	0.53	22.93	0.84
	9.39	48.75	0.51	1.00	24.76	48.98	71.8%	0.51	20.06	0.81
	9.44	46.83	0.48	0.95	22.37	47.05	69.0%	0.48	17.40	0.78
	9.49	44.90	0.45	0.90	20.07	45.11	66.1%	0.45	14.94	0.74
	9.54	42.98	0.42	0.85	17.88	43.17	63.3%	0.41	12.68	0.71
WL	9.59	41.05	0.38	0.80	15.77	41.23	60.5%	0.38	10.62	0.67
	9.64	37.37	0.37	0.75	13.85	37.54	55.0%	0.37	9.10	0.66
	9.69	36.25	0.33	0.70	12.01	36.41	53.4%	0.33	7.33	0.61
	9.74	35.46	0.29	0.65	10.22	35.62	52.2%	0.29	5.68	0.56
	9.79	33.43	0.25	0.60	8.49	33.58	49.2%	0.25	4.34	0.51
	9.84	31.62	0.22	0.55	6.86	31.75	46.5%	0.22	3.15	0.46
	9.89	28.76	0.19	0.50	5.35	28.87	42.3%	0.19	2.22	0.42
	9.94	24.90	0.16	0.45	3.99	24.99	36.6%	0.16	1.50	0.38
	9.99	18.95	0.15	0.40	2.89	19.02	27.9%	0.15	1.05	0.36
	10.04	14.19	0.15	0.35	2.07	14.25	20.9%	0.15	0.73	0.35
	10.09	10.51	0.14	0.30	1.45	10.55	15.5%	0.14	0.50	0.34
	10.14	7.08	0.14	0.25	1.01	7.10	10.4%	0.14	0.35	0.35
	10.19	5.41	0.13	0.20	0.71	5.43	8.0%	0.13	0.24	0.33
	10.24	4.61	0.10	0.15	0.46	4.63	6.8%	0.10	0.13	0.28
	10.29	3.81	0.07	0.10	0.25	3.82	5.6%	0.07	0.05	0.21
	10.34	2.79	0.03	0.05	0.08	2.79	4.1%	0.03	0.01	0.12
	10.39	0.26	0.00	0.00	0.00	0.26	0.4%	0.00	0.00	0.02

STREAM NAME: Elkhead Creek Lower
XS LOCATION: 0.1 mile above gage
XS NUMBER: 3

SUMMARY SHEET

MEASURED FLOW (Qm)=	11.08	cfs
CALCULATED FLOW (Qc)=	10.62	cfs
(Qm-Qc)/Qm * 100 =	4.2	%
MEASURED WATERLINE (WLm)=	9.60	ft
CALCULATED WATERLINE (WLc)=	9.59	ft
(WLm-WLc)/WLm * 100 =	0.1	%
MAX MEASURED DEPTH (Dm)=	0.80	ft
MAX CALCULATED DEPTH (Dc)=	0.80	ft
(Dm-Dc)/Dm * 100	-0.5	%
MEAN VELOCITY=	0.67	ft/sec
MANNING'S N=	0.247	
SLOPE=	0.045	ft/ft
.4 * Qm =	4.4	cfs
2.5 * Qm=	27.7	cfs

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

FLOW (CFS)	PERIOD
___________________	__________________
___________________	__________________
___________________	__________________
___________________	__________________

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

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

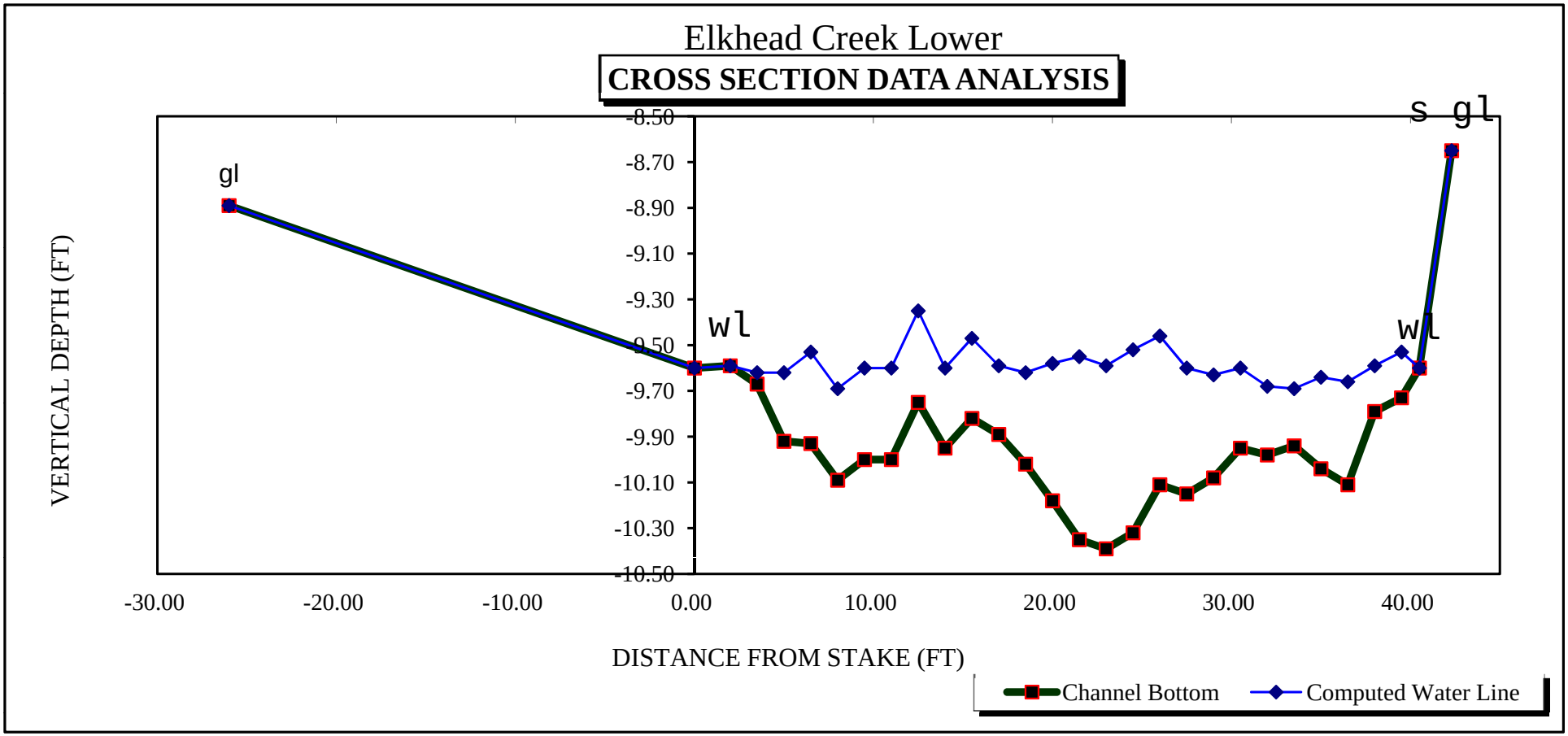
CWCB REVIEW BY: ..……………………………....……………………………………………………...…............. DATE:.................…………….....

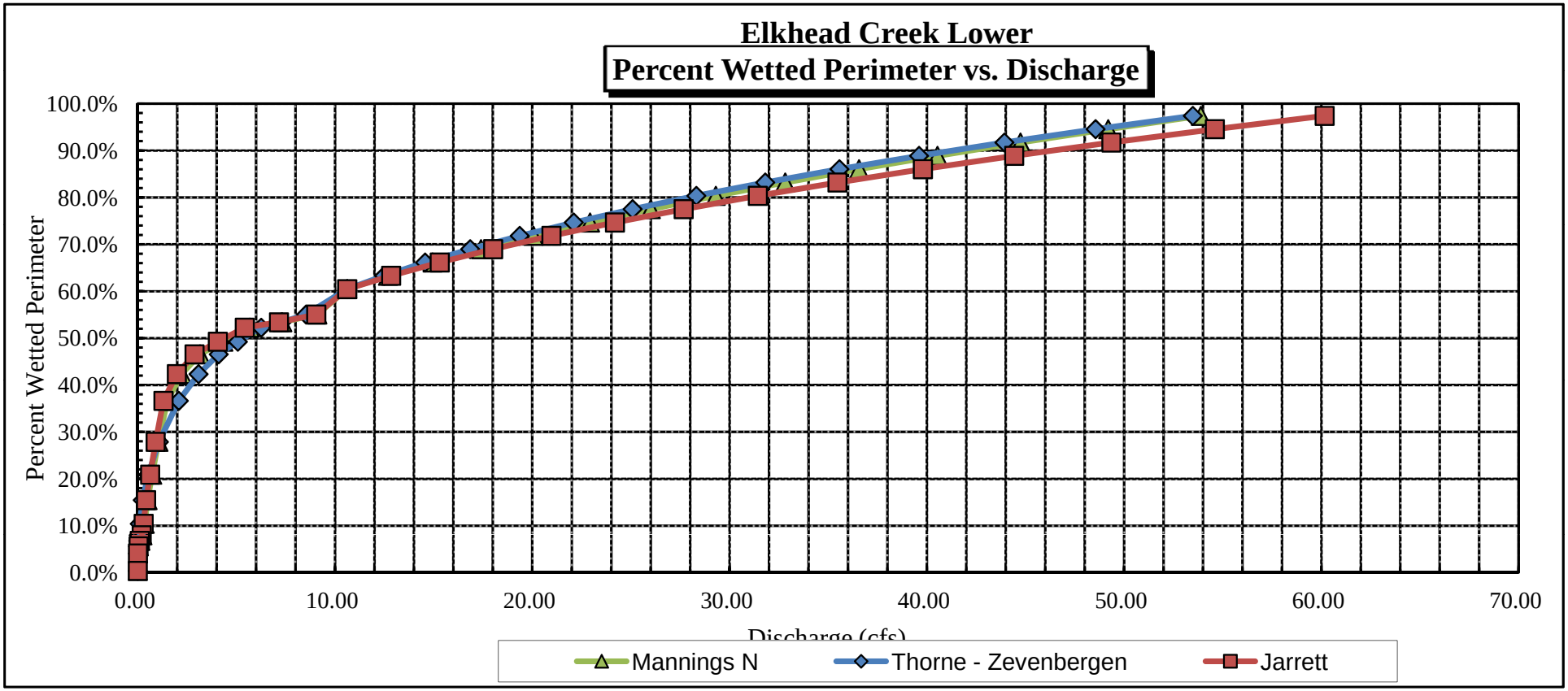
STREAM NAME: Elkhead Creek Lower
XS LOCATION: 0.1 mile above gage
XS NUMBER: 3

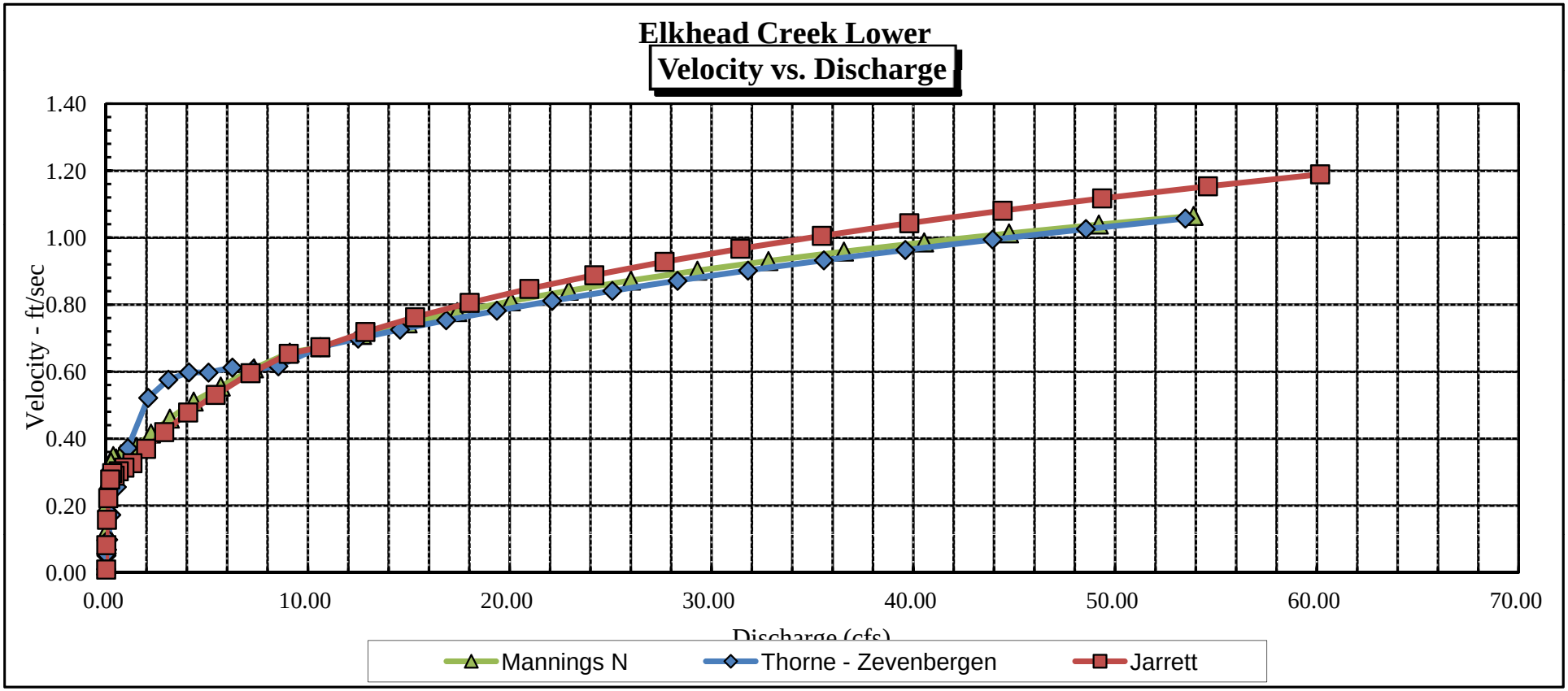
Jarrett Variable Manning's n Correction Applied

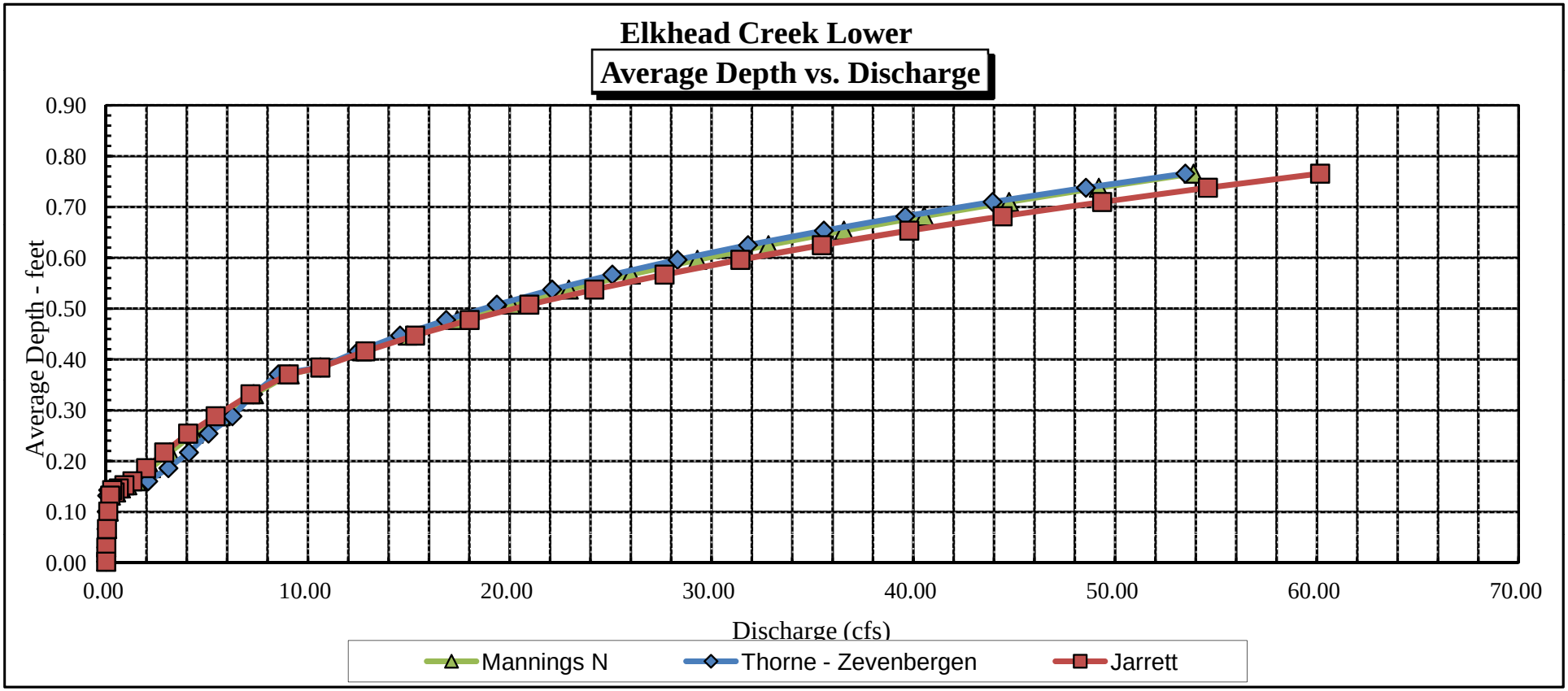
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

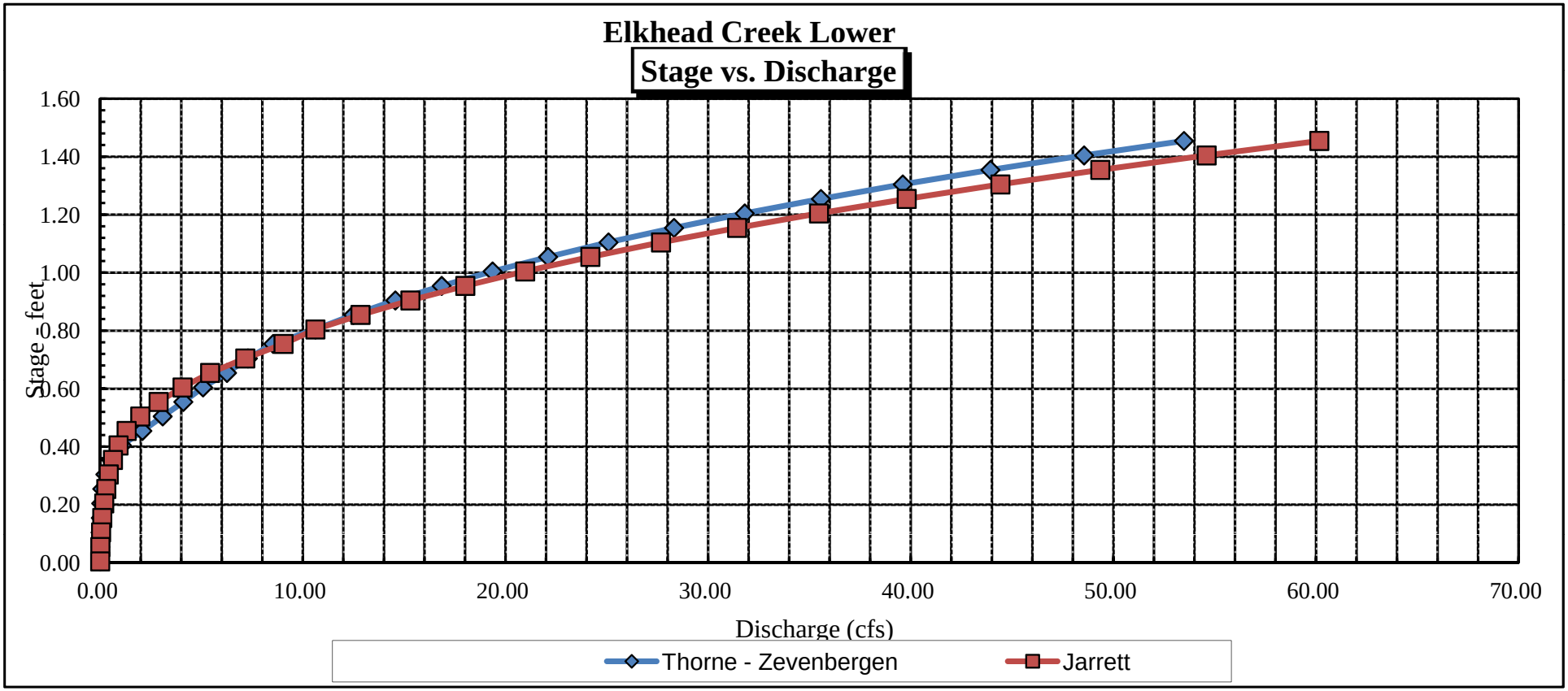
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	8.89	67.85	0.79	1.50	53.66	68.20	100.0%	0.79	65.53	1.22
	8.94	66.08	0.77	1.45	50.59	66.43	97.4%	0.76	60.16	1.19
	8.99	64.16	0.74	1.40	47.34	64.49	94.6%	0.73	54.60	1.15
	9.04	62.23	0.71	1.35	44.18	62.55	91.7%	0.71	49.36	1.12
	9.09	60.31	0.68	1.30	41.11	60.62	88.9%	0.68	44.42	1.08
	9.14	58.38	0.65	1.25	38.15	58.68	86.0%	0.65	39.80	1.04
	9.19	56.46	0.62	1.20	35.28	56.74	83.2%	0.62	35.47	1.01
	9.24	54.53	0.60	1.15	32.50	54.80	80.3%	0.59	31.43	0.97
	9.29	52.61	0.57	1.10	29.82	52.86	77.5%	0.56	27.67	0.93
	9.34	50.68	0.54	1.05	27.24	50.92	74.7%	0.53	24.19	0.89
	9.39	48.75	0.51	1.00	24.76	48.98	71.8%	0.51	20.97	0.85
	9.44	46.83	0.48	0.95	22.37	47.05	69.0%	0.48	18.01	0.81
	9.49	44.90	0.45	0.90	20.07	45.11	66.1%	0.45	15.31	0.76
	9.54	42.98	0.42	0.85	17.88	43.17	63.3%	0.41	12.84	0.72
WL	9.59	41.05	0.38	0.80	15.77	41.23	60.5%	0.38	10.62	0.67
	9.64	37.37	0.37	0.75	13.85	37.54	55.0%	0.37	9.05	0.65
	9.69	36.25	0.33	0.70	12.01	36.41	53.4%	0.33	7.16	0.60
	9.74	35.46	0.29	0.65	10.22	35.62	52.2%	0.29	5.42	0.53
	9.79	33.43	0.25	0.60	8.49	33.58	49.2%	0.25	4.06	0.48
	9.84	31.62	0.22	0.55	6.86	31.75	46.5%	0.22	2.88	0.42
	9.89	28.76	0.19	0.50	5.35	28.87	42.3%	0.19	1.98	0.37
	9.94	24.90	0.16	0.45	3.99	24.99	36.6%	0.16	1.30	0.33
	9.99	18.95	0.15	0.40	2.89	19.02	27.9%	0.15	0.91	0.31
	10.04	14.19	0.15	0.35	2.07	14.25	20.9%	0.15	0.63	0.30
	10.09	10.51	0.14	0.30	1.45	10.55	15.5%	0.14	0.42	0.29
	10.14	7.08	0.14	0.25	1.01	7.10	10.4%	0.14	0.30	0.30
	10.19	5.41	0.13	0.20	0.71	5.43	8.0%	0.13	0.20	0.28
	10.24	4.61	0.10	0.15	0.46	4.63	6.8%	0.10	0.10	0.22
	10.29	3.81	0.07	0.10	0.25	3.82	5.6%	0.07	0.04	0.16
	10.34	2.79	0.03	0.05	0.08	2.79	4.1%	0.03	0.01	0.08
	10.39	0.26	0.00	0.00	0.00	0.26	0.4%	0.00	0.00	0.01


Elkhead Creek Lower
CROSS SECTION DATA ANALYSIS
gl
wl
wl
s gl
-8.50
-8.70
-8.90
-9.10
-9.30
-9.50
-9.70
-9.90
-10.10
-10.30
-10.50
VERTICAL DEPTH (FT)
-30.00
-20.00
-10.00
0.00
10.00
20.00
30.00
40.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Elkhead Creek Lower
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
70.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Velocity vs. Discharge
Velocity - ft/sec
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Average Depth vs. Discharge
Average Depth - feet
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Stage vs. Discharge
Stage - feet
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
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:	Elkhead Creek Lower
XS LOCATION:	200 ft ab xs 5 Elkhear Ranch
XS NUMBER:	4
DATE:	27-Oct-15
OBSERVERS:	js rv sm
1/4 SEC:	0
SECTION:	0
TWP:	40 38 46.97
RANGE:	107 16 53.35
PM:	0
COUNTY:	0
WATERSHED:	0
DIVISION:	0
DOW CODE:	0
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

		*** NOTE ***
		Leave TAPE WT and TENSION
		at defaults for data collected
TAPE WT:	0.0106	with a survey level and rod
TENSION:	99999	

CHANNEL PROFILE DATA

SLOPE:	0.011

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

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

STREAM NAME: Elkhead Creek Lower
XS LOCATION: 200 ft ab xs 5 Elkhear Ranch
XS NUMBER: 4

DATA POINTS= 26

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 s gl	0.00	8.83			0.00		0.00	0.00	0.0%
	6.00	10.35			0.00		0.00	0.00	0.0%
	11.00	10.90			0.00		0.00	0.00	0.0%
wl	16.00	11.32	0.00	0.00	0.00		0.00	0.00	0.0%
	17.50	11.51	0.10	0.06	1.51	0.10	0.15	0.01	0.1%
	19.00	11.29	0.00	0.00	1.52		0.00	0.00	0.0%
	20.50	11.32	0.00	0.00	0.00		0.00	0.00	0.0%
	22.00	11.57	0.25	0.18	1.52	0.25	0.38	0.07	0.5%
	23.50	11.65	0.35	1.39	1.50	0.35	0.53	0.73	5.1%
	25.00	11.65	0.40	1.76	1.50	0.40	0.60	1.06	7.4%
	26.50	12.06	0.55	2.14	1.56	0.55	0.83	1.77	12.3%
	28.00	12.01	0.90	1.46	1.50	0.90	1.35	1.97	13.8%
	29.50	11.89	0.75	0.83	1.50	0.75	1.13	0.93	6.5%
	31.00	12.13	0.60	0.22	1.52	0.60	0.90	0.20	1.4%
	32.50	12.15	0.70	0.59	1.50	0.70	1.05	0.62	4.3%
	34.00	12.18	0.70	1.29	1.50	0.70	1.05	1.35	9.5%
	35.50	11.85	0.45	1.76	1.54	0.45	0.68	1.19	8.3%
	37.00	12.04	0.65	0.17	1.51	0.65	0.98	0.17	1.2%
	38.50	11.98	0.75	1.92	1.50	0.75	1.13	2.16	15.1%
	40.00	11.83	0.80	1.02	1.51	0.80	1.20	1.22	8.6%
	41.50	11.94	0.45	0.68	1.50	0.45	0.68	0.46	3.2%
	43.00	11.58	0.40	0.59	1.54	0.40	0.60	0.35	2.5%
	44.50	11.50	0.20	0.20	1.50	0.20	0.30	0.06	0.4%
wl	46.00	11.24	0.00	0.00	1.52		0.00	0.00	0.0%
	49.00	10.96			0.00		0.00	0.00	0.0%
1 s gl	54.70	8.89			0.00		0.00	0.00	0.0%
TOTALS ----------					28.76	0.9 (Max.)	13.50	14.32	100.0%

Manning's n = 0.0888
Hydraulic Radius= 0.46942356

STREAM NAME: Elkhead Creek Lower
XS LOCATION: 200 ft ab xs 5 Elkhear Ranch
XS NUMBER: 4

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	13.50	13.98	3.6%
11.06	13.50	22.07	63.5%
11.08	13.50	21.37	58.3%
11.10	13.50	20.68	53.2%
11.12	13.50	20.00	48.1%
11.14	13.50	19.33	43.2%
11.16	13.50	18.67	38.3%
11.18	13.50	18.01	33.4%
11.20	13.50	17.37	28.7%
11.22	13.50	16.73	24.0%
11.24	13.50	16.11	19.3%
11.26	13.50	15.49	14.7%
11.27	13.50	15.18	12.5%
11.28	13.50	14.88	10.2%
11.29	13.50	14.58	8.0%
11.30	13.50	14.28	5.8%
11.31	13.50	13.98	3.6%
11.32	13.50	13.70	1.5%
11.33	13.50	13.42	-0.6%
11.34	13.50	13.14	-2.6%
11.35	13.50	12.87	-4.7%
11.36	13.50	12.60	-6.7%
11.38	13.50	12.07	-10.6%
11.40	13.50	11.55	-14.5%
11.42	13.50	11.03	-18.3%
11.44	13.50	10.53	-22.0%
11.46	13.50	10.04	-25.6%
11.48	13.50	9.56	-29.2%
11.50	13.50	9.09	-32.6%
11.52	13.50	8.64	-36.0%
11.54	13.50	8.19	-39.3%
11.56	13.50	7.75	-42.6%

WATERLINE AT ZERO
AREA ERROR = 11.322

STREAM NAME: Elkhead Creek Lower
XS LOCATION: 200 ft ab xs 5 Elkhear Ranch
XS NUMBER: 4

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	8.89	54.46	2.26	3.29	122.93	55.33	100.0%	2.22	367.47	2.99
	10.32	44.87	1.15	1.86	51.80	45.30	81.9%	1.14	99.44	1.92
	10.37	44.42	1.12	1.81	49.57	44.84	81.0%	1.11	93.03	1.88
	10.42	43.83	1.08	1.76	47.36	44.24	79.9%	1.07	87.02	1.84
	10.47	43.23	1.05	1.71	45.18	43.63	78.9%	1.04	81.20	1.80
	10.52	42.64	1.01	1.66	43.04	43.03	77.8%	1.00	75.57	1.76
	10.57	42.05	0.97	1.61	40.92	42.42	76.7%	0.96	70.13	1.71
	10.62	41.46	0.94	1.56	38.83	41.82	75.6%	0.93	64.89	1.67
	10.67	40.86	0.90	1.51	36.77	41.22	74.5%	0.89	59.83	1.63
	10.72	40.27	0.86	1.46	34.75	40.61	73.4%	0.86	54.97	1.58
	10.77	39.68	0.83	1.41	32.75	40.01	72.3%	0.82	50.30	1.54
	10.82	39.09	0.79	1.36	30.78	39.41	71.2%	0.78	45.83	1.49
	10.87	38.50	0.75	1.31	28.84	38.80	70.1%	0.74	41.54	1.44
	10.92	37.84	0.71	1.26	26.93	38.14	68.9%	0.71	37.49	1.39
	10.97	37.01	0.68	1.21	25.06	37.30	67.4%	0.67	33.74	1.35
	11.02	35.88	0.65	1.16	23.23	36.16	65.4%	0.64	30.37	1.31
	11.07	34.75	0.62	1.11	21.47	35.03	63.3%	0.61	27.19	1.27
	11.12	33.62	0.59	1.06	19.76	33.89	61.3%	0.58	24.21	1.23
	11.17	32.49	0.56	1.01	18.11	32.76	59.2%	0.55	21.41	1.18
	11.22	31.36	0.53	0.96	16.51	31.62	57.1%	0.52	18.79	1.14
	11.27	30.38	0.49	0.91	14.97	30.64	55.4%	0.49	16.30	1.09
WL	11.32	27.78	0.49	0.86	13.50	28.03	50.7%	0.48	14.56	1.08
	11.37	26.45	0.46	0.81	12.14	26.69	48.2%	0.46	12.61	1.04
	11.42	25.13	0.43	0.76	10.85	25.35	45.8%	0.43	10.83	1.00
	11.47	23.80	0.40	0.71	9.63	24.01	43.4%	0.40	9.20	0.95
	11.52	22.37	0.38	0.66	8.48	22.56	40.8%	0.38	7.75	0.91
	11.57	21.11	0.35	0.61	7.39	21.29	38.5%	0.35	6.40	0.87
	11.62	19.85	0.32	0.56	6.37	20.03	36.2%	0.32	5.21	0.82
	11.67	17.54	0.31	0.51	5.43	17.70	32.0%	0.31	4.34	0.80
	11.72	17.14	0.27	0.46	4.57	17.30	31.3%	0.26	3.30	0.72
	11.77	16.75	0.22	0.41	3.72	16.90	30.5%	0.22	2.38	0.64
	11.82	16.36	0.18	0.36	2.89	16.49	29.8%	0.18	1.59	0.55
	11.87	14.70	0.14	0.31	2.11	14.81	26.8%	0.14	1.01	0.48
	11.92	11.90	0.12	0.26	1.44	11.98	21.7%	0.12	0.61	0.43
	11.97	9.34	0.10	0.21	0.91	9.40	17.0%	0.10	0.34	0.37
	12.02	6.25	0.08	0.16	0.51	6.29	11.4%	0.08	0.17	0.33
	12.07	3.85	0.07	0.11	0.28	3.87	7.0%	0.07	0.08	0.30
	12.12	3.31	0.03	0.06	0.10	3.32	6.0%	0.03	0.02	0.17
	12.17	0.43	0.00	0.01	0.00	0.43	0.8%	0.00	0.00	0.04

STREAM NAME: Elkhead Creek Lower
XS LOCATION: 200 ft ab xs 5 Elkhear Ranch
XS NUMBER: 4

SUMMARY SHEET

MEASURED FLOW (Qm)=	14.32	cfs
CALCULATED FLOW (Qc)=	14.56	cfs
(Qm-Qc)/Qm * 100 =	-1.7	%
MEASURED WATERLINE (WLm)=	11.31	ft
CALCULATED WATERLINE (WLc)=	11.32	ft
(WLm-WLc)/WLm * 100 =	-0.2	%
MAX MEASURED DEPTH (Dm)=	0.90	ft
MAX CALCULATED DEPTH (Dc)=	0.86	ft
(Dm-Dc)/Dm * 100	4.7	%
MEAN VELOCITY=	1.08	ft/sec
MANNING'S N=	0.089	
SLOPE=	0.011	ft/ft
.4 * Qm =	5.7	cfs
2.5 * Qm=	35.8	cfs

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

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

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

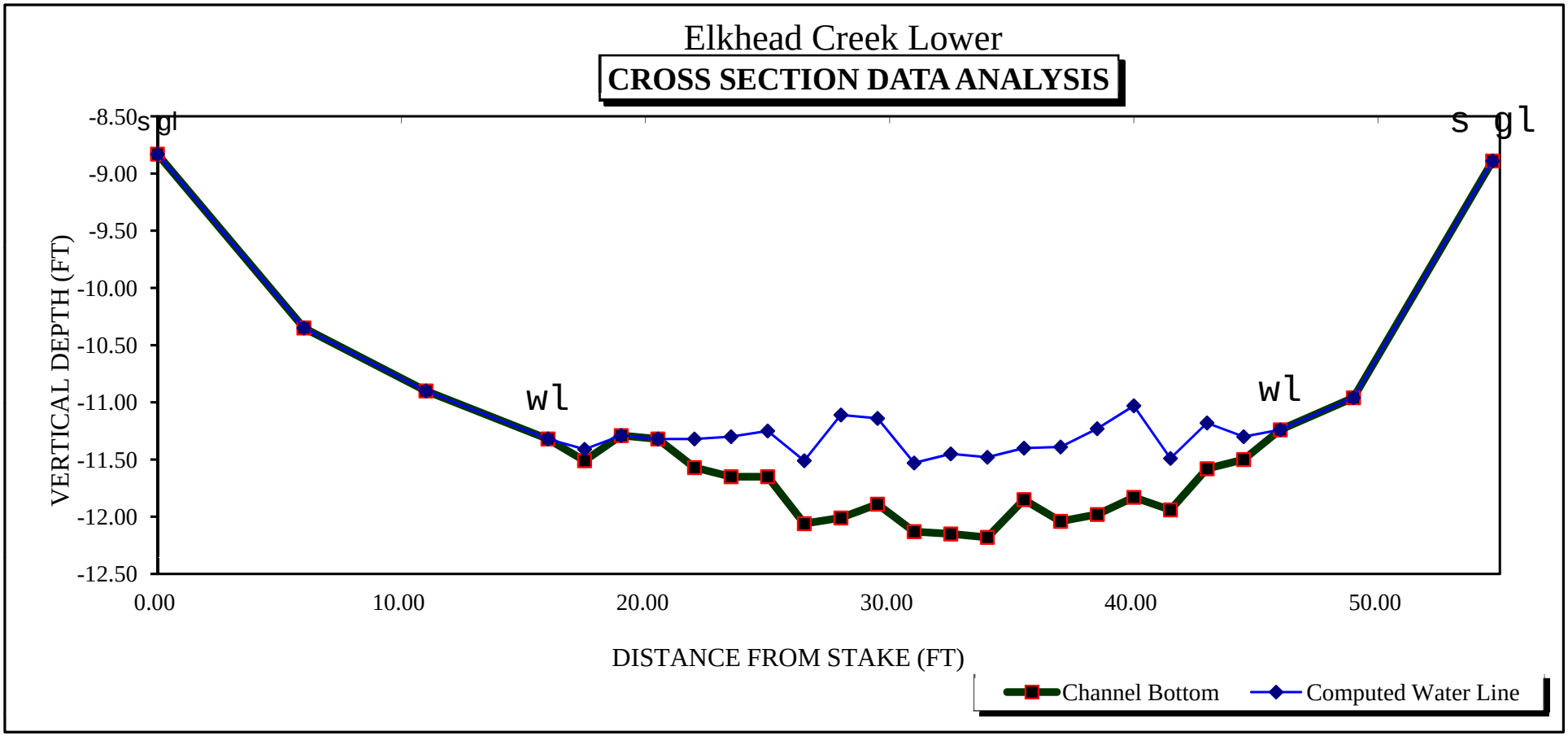
RECOMMENDATION BY: ……………………..………..……............................... AGENCY..……………………….....……...…...…..…....... DATE:......…...…......……………

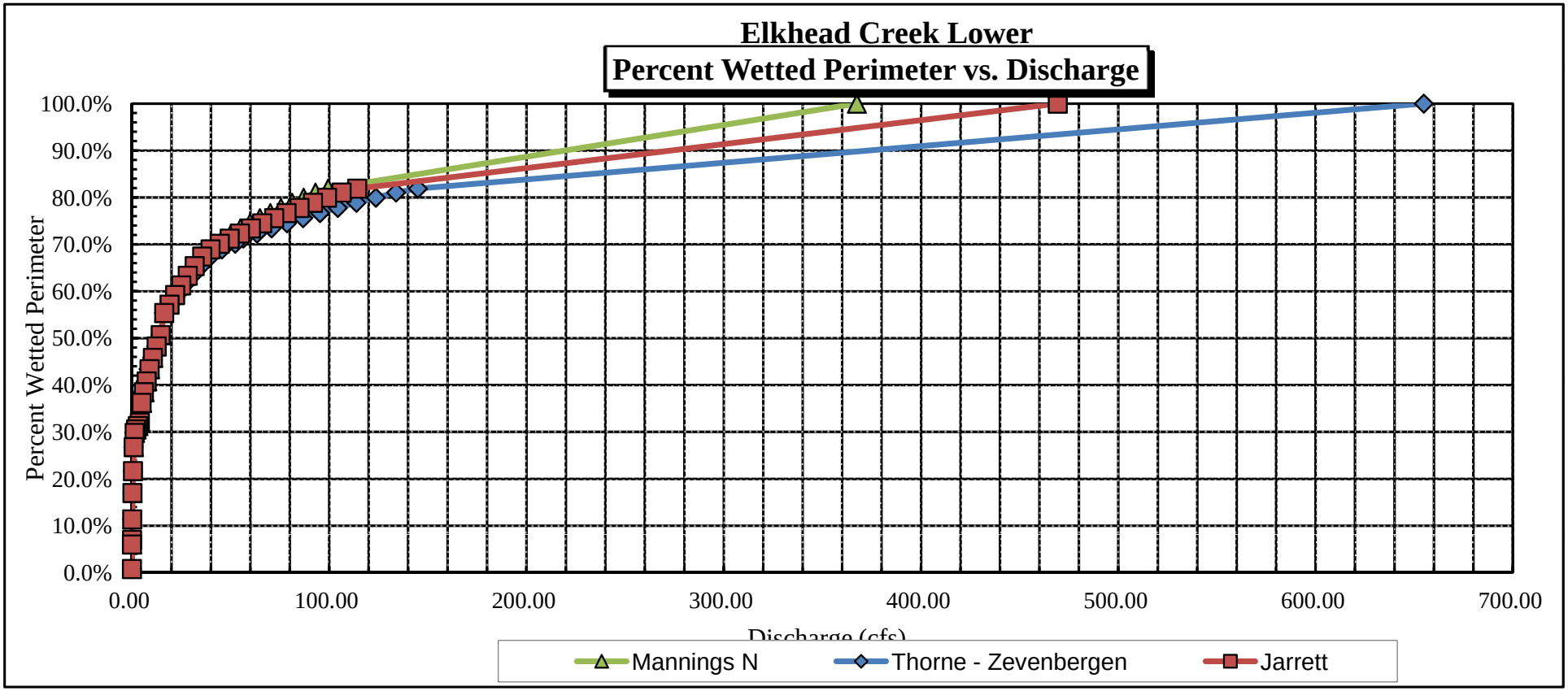
CWCB REVIEW BY: ..……………………………....……………………………………………………...….............. DATE:.................…………….....…

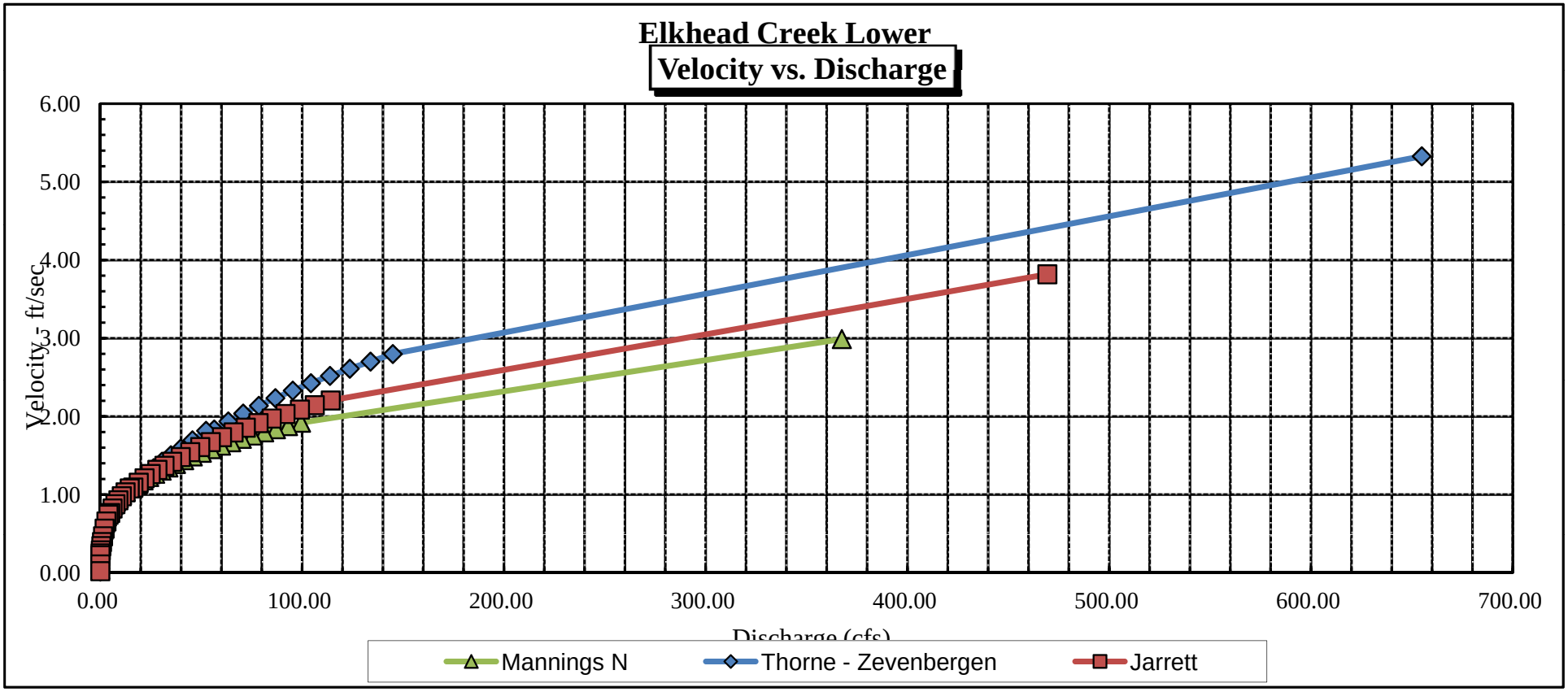
STREAM NAME: Elkhead Creek Lower
XS LOCATION: 200 ft ab xs 5 Elkhear Ranch
XS NUMBER: 4 Jarrett Variable Manning's n Correction Applied

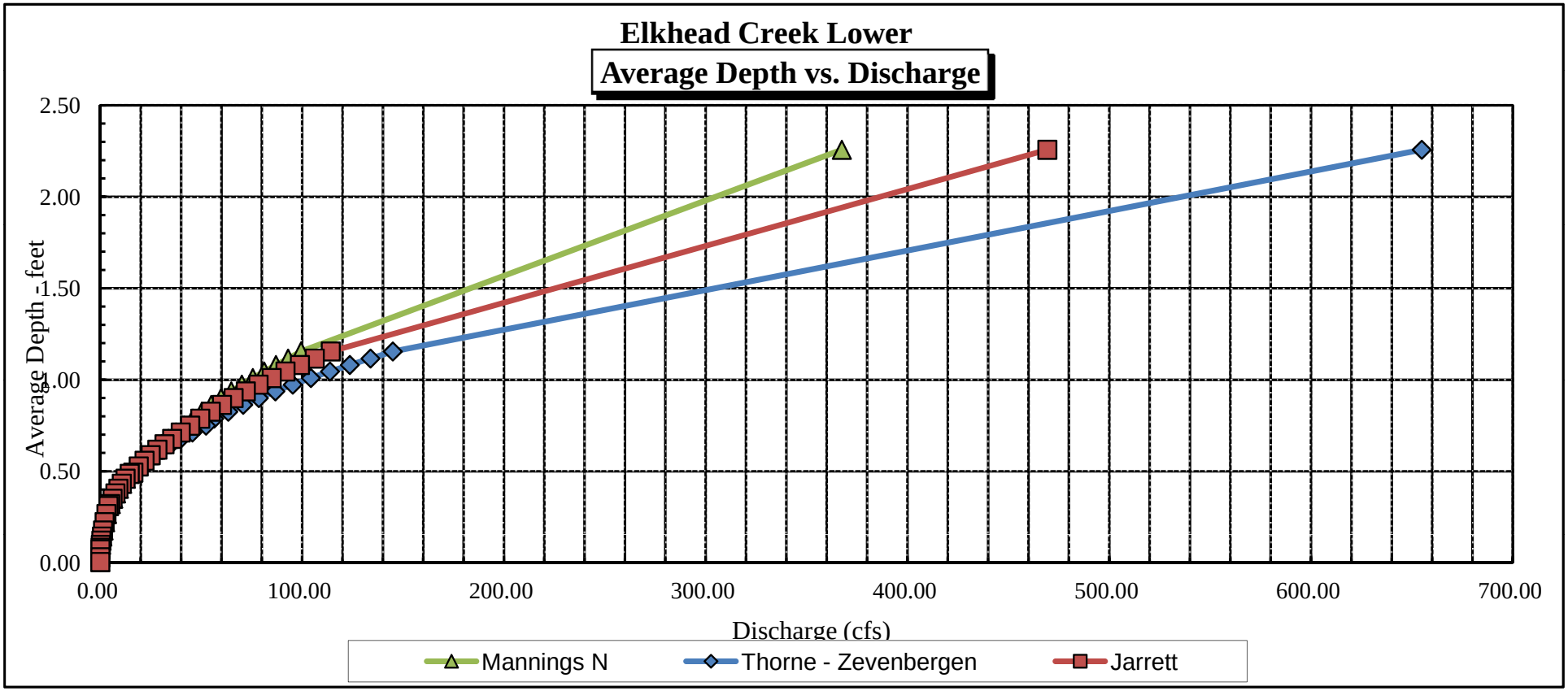
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

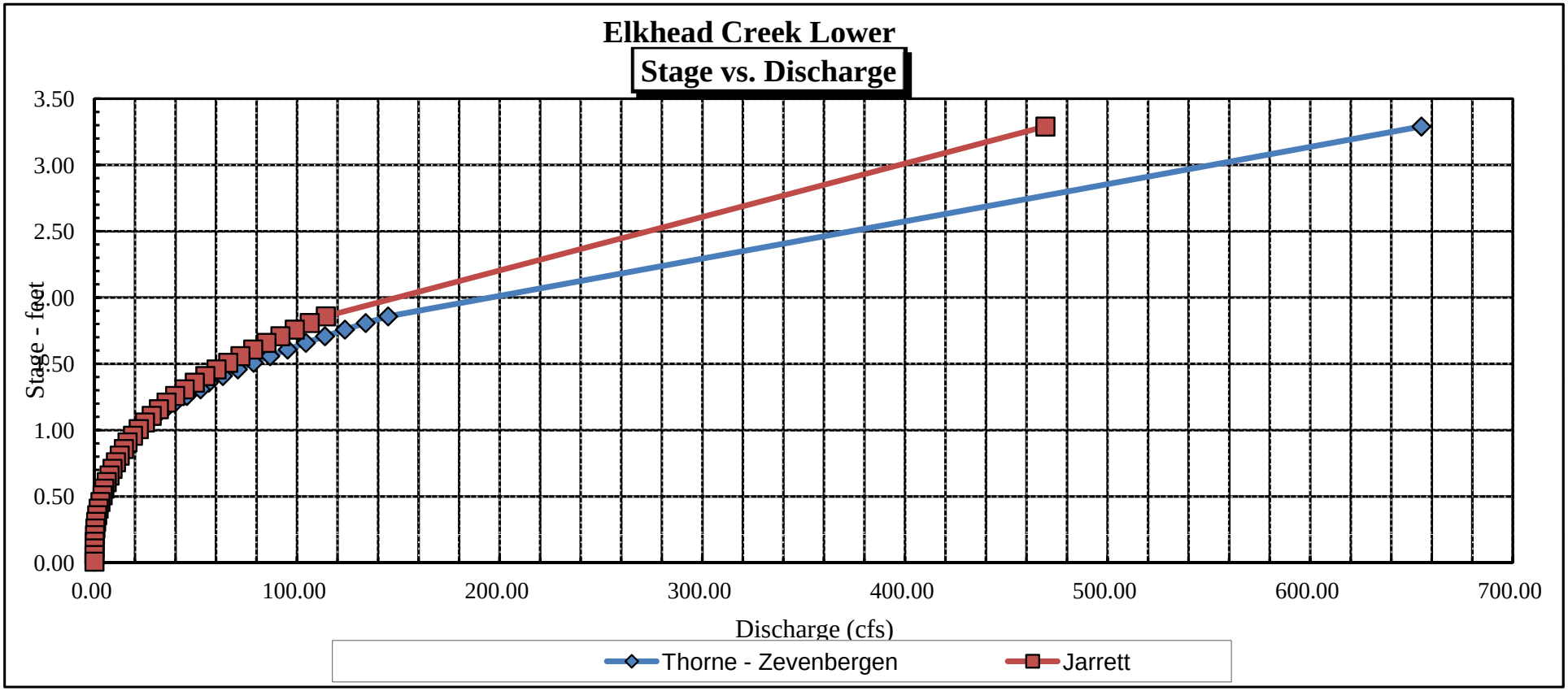
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	8.89	54.46	2.26	3.29	122.93	55.33	100.0%	2.22	469.31	3.82
	10.32	44.87	1.15	1.86	51.80	45.30	81.9%	1.14	114.19	2.20
	10.37	44.42	1.12	1.81	49.57	44.84	81.0%	1.11	106.26	2.14
	10.42	43.83	1.08	1.76	47.36	44.24	79.9%	1.07	98.88	2.09
	10.47	43.23	1.05	1.71	45.18	43.63	78.9%	1.04	91.77	2.03
	10.52	42.64	1.01	1.66	43.04	43.03	77.8%	1.00	84.94	1.97
	10.57	42.05	0.97	1.61	40.92	42.42	76.7%	0.96	78.37	1.92
	10.62	41.46	0.94	1.56	38.83	41.82	75.6%	0.93	72.07	1.86
	10.67	40.86	0.90	1.51	36.77	41.22	74.5%	0.89	66.04	1.80
	10.72	40.27	0.86	1.46	34.75	40.61	73.4%	0.86	60.26	1.73
	10.77	39.68	0.83	1.41	32.75	40.01	72.3%	0.82	54.76	1.67
	10.82	39.09	0.79	1.36	30.78	39.41	71.2%	0.78	49.51	1.61
	10.87	38.50	0.75	1.31	28.84	38.80	70.1%	0.74	44.52	1.54
	10.92	37.84	0.71	1.26	26.93	38.14	68.9%	0.71	39.85	1.48
	10.97	37.01	0.68	1.21	25.06	37.30	67.4%	0.67	35.58	1.42
	11.02	35.88	0.65	1.16	23.23	36.16	65.4%	0.64	31.80	1.37
	11.07	34.75	0.62	1.11	21.47	35.03	63.3%	0.61	28.26	1.32
	11.12	33.62	0.59	1.06	19.76	33.89	61.3%	0.58	24.96	1.26
	11.17	32.49	0.56	1.01	18.11	32.76	59.2%	0.55	21.89	1.21
	11.22	31.36	0.53	0.96	16.51	31.62	57.1%	0.52	19.04	1.15
	11.27	30.38	0.49	0.91	14.97	30.64	55.4%	0.49	16.33	1.09
WL	11.32	27.78	0.49	0.86	13.50	28.03	50.7%	0.48	14.56	1.08
	11.37	26.45	0.46	0.81	12.14	26.69	48.2%	0.46	12.50	1.03
	11.42	25.13	0.43	0.76	10.85	25.35	45.8%	0.43	10.62	0.98
	11.47	23.80	0.40	0.71	9.63	24.01	43.4%	0.40	8.93	0.93
	11.52	22.37	0.38	0.66	8.48	22.56	40.8%	0.38	7.44	0.88
	11.57	21.11	0.35	0.61	7.39	21.29	38.5%	0.35	6.08	0.82
	11.62	19.85	0.32	0.56	6.37	20.03	36.2%	0.32	4.87	0.77
	11.67	17.54	0.31	0.51	5.43	17.70	32.0%	0.31	4.04	0.74
	11.72	17.14	0.27	0.46	4.57	17.30	31.3%	0.26	2.99	0.66
	11.77	16.75	0.22	0.41	3.72	16.90	30.5%	0.22	2.10	0.56
	11.82	16.36	0.18	0.36	2.89	16.49	29.8%	0.18	1.35	0.47
	11.87	14.70	0.14	0.31	2.11	14.81	26.8%	0.14	0.83	0.39
	11.92	11.90	0.12	0.26	1.44	11.98	21.7%	0.12	0.49	0.34
	11.97	9.34	0.10	0.21	0.91	9.40	17.0%	0.10	0.26	0.29
	12.02	6.25	0.08	0.16	0.51	6.29	11.4%	0.08	0.13	0.25
	12.07	3.85	0.07	0.11	0.28	3.87	7.0%	0.07	0.06	0.22
	12.12	3.31	0.03	0.06	0.10	3.32	6.0%	0.03	0.01	0.11
	12.17	0.43	0.00	0.01	0.00	0.43	0.8%	0.00	0.00	0.02


Elkhead Creek Lower
CROSS SECTION DATA ANALYSIS
sgl
sgl
wl
wl
-8.50
-9.00
-9.50
-10.00
-10.50
-11.00
-11.50
-12.00
-12.50
VERTICAL DEPTH (FT)
0.00
10.00
20.00
30.00
40.00
50.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Elkhead Creek Lower
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
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Velocity vs. Discharge
Velocity - ft/sec
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Average Depth vs. Discharge
Average Depth - feet
2.50
2.00
1.50
1.00
0.50
0.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Stage vs. Discharge
Stage - feet
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
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:	Elkhead Creek Lower
XS LOCATION:	Above bridge on Elkhead Ranch
XS NUMBER:	5
DATE:	27-Oct-15
OBSERVERS:	js rv sm
1/4 SEC:	0
SECTION:	0
TWP:	40 38 47.46
RANGE:	107 16 51.7
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:	0.012

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

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

STREAM NAME: Elkhead Creek Lower
XS LOCATION: Above bridge on Elkhead Ranch
XS NUMBER: 5

DATA POINTS= 29

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1	s gl	0.00	8.03			0.00		0.00	0.00	0.0%
		4.00	9.08			0.00		0.00	0.00	0.0%
		6.50	9.72			0.00		0.00	0.00	0.0%
	wl	8.80	9.79	0.00	0.00	0.00		0.00	0.00	0.0%
		9.00	10.10	0.20	0.21	0.37	0.20	0.22	0.05	0.4%
		11.00	10.03	0.15	0.00	2.00	0.15	0.30	0.00	0.0%
		13.00	9.92	0.20	0.78	2.00	0.20	0.40	0.31	2.5%
		15.00	10.03	0.30	1.29	2.00	0.30	0.60	0.77	6.2%
		17.00	10.39	0.50	0.59	2.03	0.50	1.00	0.59	4.7%
		19.00	10.19	0.40	1.24	2.01	0.40	0.80	0.99	7.9%
		21.00	10.32	0.50	0.45	2.00	0.50	1.00	0.45	3.6%
		23.00	10.57	0.70	0.37	2.02	0.70	1.40	0.52	4.1%
		25.00	10.63	0.70	1.04	2.00	0.70	1.40	1.46	11.6%
		27.00	10.60	0.80	0.20	2.00	0.80	1.60	0.32	2.5%
		29.00	10.64	0.60	0.87	2.00	0.60	1.20	1.04	8.3%
		31.00	10.25	0.50	1.02	2.04	0.50	1.00	1.02	8.1%
		33.00	10.34	0.75	0.11	2.00	0.75	1.50	0.17	1.3%
		35.00	10.24	0.50	1.52	2.00	0.50	1.00	1.52	12.1%
		37.00	10.60	0.85	0.64	2.03	0.85	1.70	1.09	8.7%
		39.00	10.03	0.60	0.55	2.08	0.60	1.20	0.66	5.3%
		41.00	9.92	0.20	0.35	2.00	0.20	0.40	0.14	1.1%
		43.00	10.16	0.35	1.28	2.01	0.35	0.70	0.90	7.1%
		45.00	10.00	0.30	0.93	2.01	0.30	0.60	0.56	4.4%
		47.00	9.90	0.25	0.01	2.00	0.25	0.38	0.00	0.0%
	wl	48.00	9.80	0.00	0.00	1.00		0.00	0.00	0.0%
		49.80	9.24			0.00		0.00	0.00	0.0%
		53.00	8.38			0.00		0.00	0.00	0.0%
1	gl	55.50	7.98			0.00		0.00	0.00	0.0%
	s	57.50	7.40			0.00		0.00	0.00	0.0%
	TOTALS ----------					39.62	0.85	18.40	12.55	100.0%
							(Max.)			

Manning's n = 0.1430
Hydraulic Radius= 0.46422906

STREAM NAME: Elkhead Creek Lower
XS LOCATION: Above bridge on Elkhead Ranch
XS NUMBER: 5

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	18.40	17.60	-4.3%
9.55	18.40	28.04	52.4%
9.57	18.40	27.18	47.8%
9.59	18.40	26.33	43.1%
9.61	18.40	25.48	38.5%
9.63	18.40	24.63	33.9%
9.65	18.40	23.78	29.3%
9.67	18.40	22.93	24.7%
9.69	18.40	22.09	20.1%
9.71	18.40	21.25	15.5%
9.73	18.40	20.42	11.0%
9.75	18.40	19.59	6.5%
9.76	18.40	19.19	4.3%
9.77	18.40	18.78	2.1%
9.78	18.40	18.38	-0.1%
9.79	18.40	17.99	-2.2%
9.80	18.40	17.60	-4.3%
9.81	18.40	17.20	-6.5%
9.82	18.40	16.81	-8.6%
9.83	18.40	16.42	-10.7%
9.84	18.40	16.03	-12.8%
9.85	18.40	15.65	-14.9%
9.87	18.40	14.87	-19.1%
9.89	18.40	14.11	-23.3%
9.91	18.40	13.34	-27.5%
9.93	18.40	12.59	-31.6%
9.95	18.40	11.86	-35.5%
9.97	18.40	11.16	-39.3%
9.99	18.40	10.50	-42.9%
10.01	18.40	9.87	-46.3%
10.03	18.40	9.27	-49.6%
10.05	18.40	8.70	-52.7%

WATERLINE AT ZERO
AREA ERROR = 9.775

STREAM NAME: Elkhead Creek Lower
XS LOCATION: Above bridge on Elkhead Ranch
XS NUMBER: 5

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	8.03	55.19	1.85	2.61	101.84	56.06	100.0%	1.82	172.59	1.69
	8.77	48.69	1.30	1.87	63.33	49.39	88.1%	1.28	85.08	1.34
	8.82	48.32	1.26	1.82	60.90	49.00	87.4%	1.24	80.14	1.32
	8.87	47.94	1.22	1.77	58.50	48.61	86.7%	1.20	75.34	1.29
	8.92	47.56	1.18	1.72	56.11	48.22	86.0%	1.16	70.66	1.26
	8.97	47.19	1.14	1.67	53.74	47.83	85.3%	1.12	66.11	1.23
	9.02	46.81	1.10	1.62	51.39	47.44	84.6%	1.08	61.70	1.20
	9.07	46.43	1.06	1.57	49.06	47.05	83.9%	1.04	57.42	1.17
	9.12	46.05	1.02	1.52	46.75	46.66	83.2%	1.00	53.28	1.14
	9.17	45.67	0.97	1.47	44.45	46.26	82.5%	0.96	49.27	1.11
	9.22	45.29	0.93	1.42	42.18	45.87	81.8%	0.92	45.40	1.08
	9.27	44.93	0.89	1.37	39.93	45.49	81.1%	0.88	41.66	1.04
	9.32	44.57	0.85	1.32	37.69	45.12	80.5%	0.84	38.05	1.01
	9.37	44.22	0.80	1.27	35.47	44.75	79.8%	0.79	34.58	0.97
	9.42	43.86	0.76	1.22	33.27	44.38	79.2%	0.75	31.25	0.94
	9.47	43.50	0.71	1.17	31.08	44.01	78.5%	0.71	28.06	0.90
	9.52	43.15	0.67	1.12	28.92	43.64	77.9%	0.66	25.02	0.87
	9.57	42.79	0.63	1.07	26.77	43.27	77.2%	0.62	22.12	0.83
	9.62	42.44	0.58	1.02	24.64	42.90	76.5%	0.57	19.37	0.79
	9.67	42.08	0.54	0.97	22.52	42.53	75.9%	0.53	16.78	0.75
	9.72	41.59	0.49	0.92	20.43	42.02	75.0%	0.49	14.38	0.70
WL	9.77	39.78	0.46	0.87	18.39	40.21	71.7%	0.46	12.43	0.68
	9.82	38.93	0.42	0.82	16.43	39.33	70.2%	0.42	10.45	0.64
	9.87	38.40	0.38	0.77	14.50	38.77	69.2%	0.37	8.57	0.59
	9.92	37.32	0.34	0.72	12.60	37.67	67.2%	0.33	6.91	0.55
	9.97	33.15	0.33	0.67	10.84	33.46	59.7%	0.32	5.82	0.54
	10.02	29.15	0.32	0.62	9.28	29.43	52.5%	0.32	4.89	0.53
	10.07	26.11	0.30	0.57	7.90	26.34	47.0%	0.30	4.03	0.51
	10.12	23.88	0.28	0.52	6.66	24.08	42.9%	0.28	3.22	0.48
	10.17	22.69	0.24	0.47	5.50	22.87	40.8%	0.24	2.42	0.44
	10.22	21.35	0.21	0.42	4.39	21.52	38.4%	0.20	1.73	0.39
	10.27	18.07	0.19	0.37	3.39	18.22	32.5%	0.19	1.26	0.37
	10.32	13.74	0.19	0.32	2.60	13.86	24.7%	0.19	0.97	0.37
	10.37	11.20	0.18	0.27	1.99	11.30	20.2%	0.18	0.71	0.36
	10.42	9.86	0.15	0.22	1.46	9.93	17.7%	0.15	0.47	0.32
	10.47	8.75	0.11	0.17	1.00	8.80	15.7%	0.11	0.27	0.27
	10.52	7.64	0.08	0.12	0.59	7.67	13.7%	0.08	0.12	0.21
	10.57	6.41	0.04	0.07	0.24	6.42	11.5%	0.04	0.03	0.13
	10.62	1.37	0.01	0.02	0.01	1.37	2.5%	0.01	0.00	0.04

STREAM NAME: Elkhead Creek Lower
XS LOCATION: Above bridge on Elkhead Ranch
XS NUMBER: 5

SUMMARY SHEET

MEASURED FLOW (Qm)=	12.55	cfs
CALCULATED FLOW (Qc)=	12.43	cfs
(Qm-Qc)/Qm * 100 =	1.0	%
MEASURED WATERLINE (WLm)=	9.80	ft
CALCULATED WATERLINE (WLc)=	9.77	ft
(WLm-WLc)/WLm * 100 =	0.2	%
MAX MEASURED DEPTH (Dm)=	0.85	ft
MAX CALCULATED DEPTH (Dc)=	0.87	ft
(Dm-Dc)/Dm * 100	-1.8	%
MEAN VELOCITY=	0.68	ft/sec
MANNING'S N=	0.143	
SLOPE=	0.012	ft/ft
.4 * Qm =	5.0	cfs
2.5 * Qm=	31.4	cfs

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

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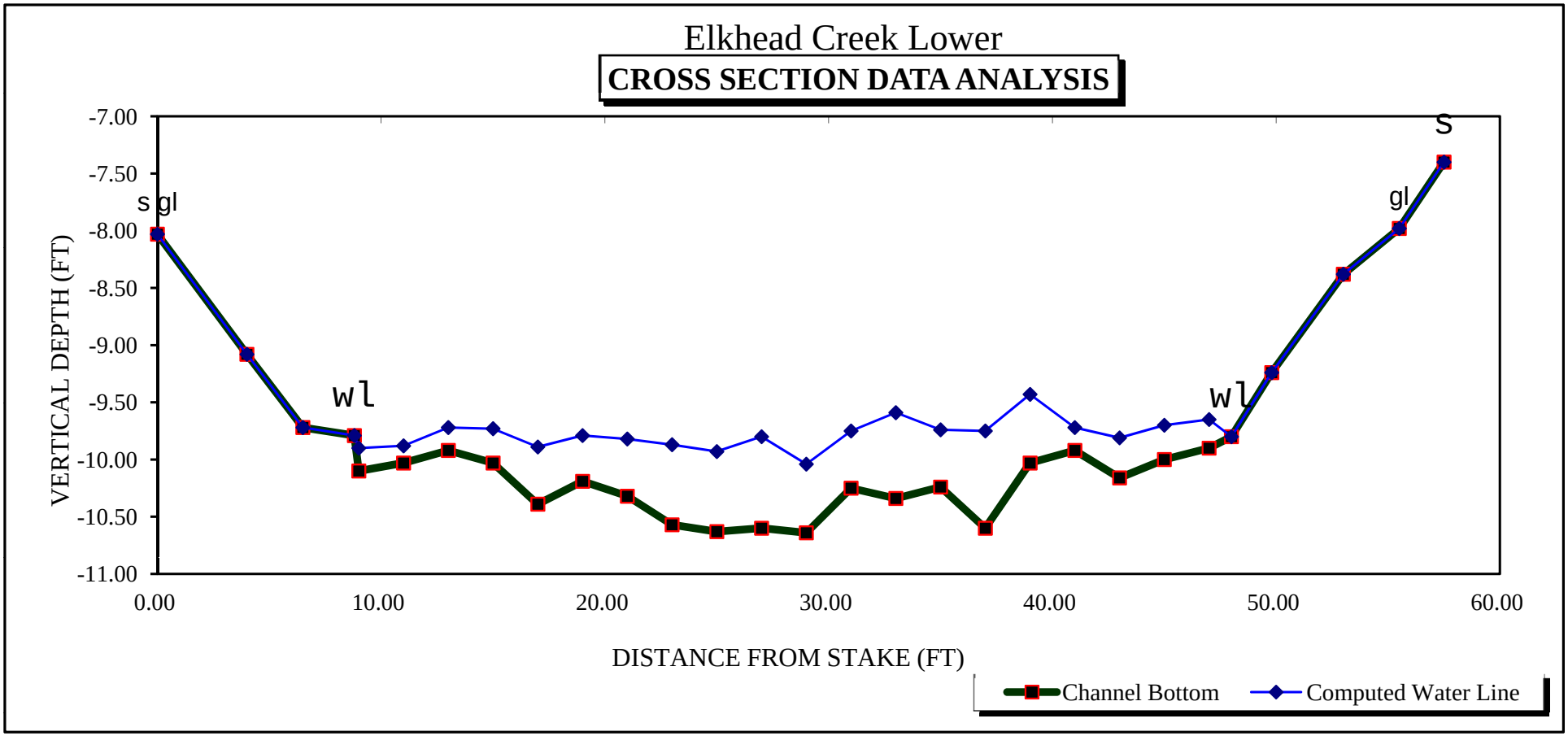
RECOMMENDATION BY: ……………………..………..……............................... AGENCY..……………………….....……...…...…….…...... DATE:.......…..…......……………

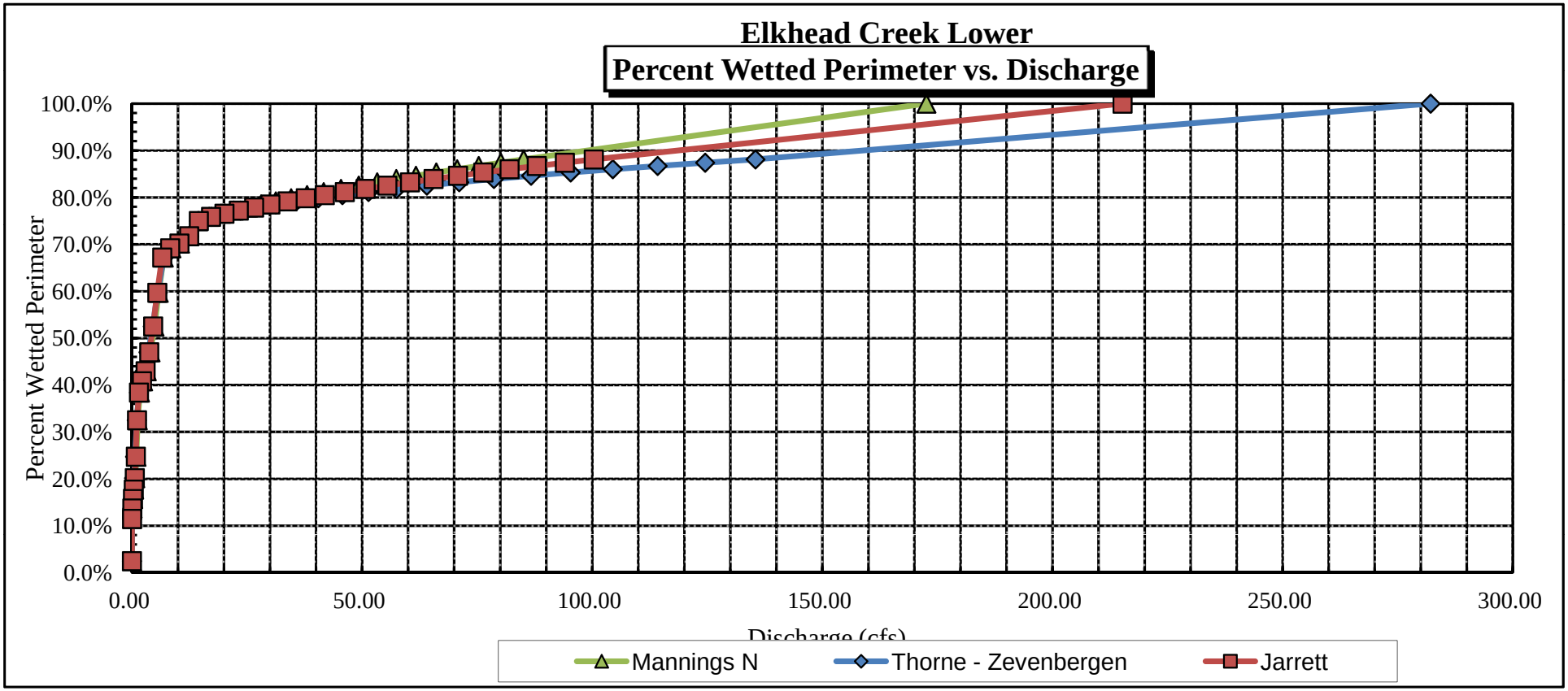
CWCB REVIEW BY: ..……………………………....………………………………………………….......................................…............. DATE:.................…………….....

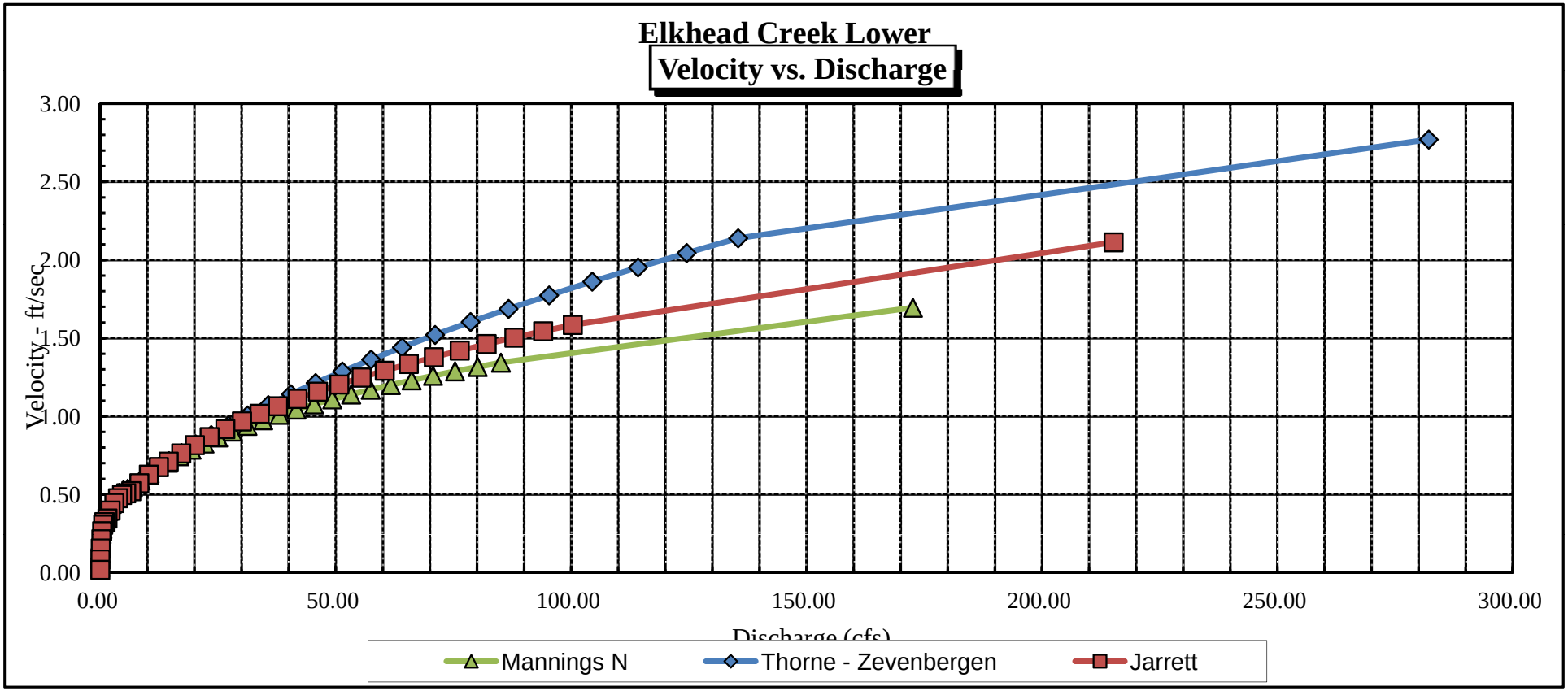
STREAM NAME: Elkhead Creek Lower
XS LOCATION: Above bridge on Elkhead Ranch
XS NUMBER: 5 Jarrett Variable Manning's n Correction Applied

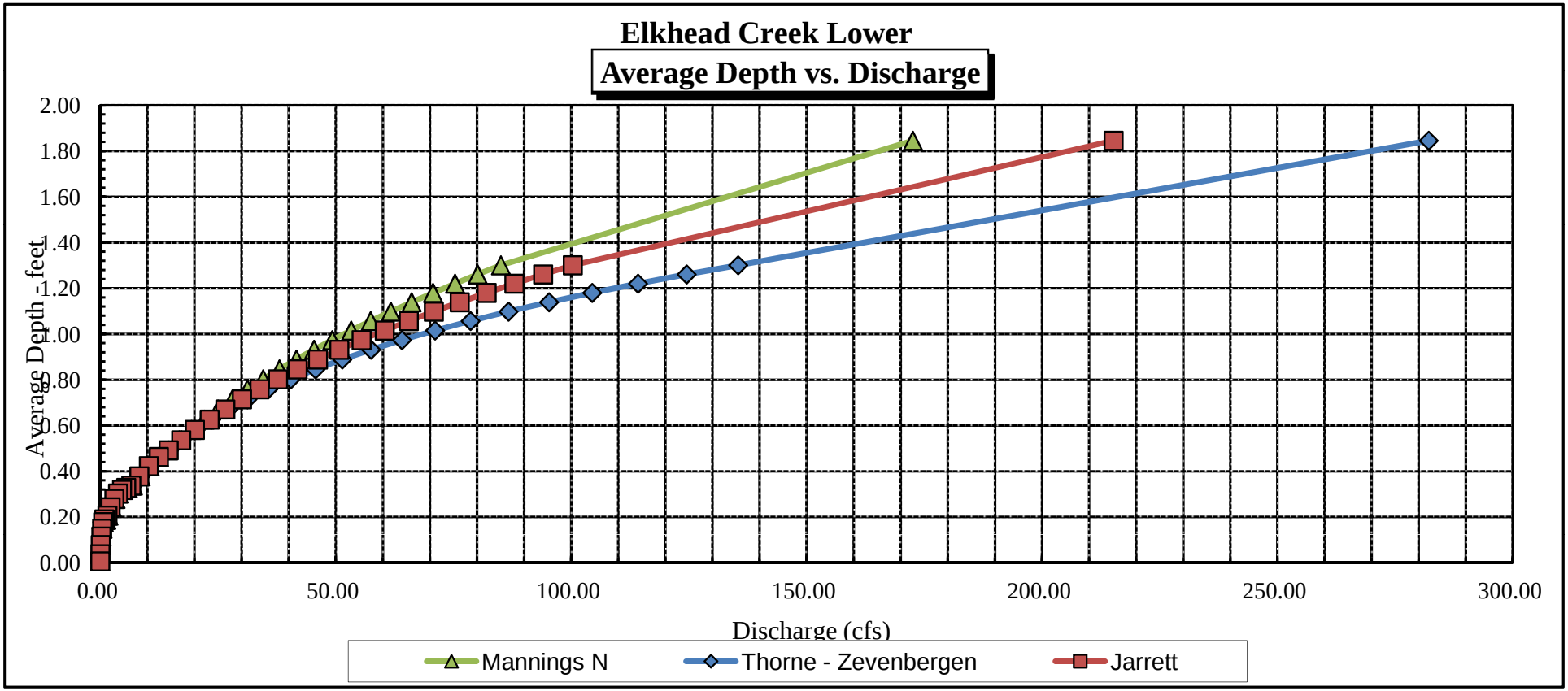
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

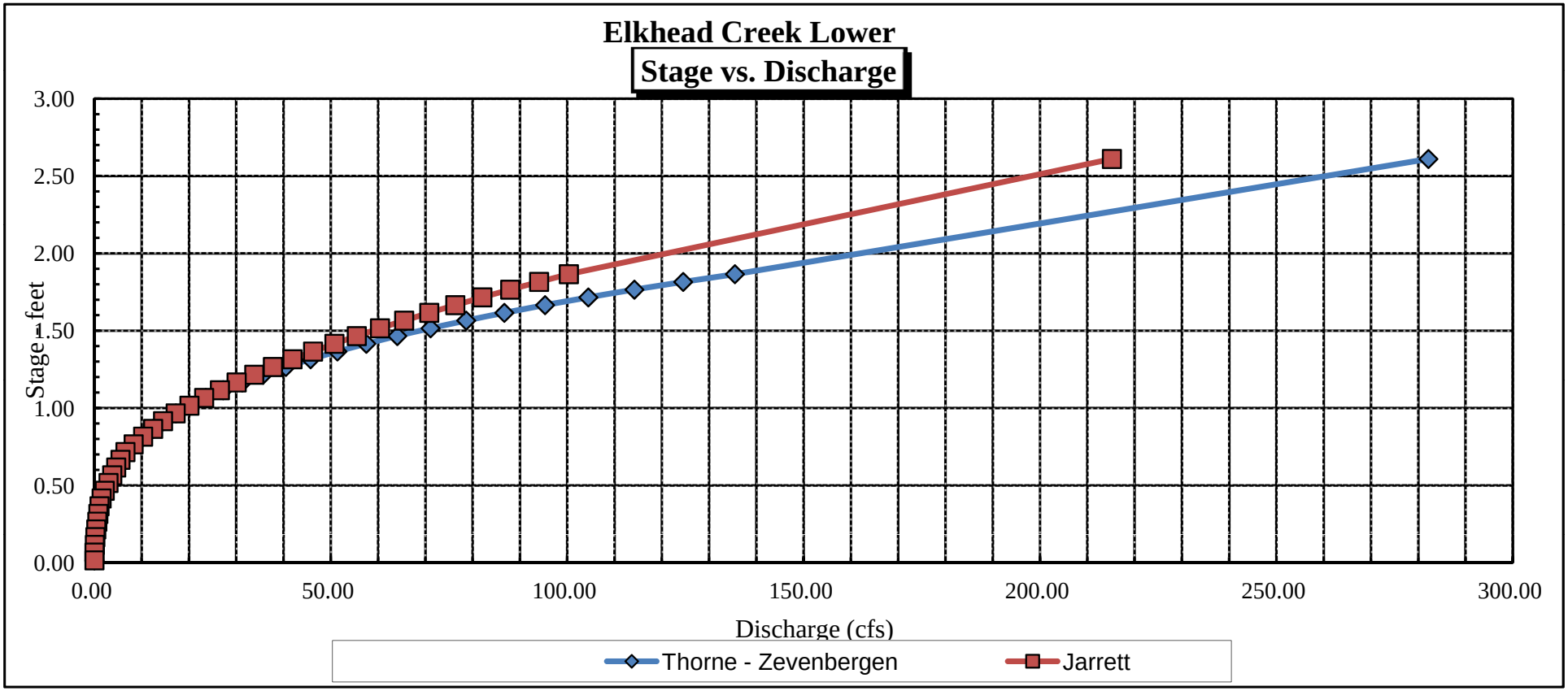
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	8.03	55.19	1.85	2.61	101.84	56.06	100.0%	1.82	215.20	2.11
	8.77	48.69	1.30	1.87	63.33	49.39	88.1%	1.28	100.34	1.58
	8.82	48.32	1.26	1.82	60.90	49.00	87.4%	1.24	94.04	1.54
	8.87	47.94	1.22	1.77	58.50	48.61	86.7%	1.20	87.95	1.50
	8.92	47.56	1.18	1.72	56.11	48.22	86.0%	1.16	82.04	1.46
	8.97	47.19	1.14	1.67	53.74	47.83	85.3%	1.12	76.34	1.42
	9.02	46.81	1.10	1.62	51.39	47.44	84.6%	1.08	70.83	1.38
	9.07	46.43	1.06	1.57	49.06	47.05	83.9%	1.04	65.51	1.34
	9.12	46.05	1.02	1.52	46.75	46.66	83.2%	1.00	60.40	1.29
	9.17	45.67	0.97	1.47	44.45	46.26	82.5%	0.96	55.49	1.25
	9.22	45.29	0.93	1.42	42.18	45.87	81.8%	0.92	50.77	1.20
	9.27	44.93	0.89	1.37	39.93	45.49	81.1%	0.88	46.24	1.16
	9.32	44.57	0.85	1.32	37.69	45.12	80.5%	0.84	41.90	1.11
	9.37	44.22	0.80	1.27	35.47	44.75	79.8%	0.79	37.75	1.06
	9.42	43.86	0.76	1.22	33.27	44.38	79.2%	0.75	33.81	1.02
	9.47	43.50	0.71	1.17	31.08	44.01	78.5%	0.71	30.08	0.97
	9.52	43.15	0.67	1.12	28.92	43.64	77.9%	0.66	26.54	0.92
	9.57	42.79	0.63	1.07	26.77	43.27	77.2%	0.62	23.21	0.87
	9.62	42.44	0.58	1.02	24.64	42.90	76.5%	0.57	20.09	0.82
	9.67	42.08	0.54	0.97	22.52	42.53	75.9%	0.53	17.18	0.76
	9.72	41.59	0.49	0.92	20.43	42.02	75.0%	0.49	14.52	0.71
WL	9.77	39.78	0.46	0.87	18.39	40.21	71.7%	0.46	12.43	0.68
	9.82	38.93	0.42	0.82	16.43	39.33	70.2%	0.42	10.30	0.63
	9.87	38.40	0.38	0.77	14.50	38.77	69.2%	0.37	8.30	0.57
	9.92	37.32	0.34	0.72	12.60	37.67	67.2%	0.33	6.57	0.52
	9.97	33.15	0.33	0.67	10.84	33.46	59.7%	0.32	5.50	0.51
	10.02	29.15	0.32	0.62	9.28	29.43	52.5%	0.32	4.61	0.50
	10.07	26.11	0.30	0.57	7.90	26.34	47.0%	0.30	3.77	0.48
	10.12	23.88	0.28	0.52	6.66	24.08	42.9%	0.28	2.97	0.45
	10.17	22.69	0.24	0.47	5.50	22.87	40.8%	0.24	2.19	0.40
	10.22	21.35	0.21	0.42	4.39	21.52	38.4%	0.20	1.52	0.35
	10.27	18.07	0.19	0.37	3.39	18.22	32.5%	0.19	1.09	0.32
	10.32	13.74	0.19	0.32	2.60	13.86	24.7%	0.19	0.84	0.32
	10.37	11.20	0.18	0.27	1.99	11.30	20.2%	0.18	0.61	0.31
	10.42	9.86	0.15	0.22	1.46	9.93	17.7%	0.15	0.39	0.27
	10.47	8.75	0.11	0.17	1.00	8.80	15.7%	0.11	0.21	0.21
	10.52	7.64	0.08	0.12	0.59	7.67	13.7%	0.08	0.09	0.15
	10.57	6.41	0.04	0.07	0.24	6.42	11.5%	0.04	0.02	0.08
	10.62	1.37	0.01	0.02	0.01	1.37	2.5%	0.01	0.00	0.02


Elkhead Creek Lower
CROSS SECTION DATA ANALYSIS
-7.00
-7.50
-8.00
-8.50
-9.00
-9.50
-10.00
-10.50
-11.00
VERTICAL DEPTH (FT)
s gl
wl
wl
gl
s
0.00
10.00
20.00
30.00
40.00
50.00
60.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Elkhead Creek Lower
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
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Velocity vs. Discharge
Velocity - ft/sec
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Average Depth vs. Discharge
Average Depth - feet
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Elkhead Creek Lower
Stage vs. Discharge
Stage - feet
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Elkhead creek #1						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: Just below Bridge						
40 35 29.36 107 19 16.52						
DATE: 10/27/15	OBSERVERS: Jay Skinner, R. Viehl, Sam May					
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:	
COUNTY:	WATERSHED: Elkhead Creek		WATER DIVISION: 6		DOW WATER CODE:	
MAP(S):	USGS:					
	USFS:					

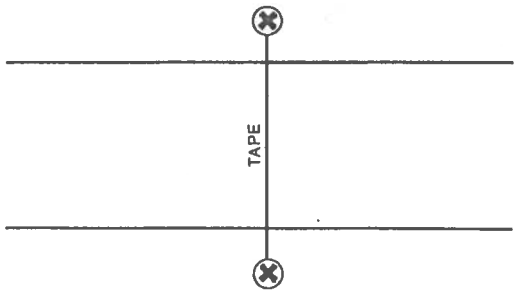
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: Marsh McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE:		PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS:	

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	10.85
⊗ Tape @ Stake RB	0.0	10.95
① WS @ Tape LB/RB	0.0	
② WS Upstream	6 Ft	10.81
③ WS Downstream	47 Ft	11.71
SLOPE	0.9 / 53 = 0.017	

SKETCH



LEGEND:
- Stake ⊗
- Station ①
- Photo ◇①→
- Direction of Flow ← →

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO	DISTANCE ELECTROFISHED: _____ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: YES/NO

LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

FORM #ISF ED 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE:	SHEET ___ OF ___

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 11.24 AM

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
S	0.5			9.2							
	2			9.6							
	4			9.45							
	4.5			10.47							
	5.5			10.79							
WL	6.5			10.35	0						
	8.0			11.17	0.25		1.15				
	10			10.99	0.15		1.18				
	12			11.15	0.35		1.00				
	14			11.15	0.30		1.08				
	16			11.25	0.45		1.11				
	18			11.33	0.50		0.50				
	20			11.01	0.40		0.92				
	22			11.23	0.35		0.44				
	24			11.26	0.40		0.57				
	26			11.14	0.50		0.70				
	28			11.19	0.35		0.07				
	30			11.08	0.20		0.23				
	32			11.10	0.20		0.37				
	34			11.14	0.20		0.92				
	36			11.21	0.30		0.44				
	38			11.35	0.40		0.62				
	40			11.20	0.40		1.02				
	42			11.30	0.35		0.48				
	44			11.21	0.20		0.00				
	46			11.32	0.40		0.72				
	48			11.29	0.40		0.86				
	50			11.30	0.35		0.41				
	52			11.19	0.45		0.98				
	54			11.05	0.20		0.42				
WL	55				0						
	57.5			10.58							
GL	59.5			9.97							
S	63.5			8.76							
TOTALS:											

End of Measurement	Time:	Gage Reading: _____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Elkhead Creek					CROSS-SECTION NO.: 3
CROSS-SECTION LOCATION: ½ mile u/s of Bridge					
DATE:	OBSERVERS: J. Skinner, R. Viehl, S. May				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED:	WATER DIVISION: 6	DOW WATER CODE:		
MAP(S): USGS: 40.35 27.94					
USFS: 107 19 6.15					

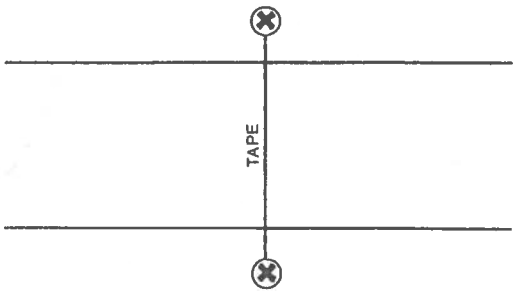
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE:			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	8.98
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	
② WS Upstream	9	9.60
③ WS Downstream	4	10.18
SLOPE	0.58 / 13 = 0.045	

SKETCH



LEGEND:
Stake ⊗
Station ①
Photo ①→
Direction of Flow ← →

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO	DISTANCE ELECTROFISHED: _____ ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: YES/NO

LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE:	SHEET ___ OF ___

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME:

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
GL	-26.0		8.89								
			9.60								
W	2.0		9.59								
	3.5		9.67		0.05			0			
	5.0		9.92		0.3			.096			
	6.5		9.93		0.4			1.27			
	8.0		10.09		0.4			1.14			
	9.5		10.00		0.4			1.14			
	11.0		10.00		0.4			1.07			
	12.5		9.75		0.4			0.83			
	14.0		9.95		0.35			0.86			
	15.5		9.82		0.35			0.49			
	17.0		9.89		0.30			0.58			
	18.5		10.02		0.40			0.30			
	20.0		10.18		0.60			0.57			
	21.5		10.35		0.80			0.68			
	23.0		10.39		0.80			0.69			
	24.5		10.32		0.80			0.74			
	26.0		10.11		0.65			0.59			
	27.5		10.15		0.55			0.68			
	29.0		10.08		0.45			0.69			
	30.5		9.95		0.35			0.39			
	32.0		9.98		0.30			0.50			
	33.5		9.94		0.25			0.67			
	35.0		10.04		0.40			0.45			
	36.5		10.11		0.45			0.86			
	38.0		9.79		0.20			0.11			
	39.5		9.73		.20			0.07			
WL	40.5		9.60								
SGL	42.3		9.65								
TOTALS:											

End of Measurement	Time: 142	Gage Reading: _____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Elkhead Creek					CROSS-SECTION NO.: 4
CROSS-SECTION LOCATION: ~200 Feet above Cross X 4 5					
DATE:	OBSERVERS: J. SKINNER S. May R. Viehl				
LEGAL DESCRIPTION	¼ SECTION:	SECTION: 1	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED:	WATER DIVISION: 6	DOW WATER CODE:		
MAP(S): USGS: 40 38 46.79					
USFS: 107 16 53.35					

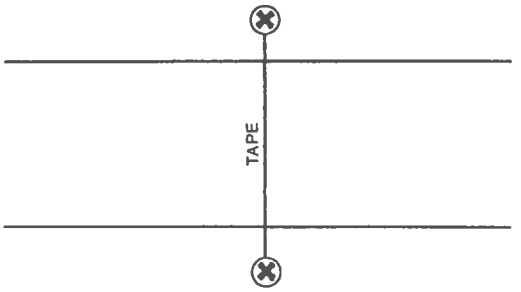
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE:			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	
② WS Upstream	21.0 ft	10.95
③ WS Downstream	25.0 ft	11.44
SLOPE	0.49 / 46 = 0.011	

SKETCH



LEGEND:
- Stake ⊗
- Station ①
- Photo ①→
- Direction of Flow ← →

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO	DISTANCE ELECTROFISHED: _____ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: YES/NO

LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE:	SHEET ___ OF ___

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME:

Features (Stake (S), Grassline (G), Waterline (W), Rock (R))	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
SG	0		8.83								
	6		10.35								
	11		10.90								
WL	16		11.32		0						
	17.5		11.51		.10			0.06			
	19.0		11.29		0			0			
	20.5		11.32		0			0			
	22.0		11.57		.25			0.18			
	23.5		11.65		0.35			1.39			
	25.0		11.65		0.40			1.76			
	26.5		12.06		0.55			2.14			
	28.0		12.01		0.90			1.46			
	29.5		11.89		0.75			0.83			
	31.0		12.13		0.60			0.22			
	32.5		12.15		0.70			0.59			
	34.0		12.18		0.70			1.29			
	35.5		11.85		0.45			1.76			
	37.0		12.04		0.65			0.17			
	38.5		11.99		0.75			1.92			
	40.0		11.83		0.80			1.02			
	41.5		11.94		0.45			.85 X .8			
	43.0		11.58		0.40			0.59			
	44.5		11.50		0.25			0.20			
WL	46.0		11.24		0						
	49.0		10.96								
SGL	54.7		8.89								
TOTALS:											

End of Measurement	Time: 354	Gage Reading: _____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Elkhead Creek Below Bridge ¼ mile					CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION:					
DATE: 10/27/15	OBSERVERS: J. Skinner, S. May & Vicki				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED:	WATER DIVISION: 6	DOW WATER CODE:		
MAP(S): USGS: 40 35 31.97 107 19 21.69	USFS:				

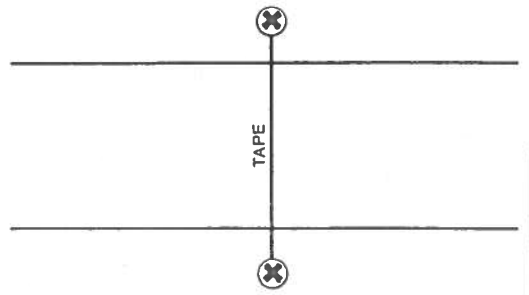
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: Marsh McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENS
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	10.67
⊗ Tape @ Stake RB	0.0	10.75
① WS @ Tape LB/RB	0.0	
② WS Upstream	7.8	10.63
③ WS Downstream	21.0 Ft	10.89
SLOPE	0.26 / 28 = 0.009	

SKETCH



LEGEND:
- Stake ⊗
- Station ①
- Photo ◇①→
- Direction of Flow ← →

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO	DISTANCE ELECTROFISHED: _____ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: YES/NO

LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE:	SHEET ___ OF ___

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 12.24 - 12

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
S	0		9.75								
G	3.0		10.35								
	7.0		10.31								
	9.0		10.64								
RB WL	12.0					Velocity					
	13.0		11.30		.6	0.46					
	14.0		11.50		.7	1.34					
	15.0		11.55		0.75	0.95					
	16		11.45		0.7	1.32					
	17		11.51		0.7	1.22					
	18		11.43		0.7	1.06					
	19		11.58		0.8	0.95					
	20		11.44		0.7	0.77					
	21		11.20		0.5	0.88					
	22		11.10		0.5	1.13					
	23		11.06		0.45	1.06					
	24		11.21		0.40	0.76					
	25		10.90		0.30	0.09					
	26		11.17		0.40	0.00					
	27		10.90		0.30	0.39					
	28		11.13		0.45	1.79					
	29		11.08		0.45	1.55					
	30		11.22		0.45	1.58					
	31		11.05		0.40	1.09					
	32		11.10		0.40	0.00					
	33		10.93		0.20	1.31					
	34		11.08		0.20	0.95					
	35		10.90		0.25	0.88					
	36		10.95		0.20	0.00					
	37		10.87		0.15	0.00					
	38		10.83		0.05	0.00					
LB WL	39		10.84		0.10	0.00					
	40										
	41		10.40								
GL	44.5		10.15								
S	49.5		9.00								
TOTALS:											

End of Measurement	Time: 1240	Gage Reading: _____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Elkhead Creek					CROSS-SECTION NO: 4
CROSS-SECTION LOCATION: Just above Bridge @ Elkhead Ranch					
DATE:	OBSERVERS: J. Skinner ; S. May , R. Vieh				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED:		WATER DIVISION: 6		DOW WATER CODE:
MAP(S): USGS: 40 36 47.46					
USFS: 107 11 51.70					

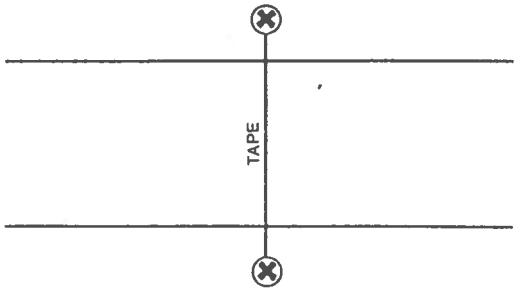
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: Marsh McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	
② WS Upstream	28	9.6
③ WS Downstream	31.5	10.31
SLOPE	0.71 / 59.5 = 0.012	

SKETCH



LEGEND:
- Stake ⊗
- Station ①
- Photo ①→
- Direction of Flow ← →

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO	DISTANCE ELECTROFISHED: _____ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: YES/NO

LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE:	SHEET ___ OF ___

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 308 PM

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
SG	0		8.03								
	4		9.08								
	6.5		9.72								
WL	8.8		9.79		0						
	9.0		10.16		0.2			0.21			
	11.0		10.03		0.15			0			
	13.0		9.92		0.20			0.78			
	15.0		10.03		.30			1.29			
	17.0		10.39		0.50			0.59			
	19.		10.19		0.40			1.24			
	21		10.32		0.50			0.45			
	23		10.57		0.70			0.37			
	25		10.63		0.70			1.04			
	27		10.60		0.80			0.20			
	29		10.64		0.60			0.87			
	31		10.75		0.50			1.02			
	33		10.34		0.75			0.11			
	35		10.24		0.50			1.52			
	37		10.60		0.85			0.64			
	39		10.03		0.60			0.55			
	41		9.92		0.20			0.35			
	43		10.16		0.35			1.28			
	45		10.00		0.30			0.93			
	47		9.90		0.25			0.01			
RB WL	48		9.80		0						
	49.75		10.24								
	53		8.38								
GL	55.5		7.98								
S	57.5		7.40								
TOTALS:											

End of Measurement	Time: 324	Gage Reading: _____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Elk head Creek					CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: Just Below X 1 350'					
DATE:	OBSERVERS: J Skinner R Viehl S May				
LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED:		WATER DIVISION: 6		DOW WATER CODE:
MAP(S): USGS: 40 40 17.61					
USFS: 107 17 9.27					

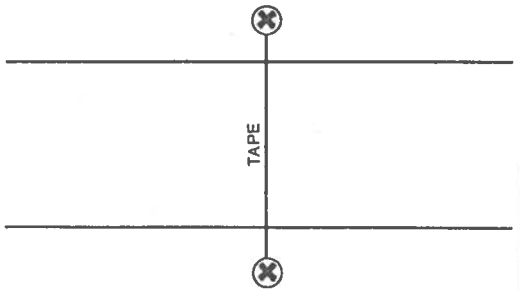
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE:			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE:	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	9.52
⊗ Tape @ Stake RB	0.0	9.55
① WS @ Tape LB/RB	0.0	
② WS Upstream	14.5	9.20
③ WS Downstream	15.5	9.59
SLOPE	0.39 / 30 = 0.013	

SKETCH



LEGEND:
- Stake ⊗
- Station ①
- Photo ◇1→
- Direction of Flow ← →

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO	DISTANCE ELECTROFISHED: _____ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: YES/NO

LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE: 10-28-15	SHEET ___ OF ___

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE)	LEFT / RIGHT	Gage Reading: _____ ft	TIME: 2:50 PM

Features (Stake (S), Grassline (G), Waterline (W), Rock (R))	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
SG	.5		8.22								
	.9		9.21								
WL	1.7		9.52		0						
	2.4		9.83		0.3			.03			
	3.1		9.91		0.35			0.07			
	3.8		10.10		0.45			0.44			
	4.5		9.70		0.20			1.44			
	5.2		9.69		0.20			1.70			
	5.9		9.71		0.20			1.55			
	6.6		9.69		0.20			1.59			
	7.3		10.62		0.80			2.13			
	8.0		10.69		1.10			1.76			
	8.7		10.55		1.10			1.09			
	9.4		10.26		0.70			1.64			
	10.1		10.30		0.65			1.96			
	10.8		10.52		0.85			1.23			
	11.5		10.44		0.90			0.40			
	12.2		9.89		0.90			0.17			
	12.9		10.03		0.25			0			
	13.6		9.80		0.35			0.04			
	14.3		9.95		0.20			0.20			
	15.0		9.70		0.20			0			
	15.7		9.91		0.25			0			
	16.4		9.63		0.10			0			
	17.1		9.76		0.20			0.01			
RB WL	17.7		9.55		0						
	20.5		9.26								
GL	24		8.70								
	24		8.15								
S	30.4		7.76								
TOTALS:											

End of Measurement	Time: 322	Gage Reading: _____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY: