United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7210
www.co.blm.gov

In Reply Refer To:
7250 (CO-932)

Ms. Linda Bassi
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Ms. Bassi:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its recommendation for an instream flow water right on Pruden Creek, located in Water Division 1.

Location and Land Status. Pruden Creek originates on the north flank of Thirtynine Mile Mountain, approximately eight miles south of Elevenmile Canyon Reservoir. This reach begins at the headwaters and extends downstream to a pond located on the Hartsel Ranch at 38°54'0.23"N 105°33'18.27"W, a distance of approximately 5.4 miles. The BLM manages approximately 0.4 miles of this reach, the U.S. Forest Service manages 3.5 miles, and 1.5 miles are in private ownership.

Biological Summary. Pruden Creek is a cold-water, high gradient stream. The reach flows through a shallow, rolling valley approximately one-fourth mile in width. The stream is confined by bedrock in some locations and travels through alluvium in other locations. The stream generally has medium-sized substrate, ranging from gravels to small boulders. The stream has a good mix of small riffles and runs but pool habitat is very limited.

Fisheries surveys have revealed a self-sustaining population of rainbow trout. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of blackfly, midges, mayfly, caddisfly and stonefly.

The riparian community is generally comprised of various willow species, alder, river birch, cottonwood, alder and potentilla. The riparian community is in good condition. The structure of the riparian community provides limited shading and cover for fish habitat.

R2Cross Analysis. The BLM collected the following R2Cross data from Pruden Creek:

Cross Section Date	Discharge Rate	Top Width	Winter Flow Recommendation (meets 2 of 3 hydraulic criteria)	Summer Flow Recommendation (meets 3 of 3 hydraulic criteria)
08/17/2009 #1	0.27 cfs	5.70 feet	0.70 cfs	Out of range
08/17/2009 #2	0.24 cfs	2.70 feet	0.27 cfs	Out of range
05/19/2014 #1	0.45 cfs	6.43 feet	0.55 cfs	1.1 cfs *See note.*
		Averages:	0.51 cfs	1.10 cfs

Note: The flow that meets all three instream flow criteria – 1.16 cfs – is outside of the confidence interval for this data set. 1.1 cfs is within the confidence interval and provides 47% wetted perimeter and meets the instream flow criteria for average depth and average velocity.

The BLM's analysis of this data, coordinated with Colorado Parks and Wildlife, indicates that the following flows are needed to protect the fishery and natural environment to a reasonable degree.

1.1 cubic feet per second is recommended during the warm weather period from May 1 to August 31. This recommendation is driven by the wetted perimeter criteria. This creek is very small and steep and has limited physical habitat, so it is important to protect a flow rate that provides usable habitat in riffles when fish are completing critical life history functions during the warm weather months.

0.44 cubic feet per second is recommended during the fall period, from September 1 to October 31. This recommendation is driven by limited water availability. This flow rate meets two of three instream flow criteria in some, but not all, of the surveyed cross sections.

0.27 cubic feet per second is recommended during the winter period from November 1 through March 31. This flow rate should prevent pools from freezing, allowing the fish population to successfully overwinter. Even though the base flow in this creek is small, it is extremely consistent, allowing the fishery to persist.

0.4 cubic feet per second is recommended during the early portion of the snowmelt runoff period, from the April 1 to April 30. This flow rate meets two of three instream flow criteria in some, but not all, of the surveyed cross sections, but reflects the fact that snowmelt runoff is not yet sufficient during April to meet all three instream flow criteria.

Water Availability. The BLM recommends relying upon two sources of data for water availability analysis. Streamstats appears to be the only reliable source of information for this

watershed. The BLM does not recommend usage of gage data from this region because all of the gage data either has very short periods of record, or is heavily influenced by water diversion and storage operations. Unfortunately, Pruden Ditch has been abandoned, so recent diversion records are not available.

The BLM is not aware of any water rights within or upstream from the proposed instream flow reach.

Relationship to Land Management Plans. The BLM's land use plan calls for Pruden Creek to be managed to maintain, restore or improve riparian conditions, such that proper functioning conditions are achieved. It also specifies that instream flow appropriations are pursued on fishery streams to ensure sufficient flows rates for fisheries protection. Appropriation of an instream flow water right would assist BLM in long-term management of riparian values and fishery values. Even though the creek is very small, it is located in an extremely dry portion of South Park, and provides important wildlife habitat functions.

Data sheets, R2Cross output, fishery survey information and photographs of the cross section were included with BLM's draft recommendation in February 2015. We thank both Colorado Parks and Wildlife and the Colorado Water Conservation Board for their cooperation in this effort.

If you have any questions regarding our instream flow recommendation, please contact Roy Smith at 303-239-3940.

Sincerely,

Brian St. George
Deputy State Director
Resources and Fire

Cc: David Gilbert, Royal Gorge FO
Keith Berger, Royal Gorge FO

Pruden Creek
Biological Resources Overview

Introduction

Pruden Creek drains a watershed of approximately 5.0 square miles in size as it leaves BLM lands and enters private lands on the south side of Elevenmile Canyon Reservoir in Park County. The creek originates at an elevation of approximately 10,750 feet and exits BLM lands at an elevation of approximately 8,850 feet. Base flows in the creek are typically less than 1.0 cfs.

Biological resources are controlled by a short duration snowmelt runoff, limited flow rates, and a frost-free growing season of less than 90 days. Water quality does not appear to be a factor that limits biological resources, since temperature, Ph, conductivity, salinity, and metals are within typical ranges for creeks found at this elevation in Colorado.

Riparian Resources

The riparian community on BLM lands is comprised of four willow species (Salix sp.), alder (Alnus incana), river birch (Betula occidentalis), Cottonwood (Populus angustifolia), Shrubby Cinquefoil (Dasiphora fruticosa)and various grasses and sedges. BLM has determined the riparian area is in proper functioning condition and is on an upward trend. It appears that the creek's sinuousity, width/depth ratio, and gradient are in balance with the landscape setting. Riparian plants have high vigor and a diversity of age classes.

At the lower elevations of the creek on BLM lands, the riparian community extends a significant distance laterally from the creek and throughout the floodplain, indicating that the riparian area has achieved its maximum potential extent.

View of riparian extent associated with creek, looking downstream toward Elevenmile Canyon Reservoir.

Typical riparian condition at the BLM-USFS boundary.

Macroinvertebrate Resources

Macrinvertebrates that have been documented during instream flow surveys include caddisfly (Trichoptera), mayfly (Ephemeroptera), stonefly (Plecoptera), blackfly (Simuliidae), water striders (Gerridae), and midges (Culicoides). Macroinvertebrate density is not high. Density is possibly limited by the high sedimentation rates in the stream channel that appear to be caused from extensive road network erosion in the higher elevation portions of the watershed.

Fisheries Resources

Pruden Creek has been historically known to support a rainbow trout (Onchrhynchus mykiss) population, but the fish population density is extremely low. Only one fish was captured during a sampling effort during 2015 that sampled 300 feet of stream, indicating the low density. Multiple fish were sighted during instream flow surveys that were conducted in 2014. BLM completed a fish survey as part of instream flow surveys in 1998, and captured two rainbow trout in a 300 foot sampling reach.

Overall conditions on Pruden Creek indicate a long-term ability to sustain a limited biomass fishery. Channel and bank stability is good to excellent. Stream shading is fair to good, provided by large shrubs and overhanging banks. Spawning habitat is fair, with sufficient spawning gravels. The most significant limiting factor is pool quantity and quality. Pool habitat is limited by the steep gradient, and pools that do exist are often filled with sediment from extensive road system higher in the watershed. The U.S. Forest Service has plans to implement corrective measures to reduce road erosion.

Pruden Creek has reaches that are very narrow, with a stream width of 2 to 2.5 feet.

This photo illustrates the mix of shrubs and trees that provide shading for fish habitat.

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

LOCATION INFORMATION

STREAM NAME:	Pruden Creek
XS LOCATION:	At BLM-USFS boundary
XS NUMBER:	2
DATE:	17-Aug-09
OBSERVERS:	R. Smith, D. Gilbert, J. Backstrand
1/4 SEC:	SW
SECTION:	28
TWP:	13S
RANGE:	73W
PM:	Sixth
COUNTY:	Park
WATERSHED:	South Platte
DIVISION:	1
DOW CODE:	30572
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:	0.043

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

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

STREAM NAME: Pruden Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 2

DATA POINTS= 14

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	2.00	4.80			0.00		0.00	0.00	0.0%
1	G	4.50	5.60			0.00		0.00	0.00	0.0%
	W	4.90	5.99	0.00		0.00		0.00	0.00	0.0%
		5.00	6.15	0.15	0.36	0.19	0.15	0.03	0.01	4.5%
		5.30	6.20	0.20	0.45	0.30	0.20	0.06	0.03	11.3%
		5.60	6.20	0.20	0.80	0.30	0.20	0.06	0.05	20.1%
		5.90	6.15	0.15	0.95	0.30	0.15	0.05	0.04	17.9%
		6.20	6.25	0.25	0.45	0.32	0.25	0.08	0.03	14.2%
		6.50	6.25	0.25	0.89	0.30	0.25	0.08	0.07	28.0%
		6.80	6.25	0.25	0.15	0.30	0.25	0.06	0.01	3.9%
		7.00	6.05	0.05	0.00	0.28	0.05	0.01	0.00	0.0%
	W	7.10	5.99	0.00		0.12		0.00	0.00	0.0%
1	G	7.20	5.58			0.00		0.00	0.00	0.0%
	RS	10.10	4.55			0.00		0.00	0.00	0.0%
	TOTALS ----------					2.41	0.25 (Max.)	0.42	0.24	100.0%

Manning's n = 0.1659
Hydraulic Radius= 0.17201036

STREAM NAME: Pruden Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.42	0.44	5.1%
5.74	0.42	1.03	147.2%
5.76	0.42	0.98	135.1%
5.78	0.42	0.93	123.1%
5.80	0.42	0.88	111.3%
5.82	0.42	0.83	99.6%
5.84	0.42	0.78	88.0%
5.86	0.42	0.73	76.6%
5.88	0.42	0.69	65.2%
5.90	0.42	0.64	54.0%
5.92	0.42	0.59	42.9%
5.94	0.42	0.55	31.9%
5.95	0.42	0.53	26.5%
5.96	0.42	0.50	21.1%
5.97	0.42	0.48	15.7%
5.98	0.42	0.46	10.4%
5.99	0.42	0.44	5.1%
6.00	0.42	0.41	-0.2%
6.01	0.42	0.39	-5.4%
6.02	0.42	0.37	-10.6%
6.03	0.42	0.35	-15.7%
6.04	0.42	0.33	-20.8%
6.06	0.42	0.29	-30.7%
6.08	0.42	0.25	-40.5%
6.10	0.42	0.21	-50.1%
6.12	0.42	0.17	-59.6%
6.14	0.42	0.13	-68.9%
6.16	0.42	0.09	-77.9%
6.18	0.42	0.06	-85.5%
6.20	0.42	0.04	-91.6%
6.22	0.42	0.02	-95.2%
6.24	0.42	0.01	-98.5%

WATERLINE AT ZERO
AREA ERROR = 6.000

STREAM NAME: Pruden Creek
XS LOCATION: At BLM-USFS boundary
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	5.60	2.70	0.52	0.65	1.39	3.37	100.0%	0.41	1.43	1.03
	5.65	2.63	0.48	0.60	1.26	3.25	96.4%	0.39	1.24	0.99
	5.70	2.57	0.44	0.55	1.13	3.13	92.7%	0.36	1.06	0.94
	5.75	2.51	0.40	0.50	1.00	3.00	89.1%	0.33	0.89	0.89
	5.80	2.44	0.36	0.45	0.88	2.88	85.4%	0.30	0.74	0.84
	5.85	2.38	0.32	0.40	0.76	2.76	81.8%	0.27	0.59	0.78
	5.90	2.31	0.28	0.35	0.64	2.64	78.1%	0.24	0.46	0.72
	5.95	2.25	0.23	0.30	0.53	2.51	74.5%	0.21	0.34	0.65
WL	6.00	2.18	0.19	0.25	0.41	2.38	70.6%	0.17	0.24	0.58
	6.05	2.06	0.15	0.20	0.31	2.23	66.0%	0.14	0.15	0.50
	6.10	1.98	0.10	0.15	0.21	2.10	62.2%	0.10	0.08	0.40
	6.15	1.91	0.06	0.10	0.11	1.97	58.5%	0.06	0.03	0.27
	6.20	0.80	0.04	0.05	0.04	0.83	24.6%	0.04	0.01	0.23
	6.25	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Pruden Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.24	cfs
CALCULATED FLOW (Qc)=	0.24	cfs
(Qm-Qc)/Qm * 100 =	-0.8	%
MEASURED WATERLINE (WLm)=	5.99	ft
CALCULATED WATERLINE (WLc)=	6.00	ft
(WLm-WLc)/WLm * 100 =	-0.2	%
MAX MEASURED DEPTH (Dm)=	0.25	ft
MAX CALCULATED DEPTH (Dc)=	0.25	ft
(Dm-Dc)/Dm * 100	-0.2	%
MEAN VELOCITY=	0.58	ft/sec
MANNING'S N=	0.166	
SLOPE=	0.043	ft/ft
.4 * Qm =	0.1	cfs
2.5 * Qm=	0.6	cfs

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

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

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

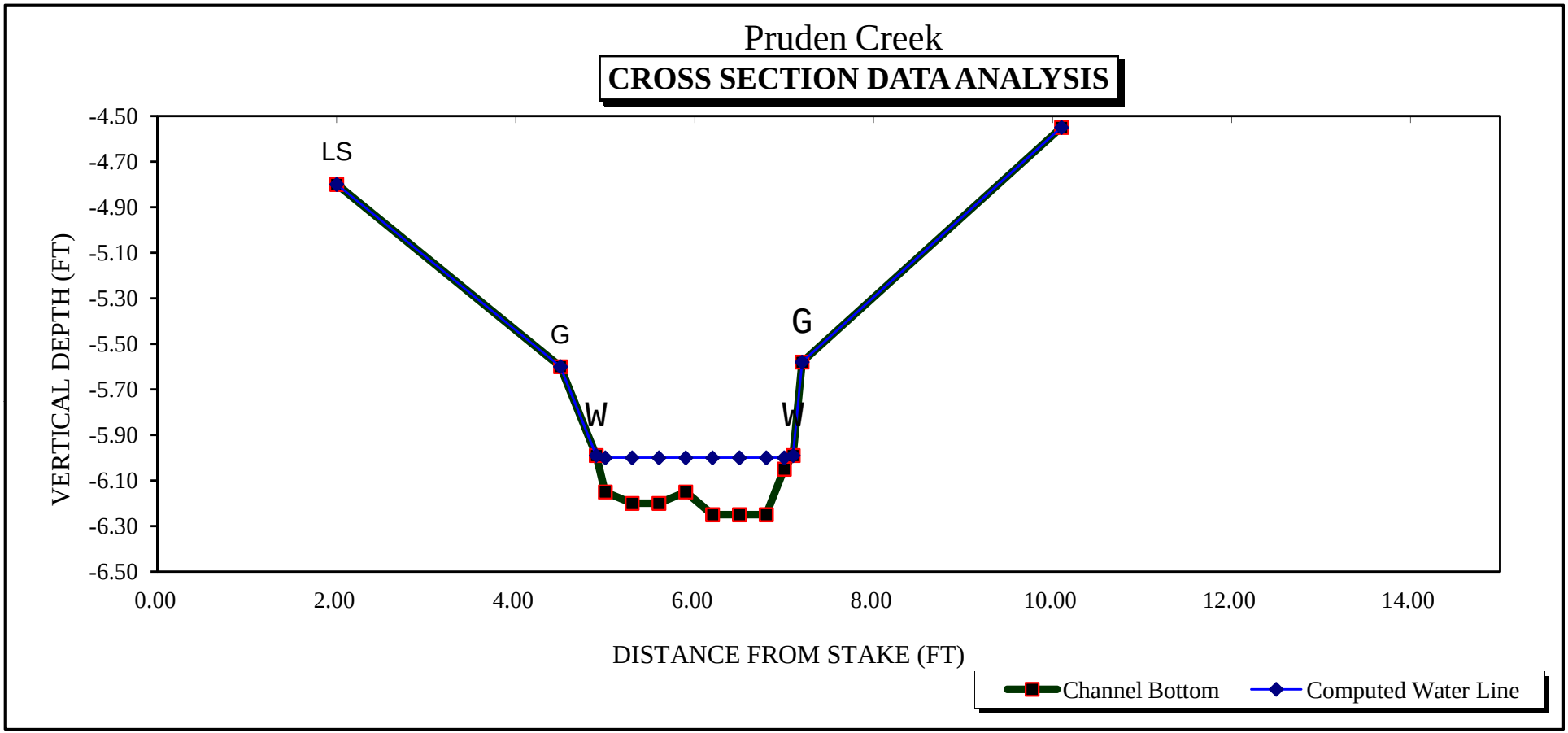
RECOMMENDATION BY: ………………...………..……............................... AGENCY...……………………......……...…...…….….... DATE:......…..…......……………

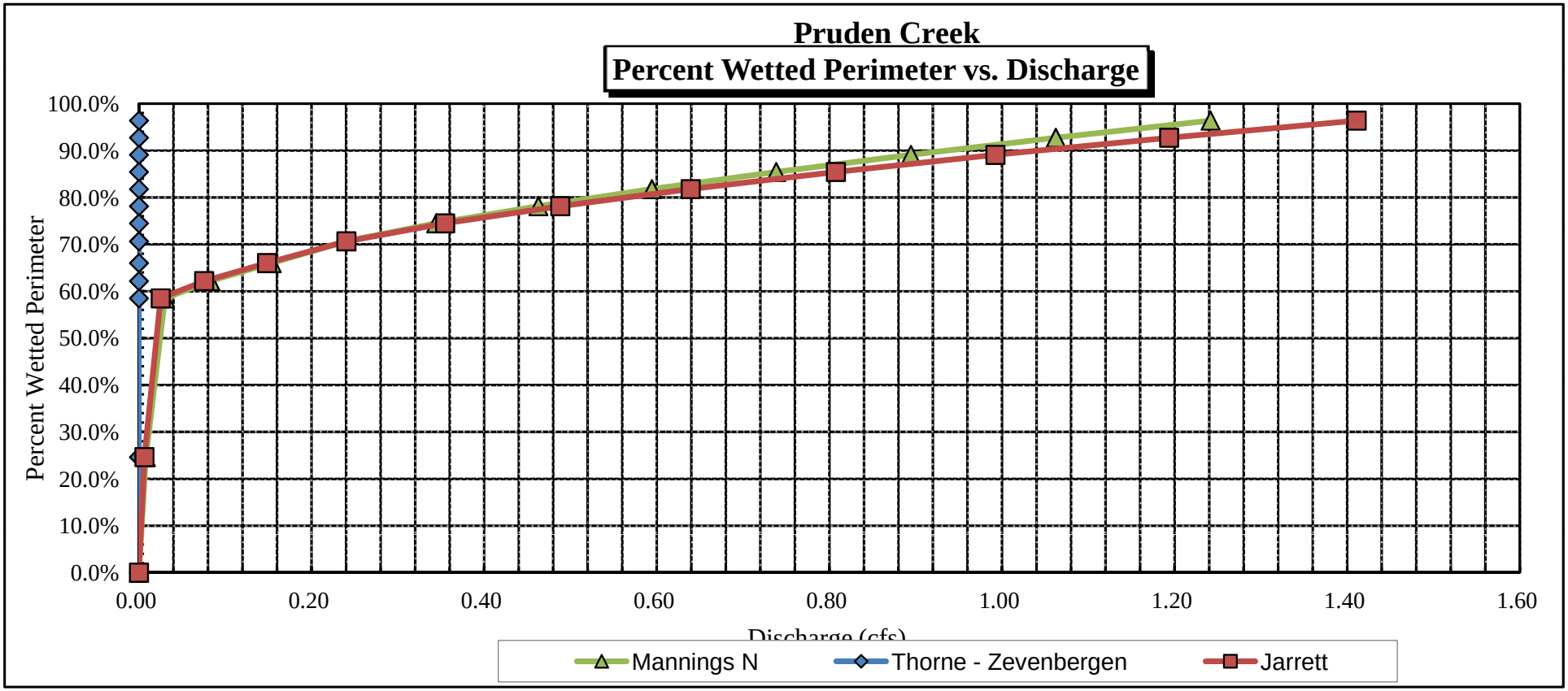
CWCB REVIEW BY: ..…………………………....…………………………………………………...…............. DATE:.................…………….…

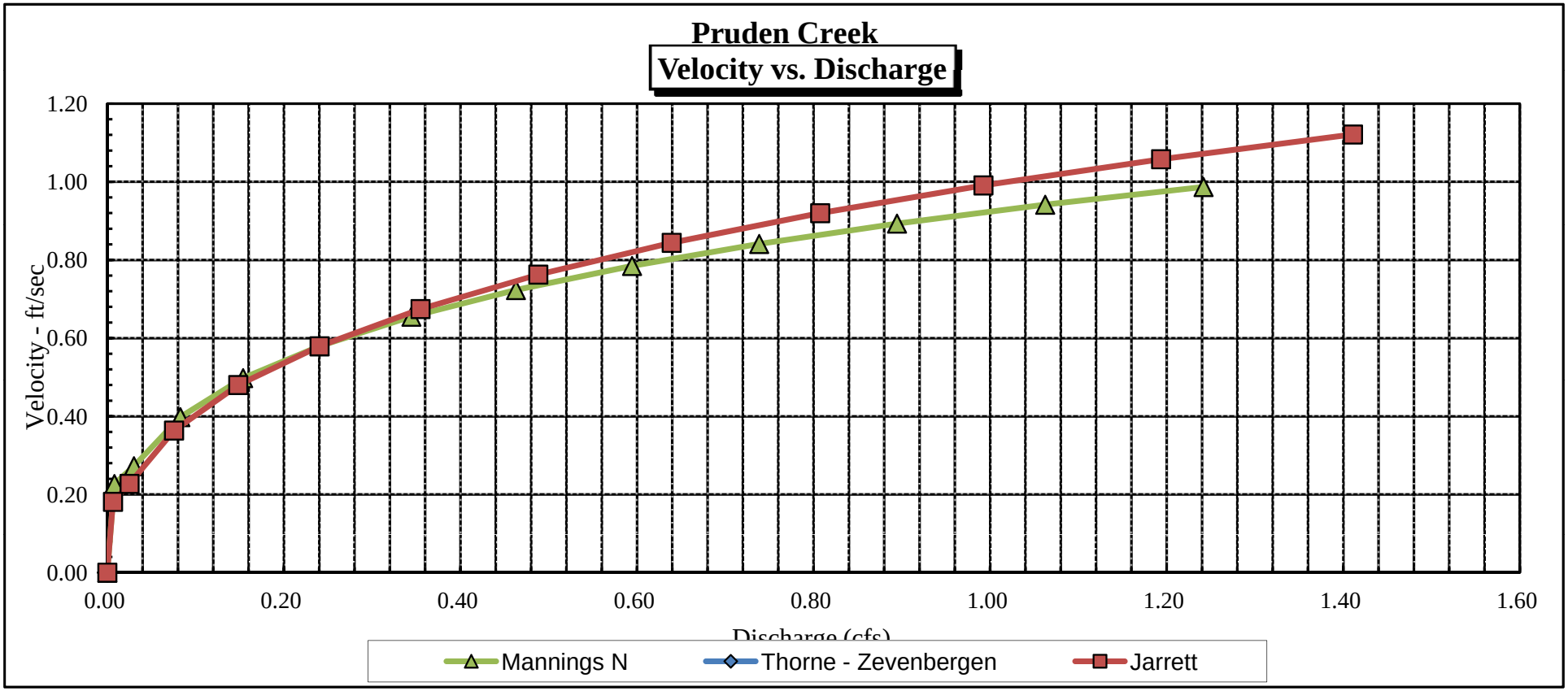
STREAM NAME: Pruden Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 2 Jarrett Variable Manning's n Correction Applied

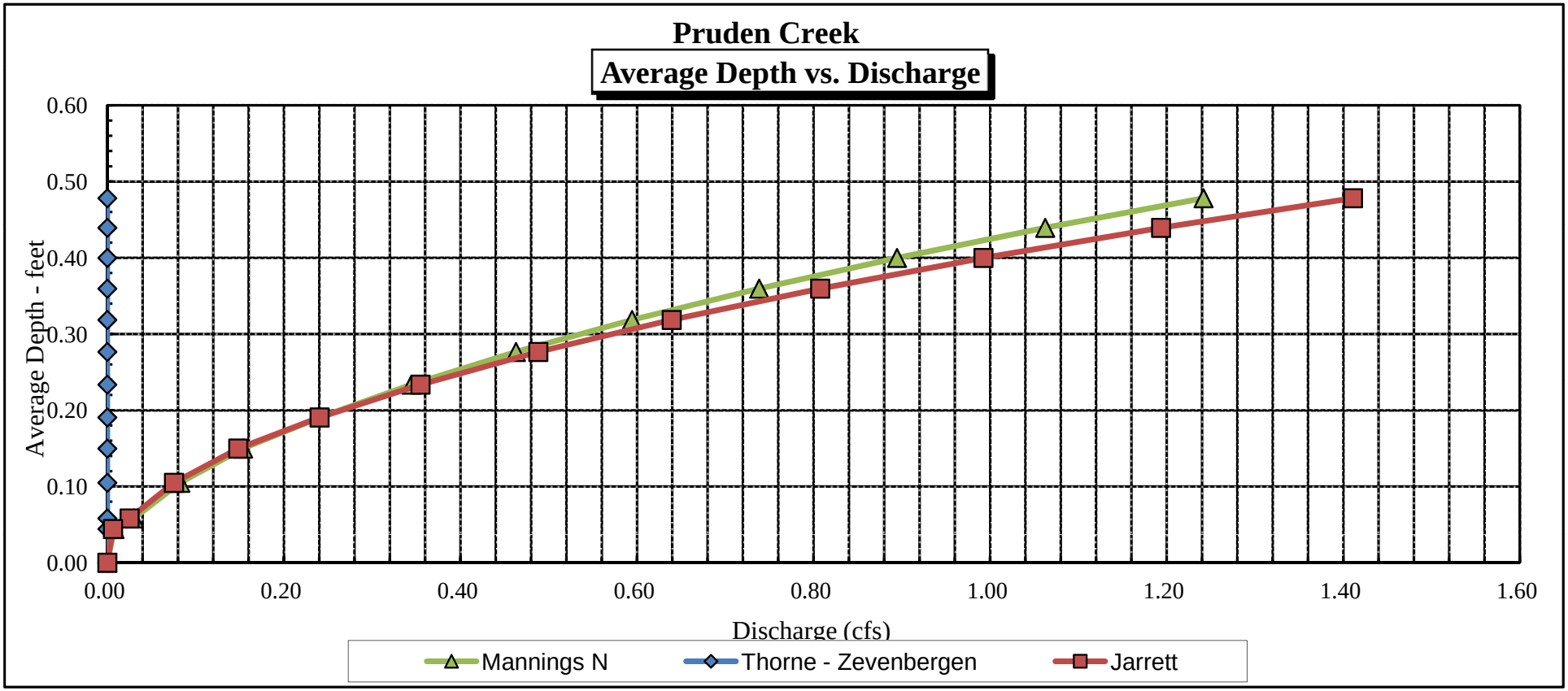
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

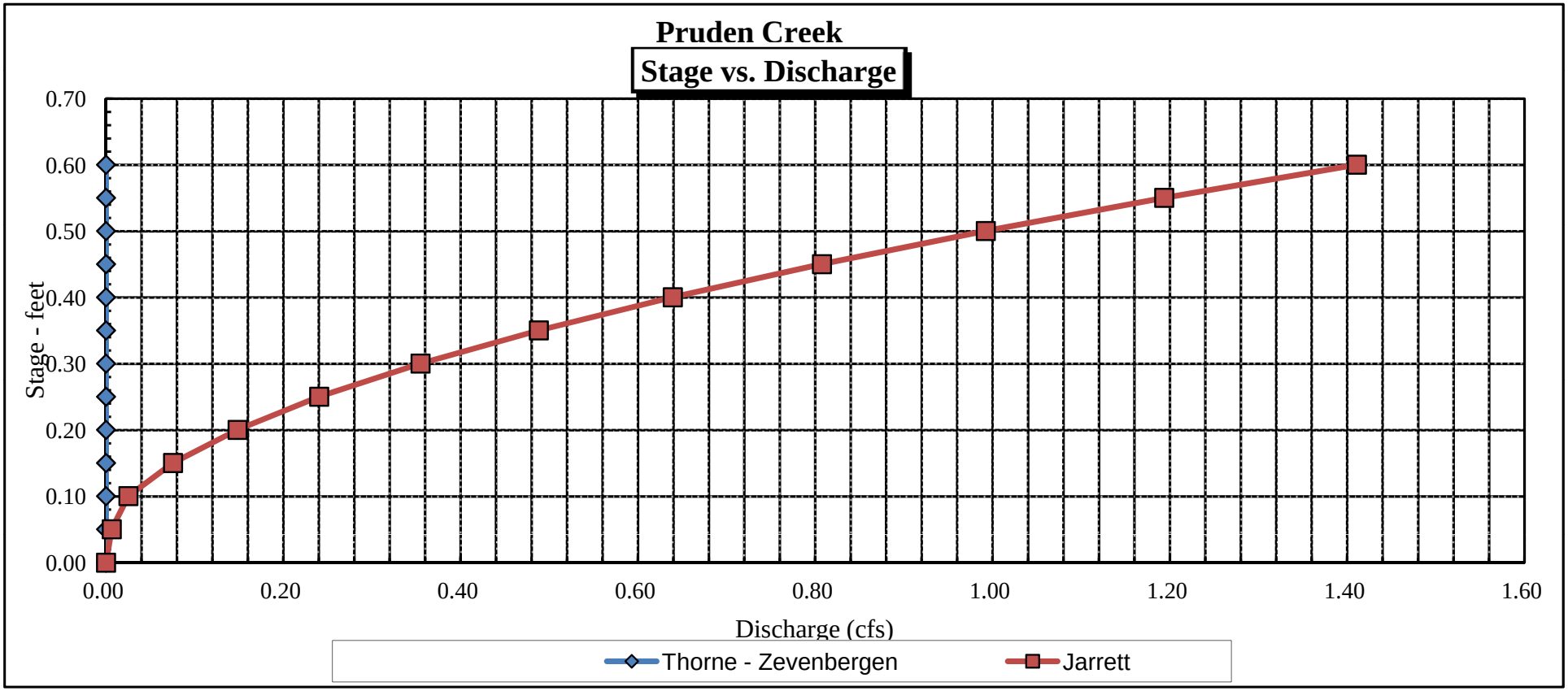
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.60	2.70	0.52	0.65	1.39	3.37	100.0%	0.41	1.64	1.18
	5.65	2.63	0.48	0.60	1.26	3.25	96.4%	0.39	1.41	1.12
	5.70	2.57	0.44	0.55	1.13	3.13	92.7%	0.36	1.19	1.06
	5.75	2.51	0.40	0.50	1.00	3.00	89.1%	0.33	0.99	0.99
	5.80	2.44	0.36	0.45	0.88	2.88	85.4%	0.30	0.81	0.92
	5.85	2.38	0.32	0.40	0.76	2.76	81.8%	0.27	0.64	0.84
	5.90	2.31	0.28	0.35	0.64	2.64	78.1%	0.24	0.49	0.76
	5.95	2.25	0.23	0.30	0.53	2.51	74.5%	0.21	0.35	0.67
WL	6.00	2.18	0.19	0.25	0.41	2.38	70.6%	0.17	0.24	0.58
	6.05	2.06	0.15	0.20	0.31	2.23	66.0%	0.14	0.15	0.48
	6.10	1.98	0.10	0.15	0.21	2.10	62.2%	0.10	0.08	0.36
	6.15	1.91	0.06	0.10	0.11	1.97	58.5%	0.06	0.03	0.23
	6.20	0.80	0.04	0.05	0.04	0.83	24.6%	0.04	0.01	0.18
	6.25	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!


Pruden Creek
CROSS SECTION DATA ANALYSIS
VERTICAL DEPTH (FT)
-4.50
-4.70
-4.90
-5.10
-5.30
-5.50
-5.70
-5.90
-6.10
-6.30
-6.50
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
LS
G
W
W
G
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Pruden Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Pruden Creek
Velocity vs. Discharge
Velocity - ft/sec
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Pruden Creek
Average Depth vs. Discharge
Average Depth - feet
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Pruden Creek
Stage vs. Discharge
Stage - feet
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
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:	Pruden Creek
XS LOCATION:	At BLM-USFS boundary
XS NUMBER:	1
DATE:	17-Aug-09
OBSERVERS:	R. Smith, D. Gilbert, J. Backstrand
1/4 SEC:	SW
SECTION:	28
TWP:	13S
RANGE:	73W
PM:	Sixth
COUNTY:	Park
WATERSHED:	South Platte
DIVISION:	1
DOW CODE:	30572
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

TAPE WT:	0.0106
TENSION:	99999

CHANNEL PROFILE DATA

SLOPE:	0.05

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

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

STREAM NAME: Pruden Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 1

DATA POINTS= 14

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	2.00	2.38			0.00		0.00	0.00	0.0%
1	G	7.30	3.82			0.00		0.00	0.00	0.0%
		8.60	4.08			0.00		0.00	0.00	0.0%
	W	9.30	4.22	0.00		0.00		0.00	0.00	0.0%
		9.60	4.30	0.10	0.30	0.31	0.10	0.03	0.01	3.3%
		9.90	4.40	0.20	0.74	0.32	0.20	0.05	0.04	13.5%
		10.10	4.40	0.20	0.82	0.20	0.20	0.06	0.05	17.9%
		10.50	4.45	0.25	0.86	0.40	0.25	0.09	0.08	27.4%
		10.80	4.40	0.20	0.98	0.30	0.20	0.06	0.06	21.4%
		11.10	4.45	0.25	0.73	0.30	0.25	0.06	0.05	16.6%
	W	11.30	4.19	0.00		0.33		0.00	0.00	0.0%
		12.30	4.08			0.00		0.00	0.00	0.0%
1	G	13.20	3.86			0.00		0.00	0.00	0.0%
	RS	17.40	2.82			0.00		0.00	0.00	0.0%
	TOTALS ----------					2.17	0.25 (Max.)	0.35	0.27	100.0%

Manning's n = 0.1255
Hydraulic Radius= 0.16157887

STREAM NAME: Pruden Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.35	0.34	-2.1%
3.96	0.35	1.23	251.3%
3.98	0.35	1.13	224.2%
4.00	0.35	1.04	198.1%
4.02	0.35	0.96	173.1%
4.04	0.35	0.87	149.1%
4.06	0.35	0.79	126.1%
4.08	0.35	0.71	104.2%
4.10	0.35	0.64	83.5%
4.12	0.35	0.58	64.3%
4.14	0.35	0.51	46.8%
4.16	0.35	0.46	30.9%
4.17	0.35	0.43	23.5%
4.18	0.35	0.41	16.6%
4.19	0.35	0.39	10.1%
4.20	0.35	0.36	3.9%
4.21	0.35	0.34	-2.1%
4.22	0.35	0.32	-7.9%
4.23	0.35	0.30	-13.6%
4.24	0.35	0.28	-19.1%
4.25	0.35	0.26	-24.5%
4.26	0.35	0.25	-29.7%
4.28	0.35	0.21	-39.9%
4.30	0.35	0.18	-49.5%
4.32	0.35	0.14	-58.6%
4.34	0.35	0.11	-67.3%
4.36	0.35	0.09	-75.6%
4.38	0.35	0.06	-83.4%
4.40	0.35	0.03	-90.8%
4.42	0.35	0.01	-96.4%
4.44	0.35	0.00	-99.3%
4.46	0.35	0.00	-100.0%

WATERLINE AT ZERO
AREA ERROR = 4.201

STREAM NAME: Pruden Creek
XS LOCATION: At BLM-USFS boundary
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	3.86	5.70	0.30	0.59	1.73	5.93	100.0%	0.29	2.01	1.16
	3.90	5.32	0.28	0.55	1.50	5.55	93.5%	0.27	1.66	1.11
	3.95	4.87	0.26	0.50	1.25	5.08	85.6%	0.25	1.29	1.04
	4.00	4.41	0.23	0.45	1.01	4.62	77.8%	0.22	0.98	0.96
	4.05	3.96	0.20	0.40	0.81	4.15	70.0%	0.19	0.71	0.89
	4.10	3.40	0.18	0.35	0.62	3.58	60.3%	0.17	0.51	0.82
	4.15	2.69	0.17	0.30	0.47	2.87	48.3%	0.16	0.37	0.79
WL	4.20	2.08	0.17	0.25	0.35	2.25	37.8%	0.16	0.27	0.77
	4.25	1.83	0.14	0.20	0.25	1.97	33.1%	0.13	0.17	0.67
	4.30	1.61	0.10	0.15	0.17	1.71	28.8%	0.10	0.09	0.56
	4.35	1.42	0.06	0.10	0.09	1.49	25.1%	0.06	0.04	0.41
	4.40	1.01	0.02	0.05	0.02	1.04	17.6%	0.02	0.01	0.22

STREAM NAME: Pruden Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.27	cfs
CALCULATED FLOW (Qc)=	0.27	cfs
(Qm-Qc)/Qm * 100 =	2.4	%
MEASURED WATERLINE (WLm)=	4.21	ft
CALCULATED WATERLINE (WLc)=	4.20	ft
(WLm-WLc)/WLm * 100 =	0.1	%
MAX MEASURED DEPTH (Dm)=	0.25	ft
MAX CALCULATED DEPTH (Dc)=	0.25	ft
(Dm-Dc)/Dm * 100	0.6	%
MEAN VELOCITY=	0.77	ft/sec
MANNING'S N=	0.126	
SLOPE=	0.05	ft/ft
.4 * Qm =	0.1	cfs
2.5 * Qm=	0.7	cfs

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

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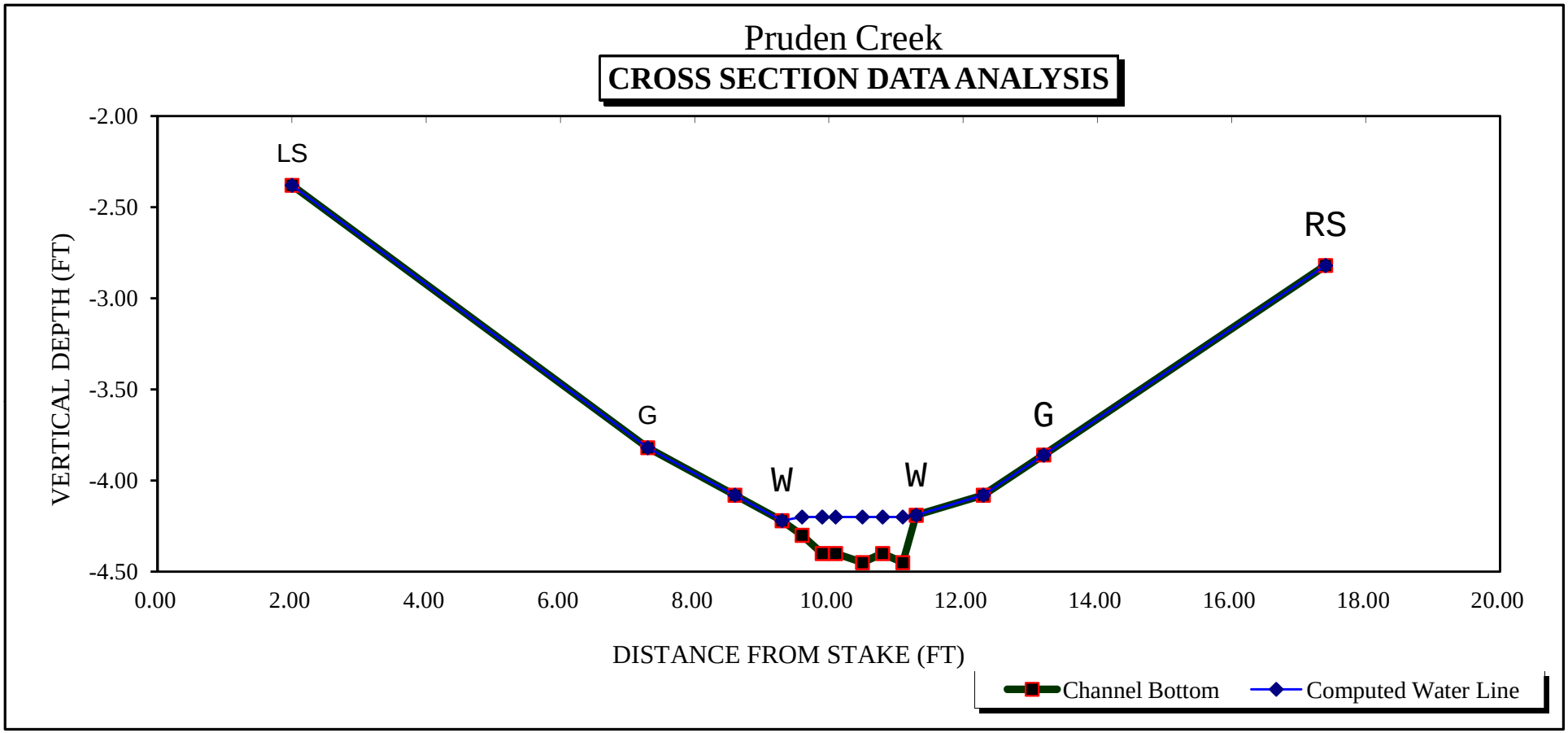
RECOMMENDATION BY: ……………………..……….………................................. AGENCY..………………………......……...…...……....... DATE:.......…...….......……………

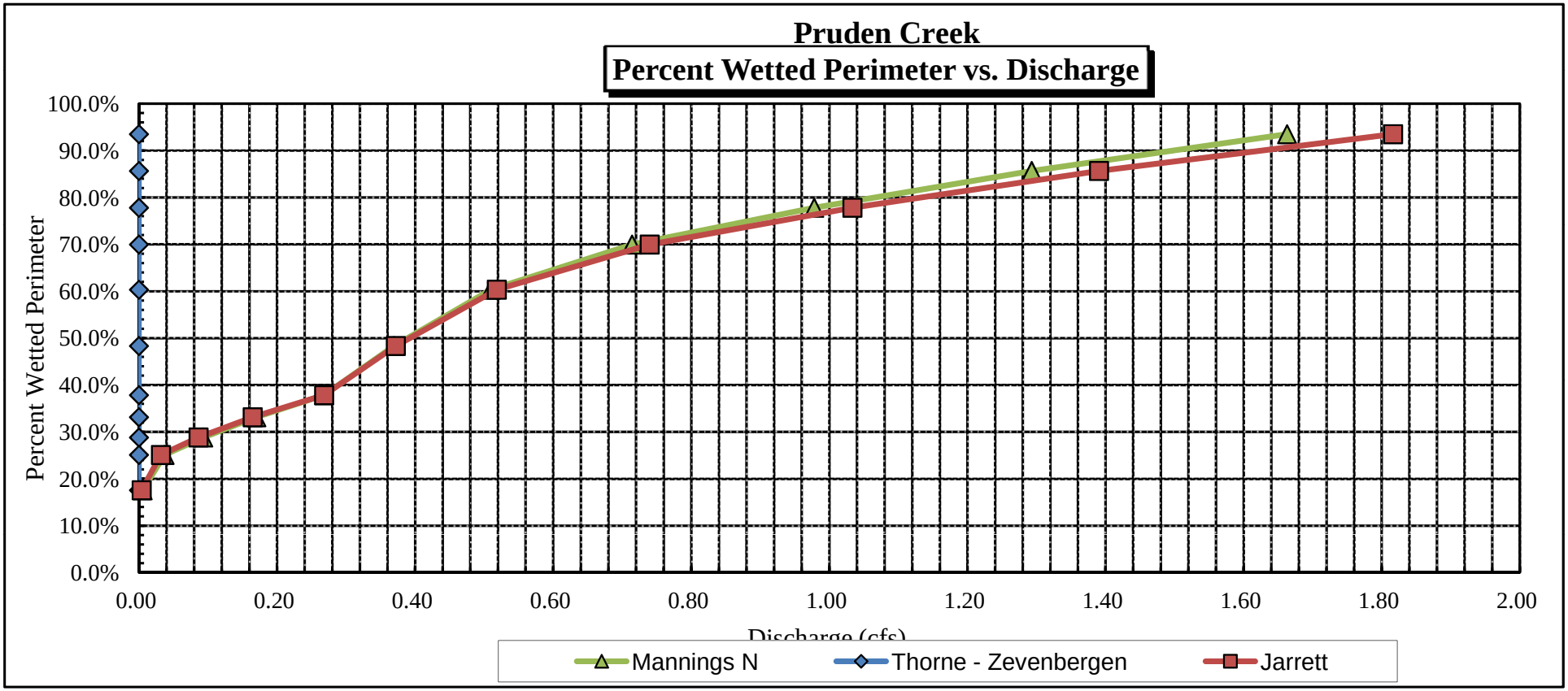
CWCB REVIEW BY: ..……………………………....…………………………………………………..……............. DATE:.................…………….....

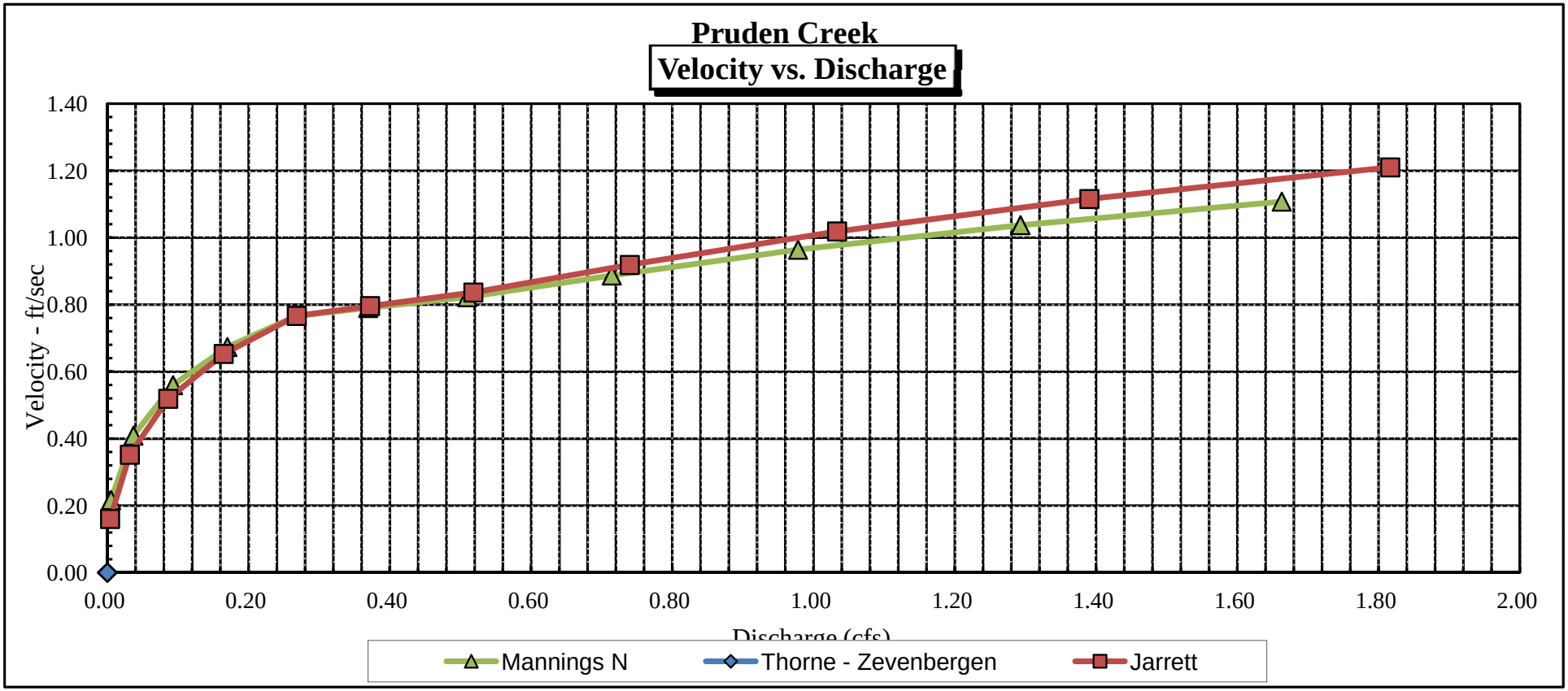
STREAM NAME: Pruden Creek
XS LOCATION: At BLM-USFS boundary
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

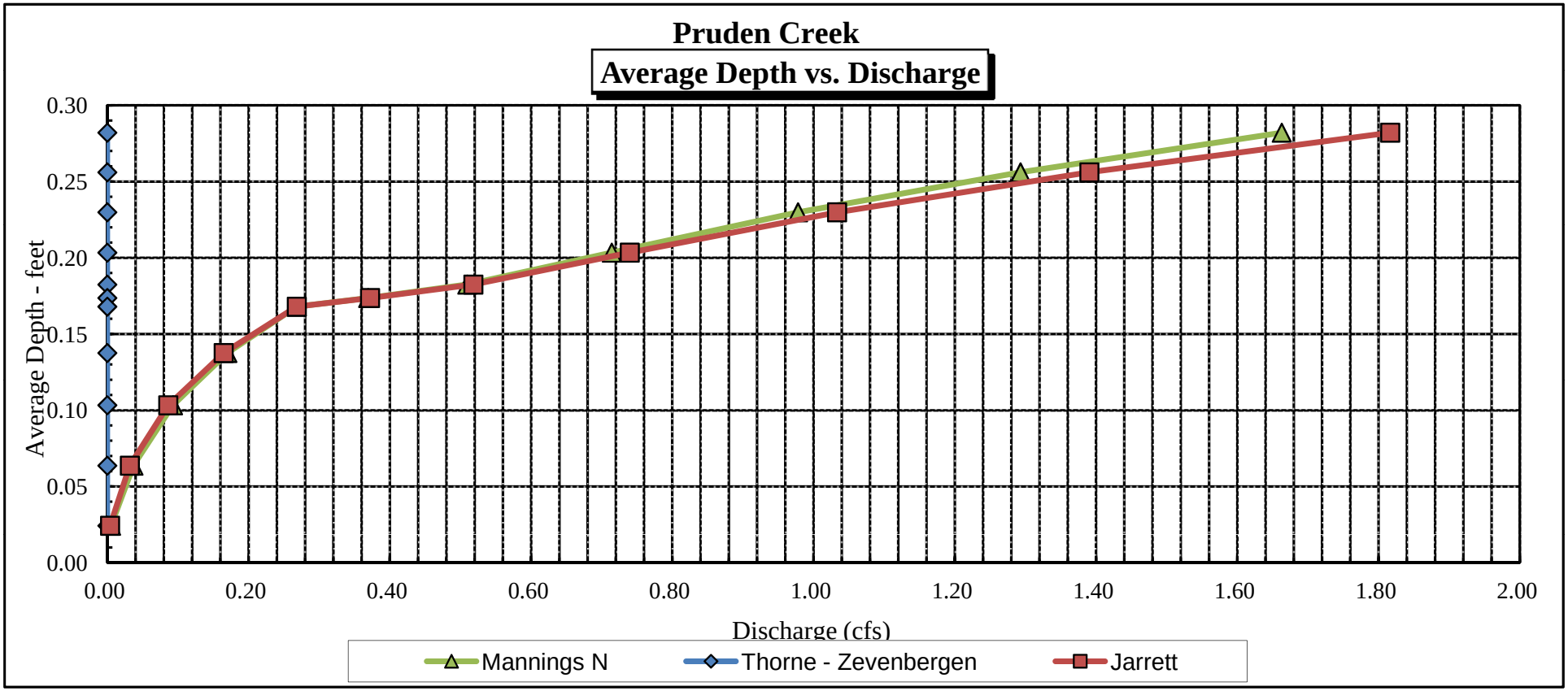
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

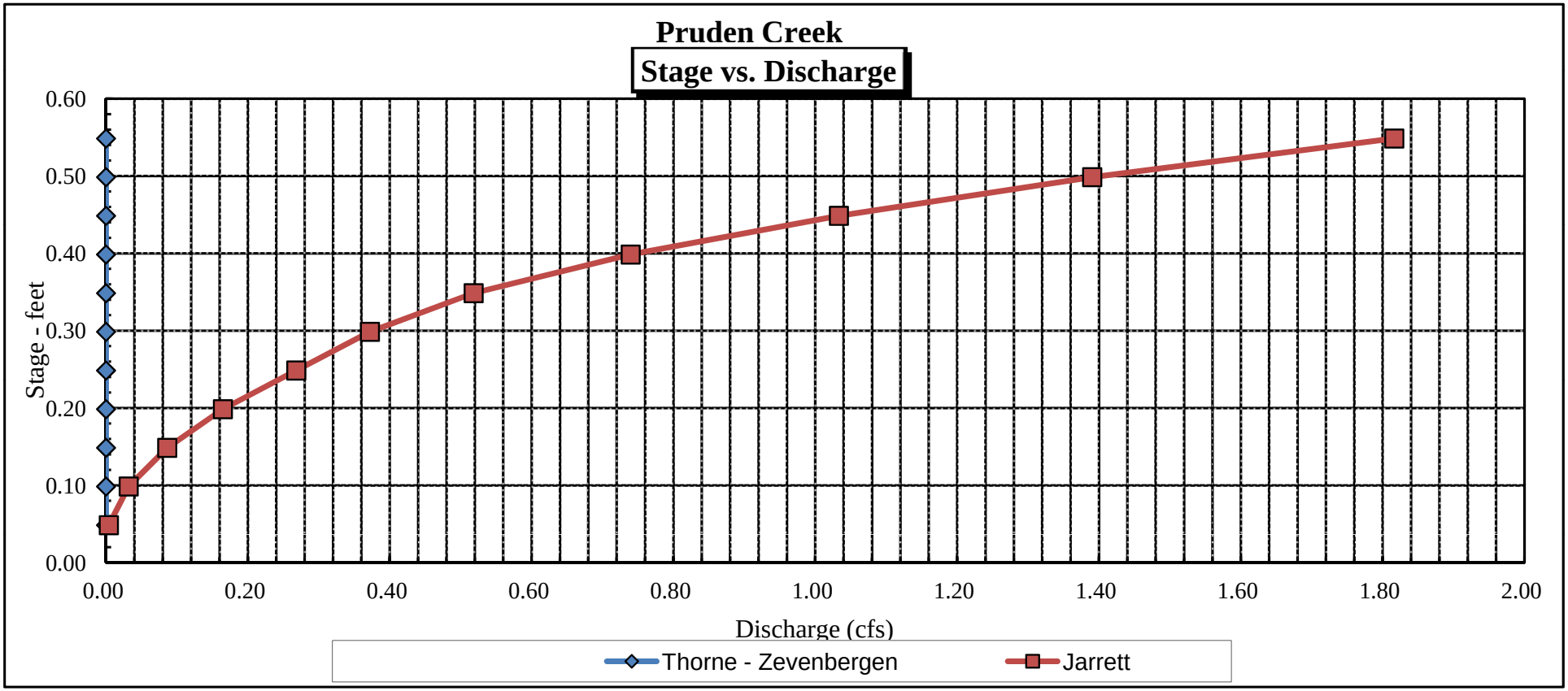
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	3.86	5.70	0.30	0.59	1.73	5.93	100.0%	0.29	2.23	1.29
	3.90	5.32	0.28	0.55	1.50	5.55	93.5%	0.27	1.82	1.21
	3.95	4.87	0.26	0.50	1.25	5.08	85.6%	0.25	1.39	1.12
	4.00	4.41	0.23	0.45	1.01	4.62	77.8%	0.22	1.03	1.02
	4.05	3.96	0.20	0.40	0.81	4.15	70.0%	0.19	0.74	0.92
	4.10	3.40	0.18	0.35	0.62	3.58	60.3%	0.17	0.52	0.84
	4.15	2.69	0.17	0.30	0.47	2.87	48.3%	0.16	0.37	0.80
WL	4.20	2.08	0.17	0.25	0.35	2.25	37.8%	0.16	0.27	0.77
	4.25	1.83	0.14	0.20	0.25	1.97	33.1%	0.13	0.16	0.65
	4.30	1.61	0.10	0.15	0.17	1.71	28.8%	0.10	0.09	0.52
	4.35	1.42	0.06	0.10	0.09	1.49	25.1%	0.06	0.03	0.35
	4.40	1.01	0.02	0.05	0.02	1.04	17.6%	0.02	0.00	0.16


Pruden Creek
CROSS SECTION DATA ANALYSIS
VERTICAL DEPTH (FT)
-2.00
-2.50
-3.00
-3.50
-4.00
-4.50
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
DISTANCE FROM STAKE (FT)
LS
G
W
W
G
RS
Channel Bottom
Computed Water Line


Pruden Creek
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Pruden Creek
Velocity vs. Discharge
Velocity - ft/sec
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Pruden Creek
Average Depth vs. Discharge
Average Depth - feet
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Pruden Creek
Stage vs. Discharge
Stage - feet
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
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:	Pruden Creek
XS LOCATION:	0.25 mile d/s from USFS-BLM border
XS NUMBER:	1
DATE:	19-May-14
OBSERVERS:	R. Smith, D. Gilbert
1/4 SEC:	SW
SECTION:	28
TWP:	13S
RANGE:	73W
PM:	Sixth
COUNTY:	Park
WATERSHED:	South Platte
DIVISION:	1
DOW CODE:	30572
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:	0.041

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

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

STREAM NAME: Pruden Creek
XS LOCATION: 0.25 mile d/s from USFS-BLM border
XS NUMBER: 1

DATA POINTS= 17

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1	RS & G	1.10	8.50			0.00		0.00	0.00	0.0%
	W	1.50	8.88	0.00	0.00	0.00		0.00	0.00	0.0%
		1.80	8.98	0.10	0.49	0.32	0.10	0.03	0.01	3.2%
		2.10	9.04	0.16	0.57	0.31	0.16	0.05	0.03	6.0%
		2.40	9.04	0.16	1.25	0.30	0.16	0.05	0.06	13.3%
		2.70	9.01	0.13	1.07	0.30	0.13	0.04	0.04	9.2%
		3.00	9.06	0.18	1.09	0.30	0.18	0.05	0.06	13.0%
		3.30	9.10	0.22	0.99	0.30	0.22	0.07	0.07	14.4%
		3.60	9.20	0.32	1.37	0.32	0.32	0.10	0.13	29.1%
		3.90	9.16	0.28	0.61	0.30	0.28	0.06	0.03	7.6%
		4.00	9.16	0.28	0.67	0.10	0.28	0.03	0.02	4.1%
	W	4.10	8.91	0.00	0.00	0.27		0.00	0.00	0.0%
		4.20	8.71			0.00		0.00	0.00	0.0%
		5.00	8.54			0.00		0.00	0.00	0.0%
		6.00	8.74			0.00		0.00	0.00	0.0%
		7.00	8.66			0.00		0.00	0.00	0.0%
1	LS & G	8.00	8.58			0.00		0.00	0.00	0.0%
	TOTALS ----------					2.82	0.32 (Max.)	0.47	0.45	100.0%

Manning's n = 0.0930
Hydraulic Radius= 0.16497557

STREAM NAME: Pruden Creek
XS LOCATION: 0.25 mile d/s from USFS-BLM border
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.47	0.43	-8.0%
8.65	0.47	1.21	160.6%
8.67	0.47	1.12	140.5%
8.69	0.47	1.03	122.4%
8.71	0.47	0.96	106.2%
8.73	0.47	0.89	92.0%
8.75	0.47	0.83	79.3%
8.77	0.47	0.78	67.3%
8.79	0.47	0.72	55.3%
8.81	0.47	0.67	43.5%
8.83	0.47	0.61	31.8%
8.85	0.47	0.56	20.3%
8.86	0.47	0.53	14.5%
8.87	0.47	0.51	8.8%
8.88	0.47	0.48	3.2%
8.89	0.47	0.45	-2.4%
8.90	0.47	0.43	-8.0%
8.91	0.47	0.40	-13.5%
8.92	0.47	0.38	-18.9%
8.93	0.47	0.35	-24.2%
8.94	0.47	0.33	-29.4%
8.95	0.47	0.30	-34.6%
8.97	0.47	0.26	-44.7%
8.99	0.47	0.21	-54.6%
9.01	0.47	0.17	-64.0%
9.03	0.47	0.13	-72.6%
9.05	0.47	0.10	-79.1%
9.07	0.47	0.08	-83.7%
9.09	0.47	0.06	-87.6%
9.11	0.47	0.04	-90.9%
9.13	0.47	0.03	-93.8%
9.15	0.47	0.02	-96.4%

WATERLINE AT ZERO
AREA ERROR = 8.881

STREAM NAME: Pruden Creek
XS LOCATION: 0.25 mile d/s from USFS-BLM border
XS NUMBER: 1 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	8.58	6.43	0.25	0.62	1.58	6.93	100.0%	0.23	1.91	1.21
	8.58	6.41	0.25	0.62	1.58	6.91	99.8%	0.23	1.90	1.21
	8.63	5.25	0.24	0.57	1.28	5.71	82.5%	0.22	1.54	1.20
	8.68	4.09	0.26	0.52	1.05	4.52	65.3%	0.23	1.29	1.22
	8.73	3.01	0.29	0.47	0.88	3.40	49.1%	0.26	1.15	1.31
	8.78	2.77	0.27	0.42	0.73	3.11	44.9%	0.24	0.91	1.24
	8.83	2.69	0.22	0.37	0.60	2.98	43.0%	0.20	0.66	1.11
WL	8.88	2.61	0.18	0.32	0.46	2.85	41.1%	0.16	0.45	0.97
	8.93	2.44	0.14	0.27	0.34	2.64	38.1%	0.13	0.28	0.82
	8.98	2.27	0.10	0.22	0.22	2.42	35.0%	0.09	0.14	0.66
	9.03	1.67	0.07	0.17	0.12	1.78	25.7%	0.07	0.06	0.53
	9.08	0.88	0.07	0.12	0.06	0.95	13.7%	0.06	0.03	0.52
	9.13	0.62	0.04	0.07	0.03	0.65	9.4%	0.04	0.01	0.37
	9.18	0.20	0.01	0.02	0.00	0.21	3.0%	0.01	0.00	0.14

STREAM NAME: Pruden Creek
XS LOCATION: 0.25 mile d/s from USFS-BLM border
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.45	cfs
CALCULATED FLOW (Qc)=	0.45	cfs
(Qm-Qc)/Qm * 100 =	0.7	%
MEASURED WATERLINE (WLm)=	8.90	ft
CALCULATED WATERLINE (WLc)=	8.88	ft
(WLm-WLc)/WLm * 100 =	0.2	%
MAX MEASURED DEPTH (Dm)=	0.32	ft
MAX CALCULATED DEPTH (Dc)=	0.32	ft
(Dm-Dc)/Dm * 100	0.2	%
MEAN VELOCITY=	0.97	ft/sec
MANNING'S N=	0.093	
SLOPE=	0.041	ft/ft
.4 * Qm =	0.2	cfs
2.5 * Qm=	1.1	cfs

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

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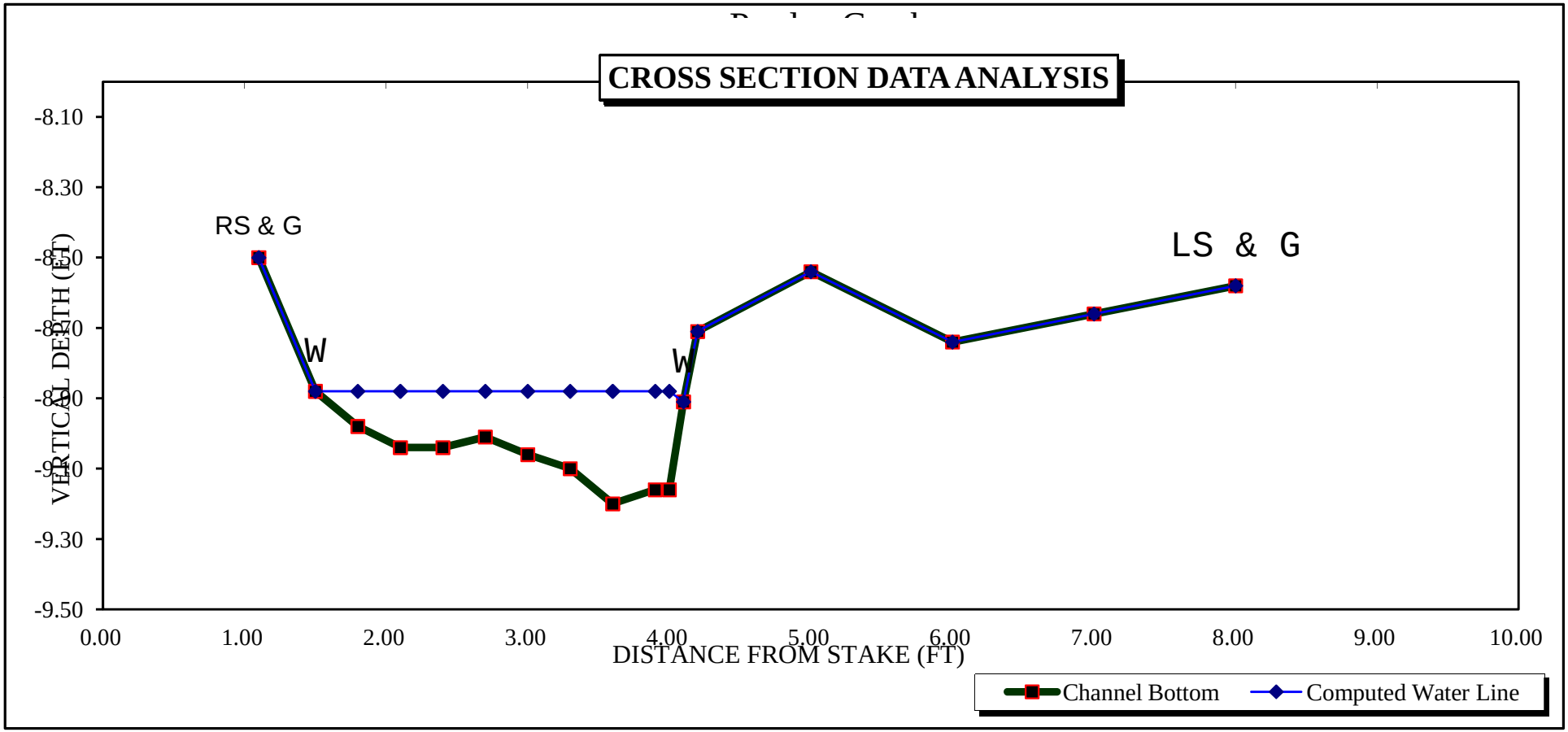
RECOMMENDATION BY: ………………...……..….............................. AGENCY..……………………......…....…...…...... DATE:......…..…......……………

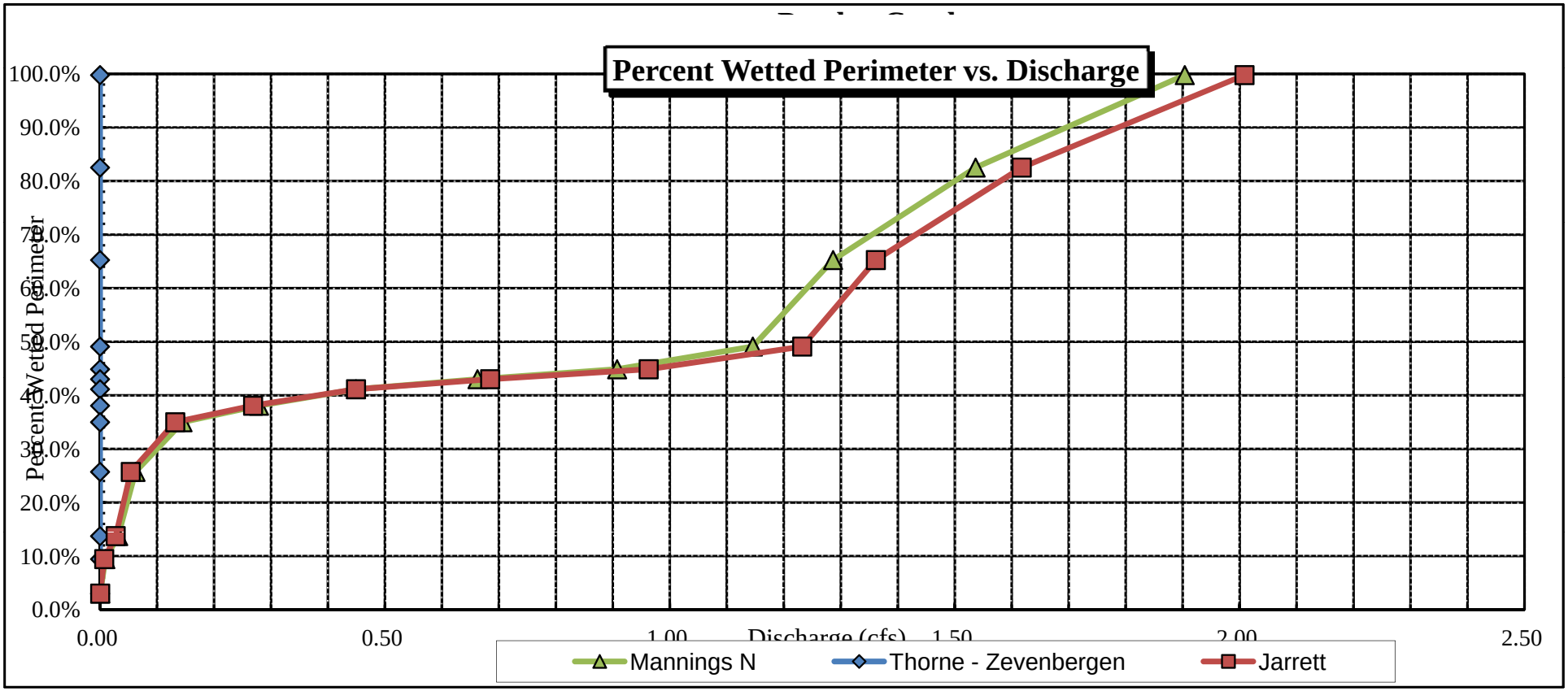
CWCB REVIEW BY: ..……………………….....……………………………………………...…............. DATE:.................……………...…

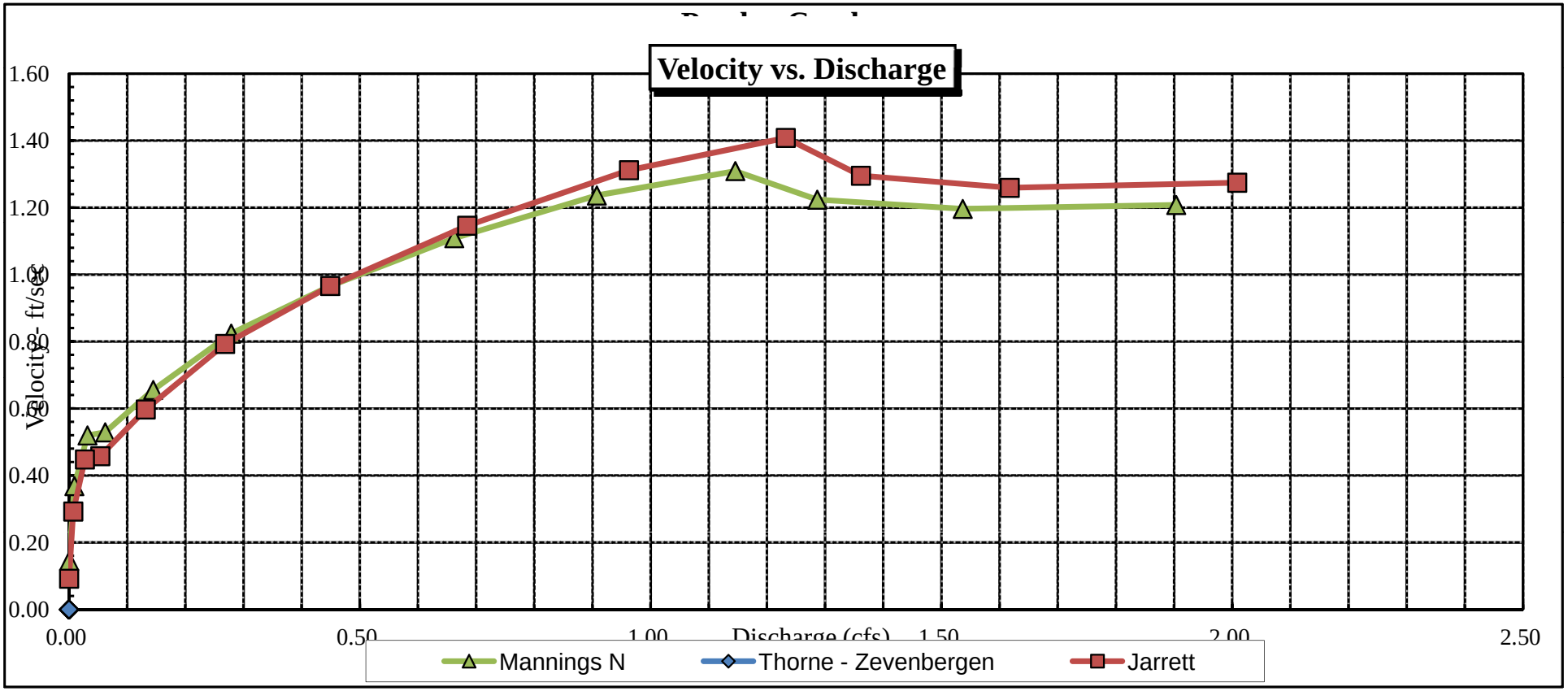
STREAM NAME: Pruden Creek
XS LOCATION: 0.25 mile d/s from USFS-BLM border
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

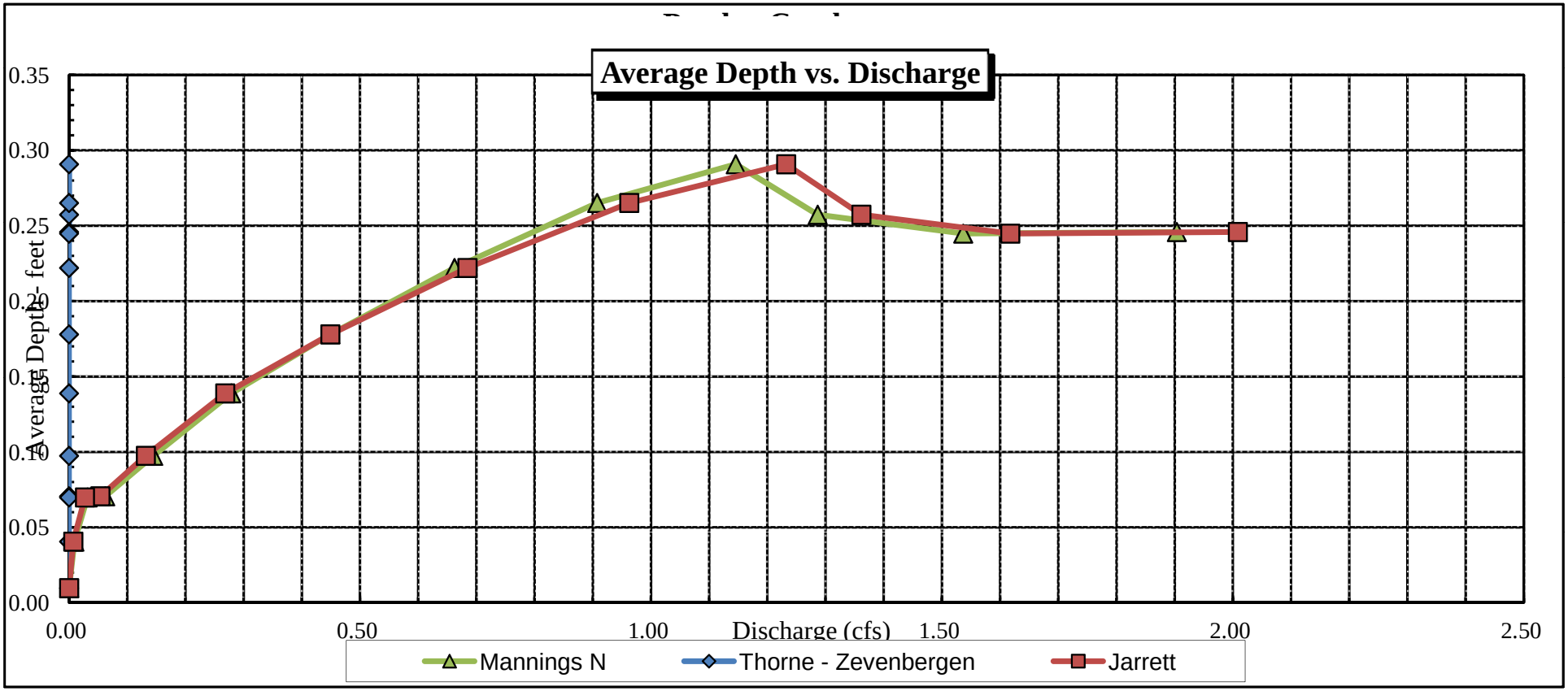
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

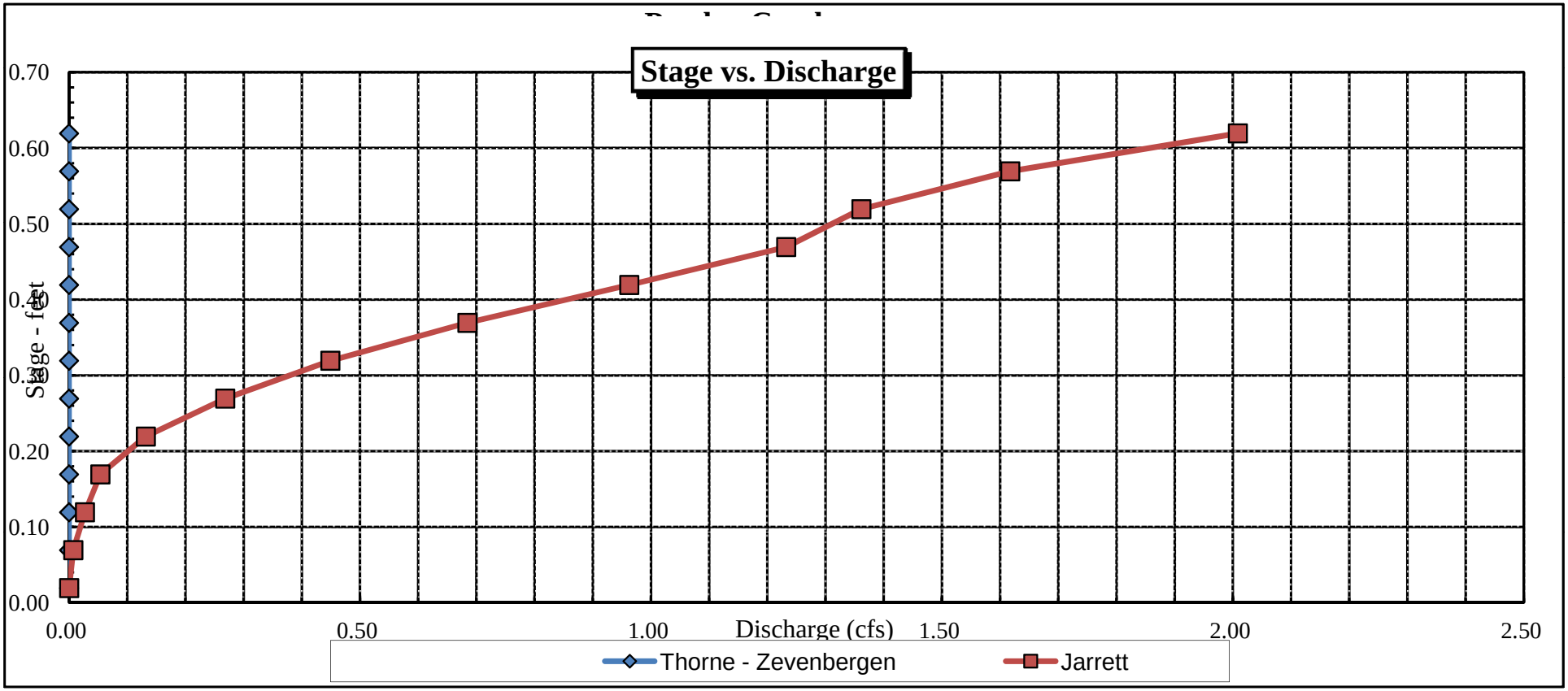
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	8.58	6.43	0.25	0.62	1.58	6.93	100.0%	0.23	2.01	1.27
	8.58	6.41	0.25	0.62	1.58	6.91	99.8%	0.23	2.01	1.27
	8.63	5.25	0.24	0.57	1.28	5.71	82.5%	0.22	1.62	1.26
	8.68	4.09	0.26	0.52	1.05	4.52	65.3%	0.23	1.36	1.30
	8.73	3.01	0.29	0.47	0.88	3.40	49.1%	0.26	1.23	1.41
	8.78	2.77	0.27	0.42	0.73	3.11	44.9%	0.24	0.96	1.31
	8.83	2.69	0.22	0.37	0.60	2.98	43.0%	0.20	0.68	1.15
WL	8.88	2.61	0.18	0.32	0.46	2.85	41.1%	0.16	0.45	0.97
	8.93	2.44	0.14	0.27	0.34	2.64	38.1%	0.13	0.27	0.79
	8.98	2.27	0.10	0.22	0.22	2.42	35.0%	0.09	0.13	0.60
	9.03	1.67	0.07	0.17	0.12	1.78	25.7%	0.07	0.05	0.46
	9.08	0.88	0.07	0.12	0.06	0.95	13.7%	0.06	0.03	0.45
	9.13	0.62	0.04	0.07	0.03	0.65	9.4%	0.04	0.01	0.29
	9.18	0.20	0.01	0.02	0.00	0.21	3.0%	0.01	0.00	0.09


CROSS SECTION DATA ANALYSIS
-8.10
-8.30
-8.50
-8.70
-8.90
-9.10
-9.30
-9.50
VERTICAL DEPTH (FT)
RS & G
W
W
LS & G
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


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
0.50
1.00
Discharge (cfs)
1.50
2.00
2.50
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
Velocity - ft/sec
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.50
1.00
Discharge (cfs)
1.50
2.00
2.50
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - feet
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.50
1.00
Discharge (cfs)
1.50
2.00
2.50
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
Stage - feet
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.50
1.00
Discharge (cfs)
1.50
2.00
2.50
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Pruden Creek					CROSS-SECTION NO.: 2	
CROSS-SECTION LOCATION: At BLM-USFS boundary						
DATE: 8-17-09	OBSERVERS: R. Smith, D. Gilbert, J. Backstrand					
LEGAL DESCRIPTION	¼ SECTION: SW	SECTION: 28	TOWNSHIP: 13 N/S	RANGE: 73 E/W	PM: Sixth	
COUNTY: Park	WATERSHED: South Platte	WATER DIVISION: 1	DOW WATER CODE: 30572			
MAP(S): USGS:						
USFS:						

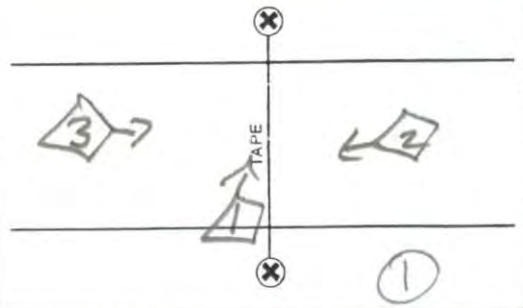
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES/NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: 2" cobbles do 1' boulders	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	5.99 / 5.99
② WS Upstream	4.0	5.87'
③ WS Downstream	11.0	6.51
SLOPE	0.64 / 15.0 = .043	

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:
caddisfly, water striders, mayfly, stonefly

COMMENTS

TDS = 170
Ph = 8.4
Temp = 15°

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Pruden Creek	CROSS-SECTION NO: 2	DATE: 8-17-09	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 2:15 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)
LS	2.0		4.80								
G	4.5		5.60								
W	4.9		5.99								
	5.0		6.15	0.15				0.36			
	5.3		6.20	0.20				0.45			
	5.6		6.20	0.20				0.80			
	5.9		6.15	0.15				0.95			
	6.2		6.25	0.25				0.45			
	6.5		6.25	0.25				0.89			
	6.8		6.25	0.25				0.15			
	7.0		6.05	0.05				0.00			
W	7.1		5.99								
G	7.2		5.58								
RS	10.1		4.55								
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: Pruden Creek						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: At BLM - USFS boundary						
DATE: 8-17-09	OBSERVERS: R Smith, J. Backstrand, D Gilbert					
LEGAL DESCRIPTION	¼ SECTION: SW	SECTION: 28	TOWNSHIP: 13 N/S	RANGE: 73 E/W	PM: Sixth	
COUNTY: Park	WATERSHED: South Platte	WATER DIVISION: 1	DOW WATER CODE: 30572			
MAP(S): USGS:	13 S 450563					
USFS:	4304272					

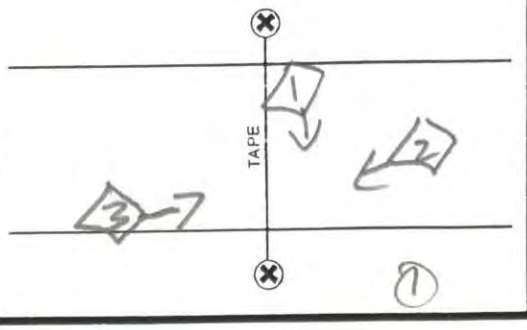
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: 2" cobble to 1' boulders	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	4.22 / 4.19
② WS Upstream	7.0'	4.08
③ WS Downstream	8.0	4.82
SLOPE	0.74/15.0' = 0.05	

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:
caddisfly, mayfly, stonefly

COMMENTS

TDS = 170
Ph = 8.4
Temp = 15°

Riparian community: alder - willow (4 species)
river birch
potentilla

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Pruden Creek	CROSS-SECTION NO.: 1	DATE: 8-17-09	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 1:20 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)
LS	2.0		2.38								
G	7.3		3.82								
	8.6		4.08								
W	9.3		4.22								
	9.6		4.30	0.1				0.30			
	9.9		4.40	0.2				0.74			
	10.1		4.40	0.2				0.82			
	10.5		4.45	0.25				0.86			
	10.8		4.40	0.2				0.98			
	11.1		4.45	0.25				0.73			
W	11.3		4.19								
	12.3		4.08								
G	13.2		3.86								
RS	17.4		2.82								
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: Pruden Creek						CROSS-SECTION NO.:
CROSS-SECTION LOCATION: 1/4 mile downstream from BLM-USFS boundary						
DATE: 5-19-14	OBSERVERS: R. Smith, D. Gilbert					
LEGAL DESCRIPTION	¼ SECTION: SW	SECTION: 28	TOWNSHIP: 13 N/S	RANGE: 73 E/W	PM: 6th	
COUNTY: Park	WATERSHED: S. Platte	WATER DIVISION: 1	DOW WATER CODE: 30572			
MAP(S): USGS:	GPS Zone 13S 450752					
USFS:	4304441					

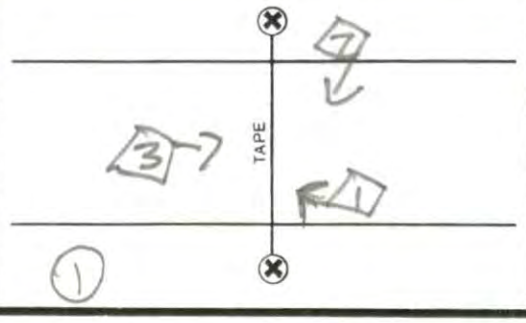
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 4" cobbles	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	surveyed
② WS Upstream	25.0'	8.04
③ WS Downstream	19.8'	9.86
SLOPE	1.82 / 44.8' = .041	

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:

May Fly black fly stone fly caddis fly

COMMENTS

Several fish sighted.

PH = 8.13
Temp = 10.2° C
Cond = 185.8
Salinity = 0.1 ppt

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Pruden Creek	CROSS-SECTION NO: 1	DATE: 5-19-14	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)
G+RS	1.7		8.50								
W	1.5		8.88	0							
	1.8		8.98	.10				0.49			
	2.1		9.04	.16				0.57			
	2.4		9.04	.16				1.25			
	2.7		9.01	.13				1.07			
	3.0		9.06	.18				1.09			
	3.3		9.10	.22				0.99			
	3.6		9.20	.32				1.37			
	3.9		9.16	.28				0.61			
	4.0		9.16	.28				0.67			
W	4.1		8.91	0							
	4.2		8.71								
	5.0		8.54								
	6.0		8.74								
	7.0		8.66								
G+LS	8.0		8.58								
TOTALS:											

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

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information

File Name	PRUDNBLM.001.WAD
Start Date and Time	2015/09/25 13:54:39

Site Details

Site Name	PRUDEN BLW BLM 7I10M
Operator(s)	BRIAN EPSTEIN

System Information

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

Units (English Units)

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

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.6%	0.8%
Velocity	1.1%	5.0%
Width	0.2%	0.2%
Method	2.9%	-
# Stations	5.1%	-
Overall	**6.1%**	**5.2%**

Summary

Averaging Int.	40	# Stations	10
Start Edge	LEW	Total Width	2.000
Mean SNR	29.1 dB	Total Area	0.776
Mean Temp	55.32 °F	Mean Depth	0.388
Disch. Equation	Mid-Section	Mean Velocity	0.6211
		Total Discharge	**0.4821**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	13:54	1.30	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	13:54	1.50	0.6	0.300	0.6	0.120	0.3002	1.00	0.3002	0.060	0.0180	3.7
2	13:56	1.70	0.6	0.390	0.6	0.156	0.4459	1.00	0.4459	0.078	0.0348	7.2
3	13:57	1.90	0.6	0.430	0.6	0.172	0.8550	1.00	0.8550	0.086	0.0736	15.3
4	13:58	2.10	0.6	0.470	0.6	0.188	1.0141	1.00	1.0141	0.094	0.0954	19.8
5	13:59	2.30	0.6	0.490	0.6	0.196	0.8553	1.00	0.8553	0.098	0.0839	17.4
6	14:00	2.50	0.6	0.500	0.6	0.200	0.6247	1.00	0.6247	0.100	0.0625	13.0
7	14:01	2.70	0.6	0.520	0.6	0.208	0.4560	1.00	0.4560	0.104	0.0475	9.8
8	14:03	2.90	0.6	0.520	0.6	0.208	0.4262	1.00	0.4262	0.156	0.0664	13.8
9	14:03	3.30	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

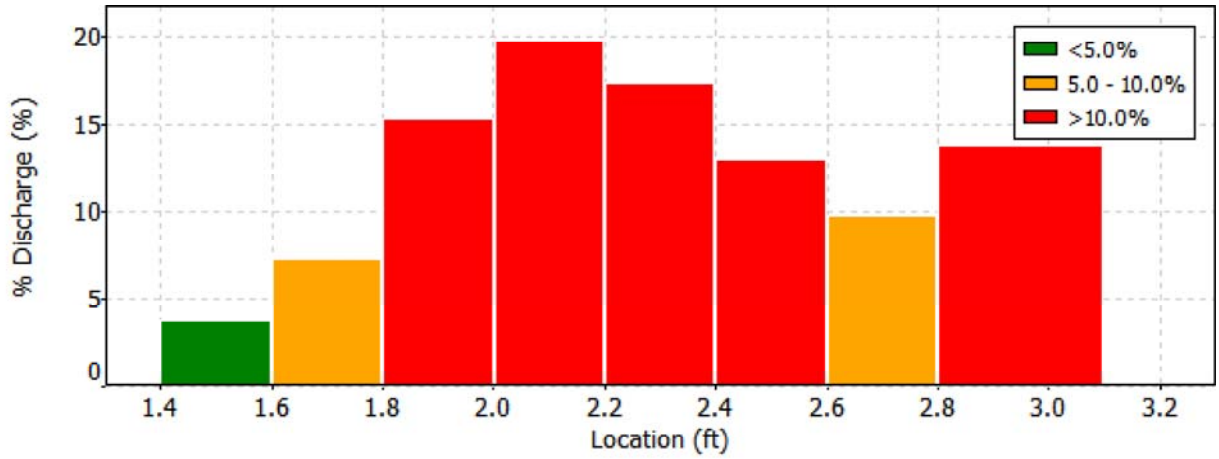
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

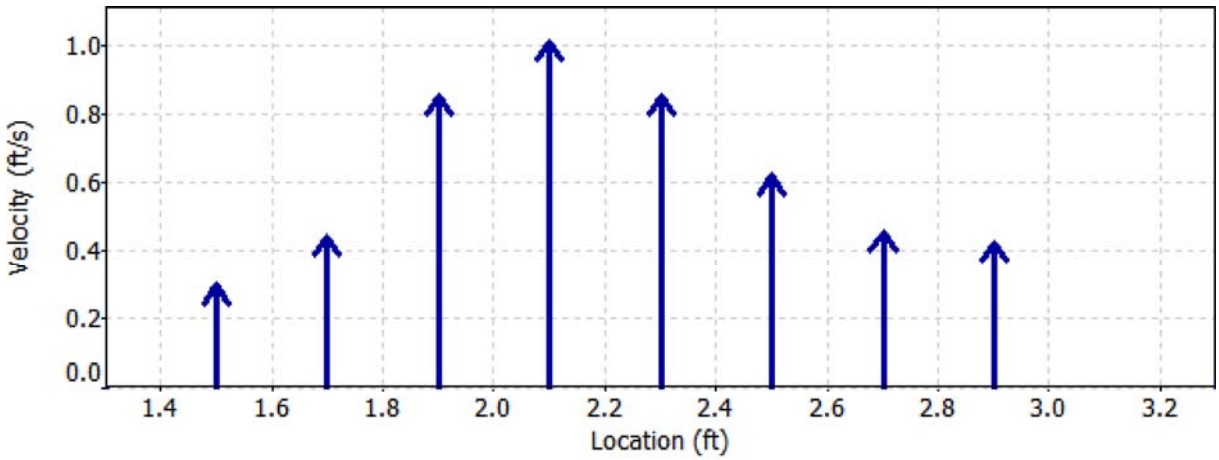
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

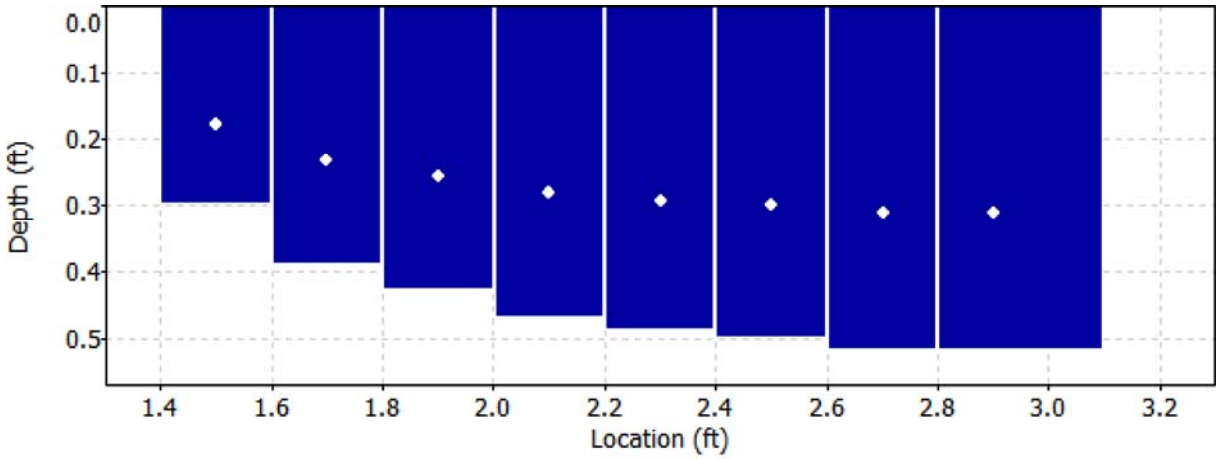
Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information		Site Details	
File Name	PRUDNBLM.001.WAD	Site Name	PRUDEN BLW BLM 7I10M
Start Date and Time	2015/09/25 13:54:39	Operator(s)	BRIAN EPSTEIN







COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information	
File Name	PRUDNBLM.001.WAD
Start Date and Time	2015/09/25 13:54:39

Site Details	
Site Name	PRUDEN BLW BLM 7I10M
Operator(s)	BRIAN EPSTEIN

Quality Control

No Quality Control warnings

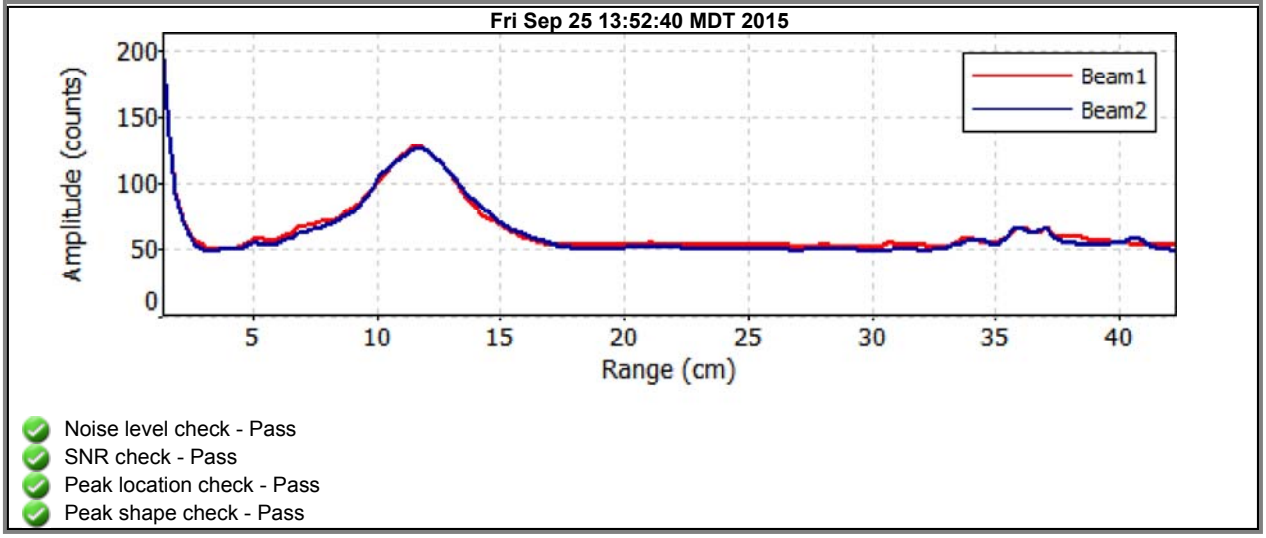
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information		Site Details	
File Name	PRUDNBLM.001.WAD	Site Name	PRUDEN BLW BLM 7I10M
Start Date and Time	2015/09/25 13:54:39	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



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

Page 1 of 2	State of Colorado	Meas. No.:	001
YYYY: 2015	**Colorado Water Conservation Board**	Division:	1
MM-DD: 09-25	ADV Discharge Measurement Notes	District:	23

Station Name:

Pruden — River, (Creek), Canal, Ditch

At, Near, Above, (Below) — BLM bridge ~0.7 miles

Latitude: 38.89933° Longitude: 105.55562° WGS84

Party: Brian Epstein

Conditions

Weather: ~72°F sunny

Wind Spd / Dir: light occasional REW Water Temp: LEW

X-Sec Desc: bed fines, with some grass (cleared) U-shaped

Flow Conds: Parallel flow lines but not parallel to bank

Control Desc.: N/A

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

Water Level Reading

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

Pressure Transducer Download		Weighted MGH		
File Name:	N/A	GH Corr.		
Time:		Correct MGH		

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	(R2354) / P2355
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	~~PRUDNBLM.001~~ PRUDNBLM.001		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6

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

Start Edge: REW 1.3	End Edge: LEW 3.3	Total Width:	2.0
Start Time: 13:54	End Time: 14:05		
Discharge: 0.40	Unsertainty: 6.1	# Stations:	10
Mean v: 0.62	Width 2.0	Mean d:	0.39
Max v: 1.01	Area: 0.78	Max d:	0.52
Mean SNR: 29.1	σv: 0.017	Mean Temp:	55.3

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

Remarks:

* See :- iPhone App Trimble GPS Hunt for GPS points : 20150925Pruden&Bodm
- iPhone Camera used for pictures

20150925PrudenCr001
- discharge measurement location
- thick woody riparian veg, mixed with non-wood riparian

1:43 Pic 20150925PrudenCr002
X-section looking downstream

State of Colorado

Colorado Water Conservation Board

Field Notes

Pruden Creek

Participants: Dave Rodgers, Roy Smith, Garver Brown, Susan Schneider, Linda Bassi, Jeff Baessler, Keith , Brian Epstein

Conversation
- Jeff summarize the program
- goal are structures and land interaction, ownership

Pic 265 Walking down to BLM enclosure

14:17 GPS: Pruden Obs 0267
- BLM wildlife exclosure
- Pic 266 Pruden Creek u.s. of gps point
  267 " " " " " " "
  268 " " " " " " w/ people
  269 Pruden ds of gps

14:37 GPS: Pruden obs 0268
- hill overlooking pruden creek, from right
- Pic 270 from gps point looking down valley
  - near pond is on private, not owned by David Rodgers
  - far pond on David Rodgers land
  Pic 271 from gps point looking cross valley
  Pic 272 from gps point looking up valley
  Pic 273 " " " " " "
  Panorama 274-278 starting ds. moving to u.s.

15:00 GPS: Pruden obs 0269
- hill overlooking Pruden, from left: Pics 279-282

15:27 GPS: Pruden Obs 0270
- inlet to big pond, proposed LT
- Pic 283 from gps point looking downstream
  284 from left bank looking at gps point (past right of travel)
  285 from dam looking u.s. at inlet, gps point

15:52 GPS Pruden Obs #11
- diversion to save ranch road
  - last cottonwoods below indicates dry below, water diverted to lands on the right of the creek bed
  - 1st year of diversion, diversion had needed to save road
- Pic 286 from gps point looking d.s.
  Pic 287 from gps point looking u.s.

State of Colorado

Colorado Water Conservation Board

Field Notes

Pruden Creek

16:30 arrive Forest Service Road 253 by Creek
- GPS: Pruden Obs 001
  - truck location on FS Rd 253 by Pruden Creek
  - Pic 250 from GPS location looking down valley
  - Pic 251 from GPS location looking up valley
  - hiked around area
    - found an unmapped tributary to Pruden by walking across Pruden in a perpendicular manner toward the east
  - abundant riparian vegetation
  - mixed forest upland vegetation: aspen/conifer/shrub/Grasslands

17:39 GPS: Pruden Obs 002
- confluence of unnamed/unmapped tributary to Pruden with Pruden Creek
  - Pic 252 from 20' ds looking us at confl
  - Pic 253 from 20' ds looking ds at Pruden Cr
- woody debris and cobbles along with riparian veg and low gradient give stability to stream
- in communication with flood plain
- soggy ground with riparian veg 15' of main channel on both sides
  - cow manure moderately present
  - huff prints in soggy areas
  - Pic 254 example of areas riparian veg and huff prints in soggy bank areas, directly left bank area of channel at confl

Notes By: Brian Epstein YYYY-MM-DD: 2015-08-05 Page 1 of 2

19:14 GPS: Pruden Obs 003
- large spring complex
- Pic 255-256 from 10' above gps spring looking from upslope
- within conifer forest
- Pic 257-258 and vid 259 from confluence with Pruden Creek looking upstream at spring complex origin ~90' upslope (out of picture)

19:30 GPS: Pruden Obs 004
- Spring contributes ≥ 90% of flow
- Pic 260 & 261 from gps location looking upstream at Pruden
- Pic 262 from 15' below gps location looking upstream at Pruden after spring contribution
- gps location is confluence of tributary spring with Pruden Creek

19:43 GPS: Pruden Obs 005
- Pic 263 from GPS location, creek left, looking cross valley at landform and veg type

20:11 GPS: Pruden Obs 006
Pic 264 from gps point on FS Rd 253 valley form looking down valley