DRAFT RECOMMENDATION – SUBJECT TO CHANGE

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 instream flow water rights on Naturita Creek, located in Water Division 4.

Location and Land Status. Naturita Creek originates near Lone Cone Mountain, approximately three miles southwest of Gurley Reservoir and eight miles south of Norwood. Naturita Creek flows into the San Miguel River approximately three miles east of the community of Naturita. This recommendation covers two stream reaches. The upper reach begins at the confluence of East Naturita Creek and West Naturita Creek and extends to the Norwood Road Crossing, a distance of approximately 11.7 stream miles. The lower reach begins at the confluence with Mud Springs Draw and extends to the confluence with the San Miguel River, a distance of approximately 15.7 stream miles.

In the upper reach, BLM manages 1.9 miles, the U.S. Forest Service manages 6.1 miles, and 3.7 miles are in private ownership. In the lower reach, BLM manages 7.7 miles, and 8.0 miles are in private ownership.

Existing Instream Flow Water Right. In 1984, the CWCB appropriated an instream flow water right on the upper reach of Naturita Creek in the amount of 3.0 cfs, year round.

Biological Summary. The upper reach of Naturita Creek is a cold-water, high gradient stream located within a deep canyon that is generally less than 0.5 mile in width. The stream is typically narrow and has a good width-to-depth ratio. The substrate is highly variable, ranging from gravels to 2-foot boulders. Bank stability is excellent because of numerous bedrock controls, a vigorous riparian community, and abundant woody debris.

The lower reach of Naturita Creek is a cool-water, low gradient stream within a canyon that is generally less than 0.5 mile in width. The stream is characterized by numerous beaver dams and few riffles habitats because of stream channel inundation caused by beaver activity. The substrate is highly variable, ranging from gravels to 2-foot boulders. Bank stability is excellent because of a vigorous riparian community and lack of disturbance from grazing.

In the upper reach, the riparian community is comprised of willow species, red osier dogwood, narrowleaf cottonwood, and box elder. In the lower reach, the riparian community is dominated by willow species and box elder.

Fish inventories have revealed that Naturita Creek has a self-supporting population of speckled dace, fathead minnow, and green sunfish. Usage by bluehead suckers has also been confirmed,

but BLM has not been able to fully document which portions of the creek are used by bluehead suckers. It appears that the bluehead suckers may occupy the creek year-round and not just during spawning season, because bluehead suckers have been confirmed in the creek during September.

An intensive macroinverterbrate survey has not been performed, but BLM spot surveys have revealed a macroinvertebrate community that includes stoneflies, mayflies and caddisflies.

R2Cross Analysis. BLM will collect data during the 2018 field season to confirm whether the existing instream flow water right is adequate to protect fish habitat, based upon current instream flow quantification methodologies.

BLM collected the following R2Cross data from the lower reach:

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)
6/27/2017 #1	6.32 cfs	10.77 feet	Out of range	14.36 cfs
6/27/2017 #2	7.25 cfs	13.47 feet	Out of range	9.00 cfs
10/3/2017 #1	2.19 cfs	10.68 feet	1.27 cfs	Out of range
		Averages:	**1.27 cfs**	**11.68 cfs**

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

Upper Reach – Confluence of East Naturita Creek and West Naturita Creek to confluence with Mud Spring Draw

(*Recommendation to be based upon 2018 data collection*.)

Lower Reach – Confluence with Mud Springs Draw to confluence with San Miguel River

> 11.7 cubic feet per second is recommended during the snowmelt runoff season from April 1 to June 30. This recommendation is driven by the average velocity criteria. This flow rate will support passage of native fishes, such as bluehead sucker, that enter the creek from the San Miguel River for spawning purposes. This flow rate will also provide sufficient physical habitat for speckled dace, which begin to spawn during early summer.
>
> 6.50 cubic feet per second is recommended from July 1 through September 30, which is the time of year when the creek receives substantial return flow from irrigation operations. This recommendation is driven by limited water availability. This flow rate significantly exceeds the average depth and wetted perimeter criteria while providing velocities in the range of 0.75 to 0.9 feet per

second.

1.25 cubic feet per second is recommended for the cold weather portion of the year, from October 1 through March 31. This flow rate is driven by the wetted perimeter criteria. This flow rate should prevent freezing in large pools and beaver ponds, where speckled dace would be expected to overwinter.

Water Availability. Naturita Creek has very complex and highly altered hydrology. Natural hydrology in the upper reach is depleted by diversions into storage and irrigation systems. Natural hydrology in the lower reach is altered by large volumes of return flows from irrigation water that is imported to the Naturita Creek watershed from other watersheds.

BLM recommends consulting multiple sources of data to establish typical hydrologic conditions. For baseline natural hydrology, BLM recommends consulting USGS Gage 09173000 for Beaver Creek near Norwood, CO. This gage is located in the watershed immediately to the east of Naturita Creek, which has very similar elevation, aspect, and slope. This gage also has a long 40-year period of record. Records for this gage will have to be adjusted for diversions out of the Beaver Creek watershed to Gurley Reservoir. USGS Gage 09175000 for West Naturita Creek near Norwood, CO should also be consulted to establish baseline natural hydrology. However, any use of this data must acknowledge that flows were substantially altered during the 1960s by construction of Miramonte Reservoir.

BLM recommends consulting irrigated acreage records maintained by the Colorado Division of Water Resources to identify the number of irrigated acres that provide return flows to the lower reach. If this acreage is combined with an irrigation efficiency factor and a return flow factor, it would be possible to develop an estimate of the volume of return flows that typically accrue to the lower reach for each month of the irrigation season. The local water commissioner should also be consulted to determine whether the irrigation systems that service this acreage deliver any waste water to Naturita Creek from the terminus of the irrigation systems.

BLM is aware of the following water rights located within upper reach:

Mondlin Pump Stations Nos. 1, 2, & 3 – 0.5 cfs
Mondlin Wastewater Ditch – 0.15 cfs
Johnson Ditch and Pump – 0.5 cfs

BLM is aware of the following water rights located within the lower reach:

Redvale Pump Station – 1.6 cfs
Austrian Twin Ditch – 1.5 cfs
Maverick Draw Ditch – 3.81 cfs
Pebble Bench Golf Course Diversion – 0.5 cfs
Pottorf Pumping Station – 0.5 cfs
Files Pump – 0.35 cfs

Relationship to Land Management Plans. The draft land use plan for the Uncompahgre Field

Office specifies that when BLM authorizes any management actions, such as mineral leasing and rights-of-way, such authorizations will contain stipulations to protect riparian values associated with the creek. The plan also specifies that grazing along with creek will be managed to meet BLM's land health standards.

Appropriation of an instream flow water right would assist BLM in long-term management of riparian values, aquatic habitat, and amphibian and values.

Relationship to Basin Implementation Plan. BLM notes that the Southwest Basin Implementation Plan lists an instream flow appropriation on Naturita Creek as one of the projects and processes necessary to meet the environmental goals of the plan.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2018. 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: Greg Larson, Uncompahgre FO
Jedd Sondergard, Uncompahgre FO

Uncompaghre Field Office Stream Surveys

May 2016

Naturita Creek – Water Code #41804

Introduction:

Naturita Creek is a small creek that is a tributary to the San Miguel River in Southwestern Colorado. The headwaters to this creek start up around the Lone Cone area in the San Juan Mountains and flows down to where it eventually parallels CO Hwy 141 until it reaches the small town of Naturita and empties into the San Miguel River.

Method:

The stream has been surveyed since 2010 by the BLM. Species primarily found in previous surveys have been bluehead suckers (*Catastomus discobolus*) a BLM species of concern and speckled dace (*Rhinichthys osculus*), both native species. Surveys have previously occurred in the fall, around the month of September; but this year it was surveyed on May 11, 2016. The survey location for this stream was approximately 500' downstream of the CO Hwy 141 crossing. A two pass depletion survey was performed using one backpack shocker set at 135 v and two netters. A series of beaver dams were used as barriers to mark to upstream and downstream extents of the 500' reach. JakeOmatic 2.42 software was used to perform the analysis from the catch data (table 1). The software was also used to create a level 2 output that includes number of fish per mile and acre, as well as pounds per acre (figure 2). Personnel present for the survey was Russ Japuntich Southwest District Fisheries Biologist, Josh Ryan Southwest District Fisheries Technician, and Ken Holsinger Wildlife Biologist Uncompahgre Field Office.

Analysis:

The sampling effort yielded a total of 42 fish, with 25 captured during the first pass and the remaining 17 captured during the second pass. A total of four different species were captured, species included: bluehead sucker, fathead minnow (*Pimephales promelas*), speckled dace (*Rhinichthys osculus*), and green sunfish (*Lepomis cyanellus*). One bluehead sucker was captured during the survey, the individual had a length of 200 mm and a weight of 86.5 g. Fathead minnows accounted for 17% of the catch. Length frequencies and relative weights (Wr) can be found in figures 3 and 4. The species that accounted for the highest percentage of capture was speckled dace at 71%, with 30 individuals captured. A capture probability = 0.28 and population estimate of 69.00, at a 95% CI (± 148.28) was calculated (table 2). The length frequencies and Wr for the species are found in figures 5 and 6. Green

sunfish accounted for 10% of the catch with 4 individuals captured. A capture probability = 1.00 and population estimate = 4.00 was calculated (table 2). Figures 7 and 8 respectively show the length frequencies and Wr for green sunfish.

Discussion:

The flows at this location were relatively high and the water was stained brown due to run-off and irrigation flows. The irrigation component to the stream also resulted in a low conductivity, which related to the fairly low to poor efficiency. A second backpack could have been useful to combat the low conductivity and high flows. The lack of native sucker species was also concerning and could be a result of the beaver ponds acting as barrier.

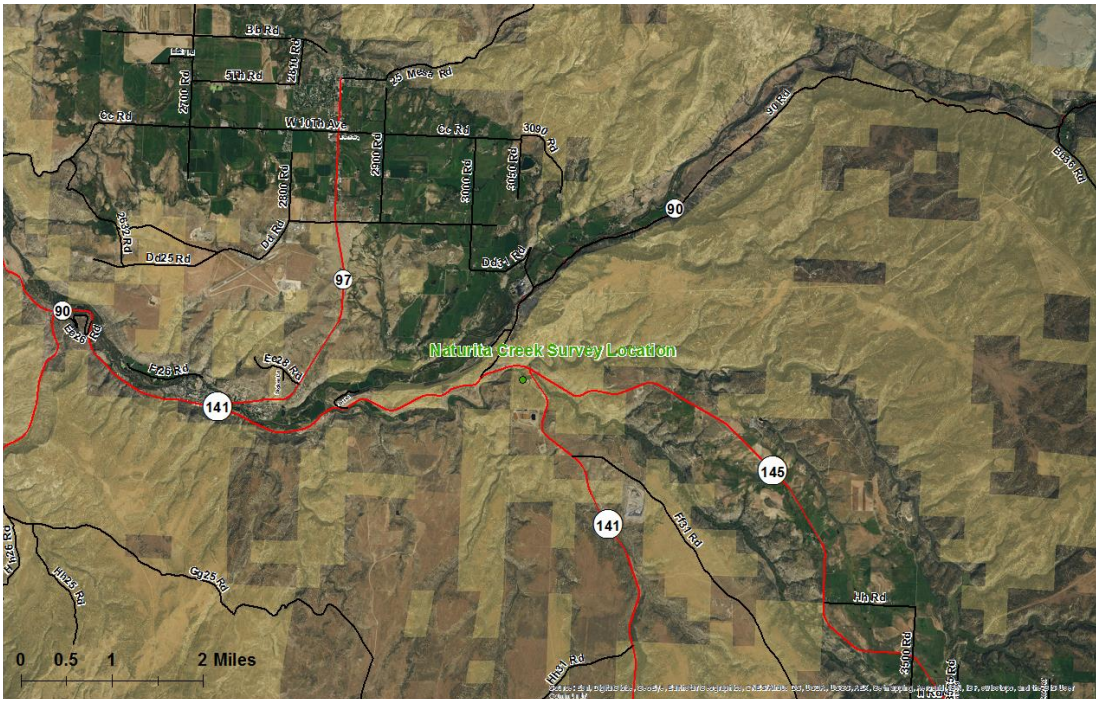
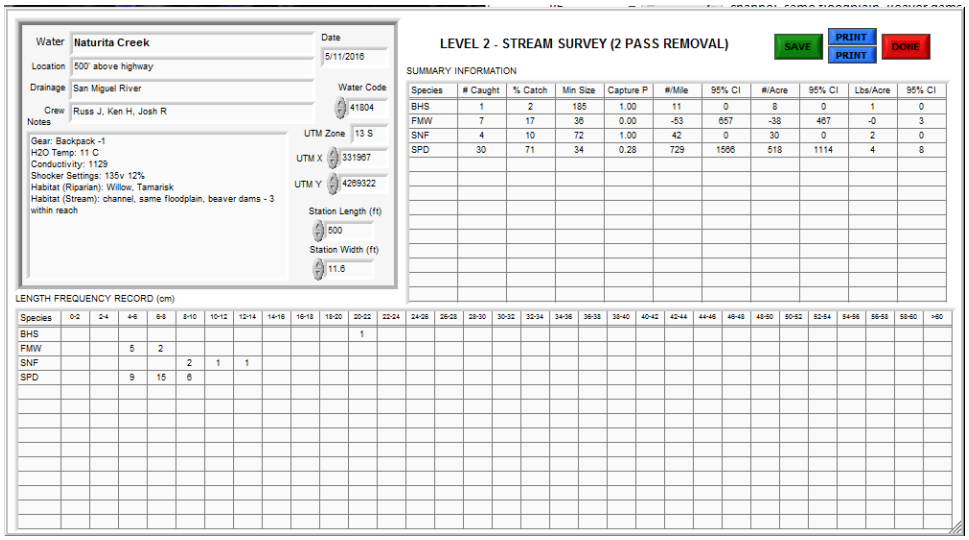


Figure 1. Map show the location of the Naturita Creek Survey site at the intersection of CO Hwy 145 and CO Hwy 141.



Water: Naturita Creek
Location: 500' above highway
Drainage: San Miguel River
Crew: Russ J, Ken H, Josh R
Notes: Gear: Backpack -1
H2O Temp: 11 C
Conductivity: 1129
Shocker Settings: 135v 12%
Habitat (Riparian): Willow, Tamarisk
Habitat (Stream): channel, same floodplain, beaver dams - 3 within reach
Date: 5/11/2016
Water Code: 41804
UTM Zone: 13 S
UTM X: 331967
UTM Y: 4269322
Station Length (ft): 500
Station Width (ft): 11.6

LEVEL 2 - STREAM SURVEY (2 PASS REMOVAL)

SAVE PRINT PRINT DONE

SUMMARY INFORMATION

Species	# Caught	% Catch	Min Size	Capture P	#/Mile	95% CI	#/Acre	95% CI	Lbs/Acre	95% CI
BHS	1	2	185	1.00	11	0	8	0	1	0
FMW	7	17	36	0.00	-53	857	-38	467	-0	3
SNF	4	10	72	1.00	42	0	30	0	2	0
SPD	30	71	34	0.28	729	1566	518	1114	4	8

LENGTH FREQUENCY RECORD (cm)

Species	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	38-40	40-42	42-44	44-46	46-48	48-50	50-52	52-54	54-56	56-58	58-60	>60
BHS											1																				
FMW			5	2																											
SNF					2	1	1																								
SPD			9	15	6																										

Figure 2. Shows the Level 2 output from JakeOmatic 2.42.

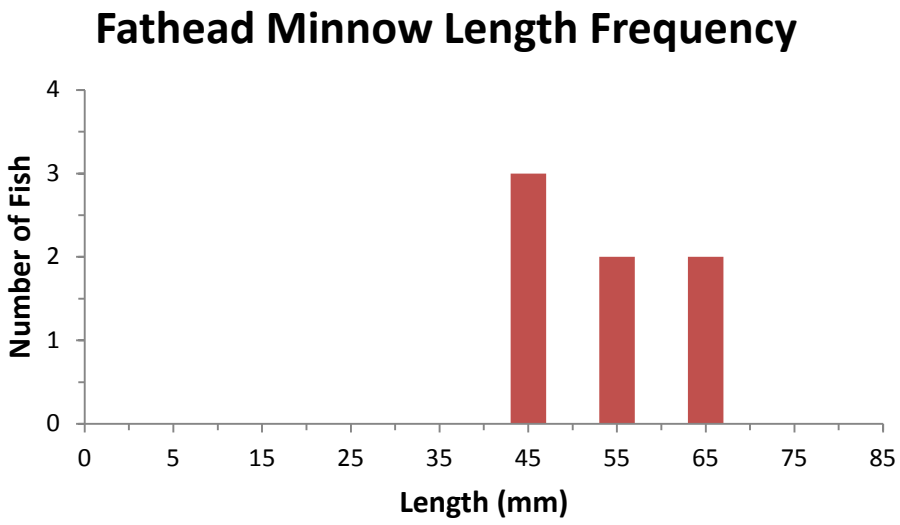


Figure 3. Length frequencies for fathead minnows.

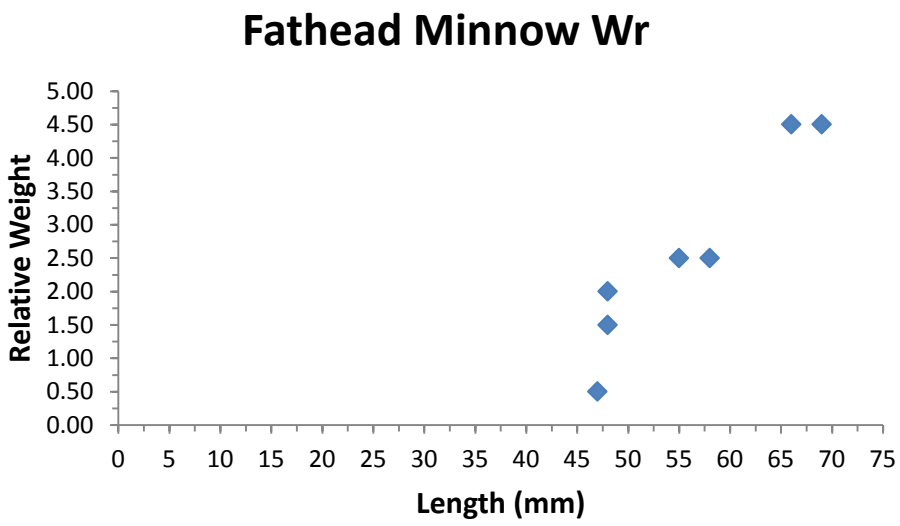


Figure 4. Fathead minnow relative weights.

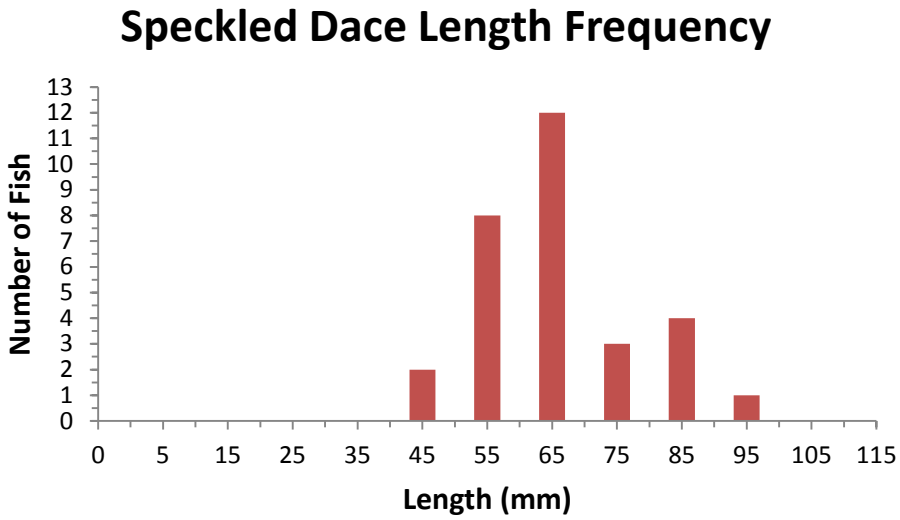


Figure 5. Speckled dace length frequencies.

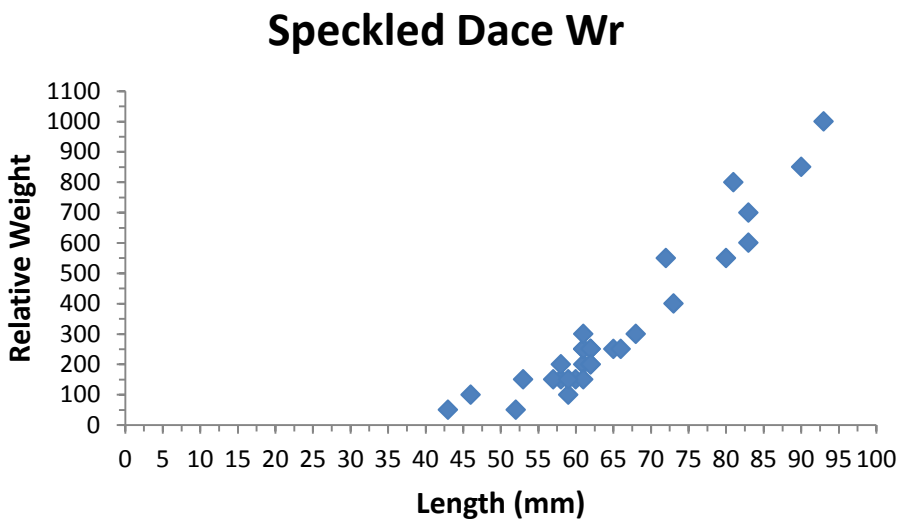


Figure 6. Speckled dace relative weights.

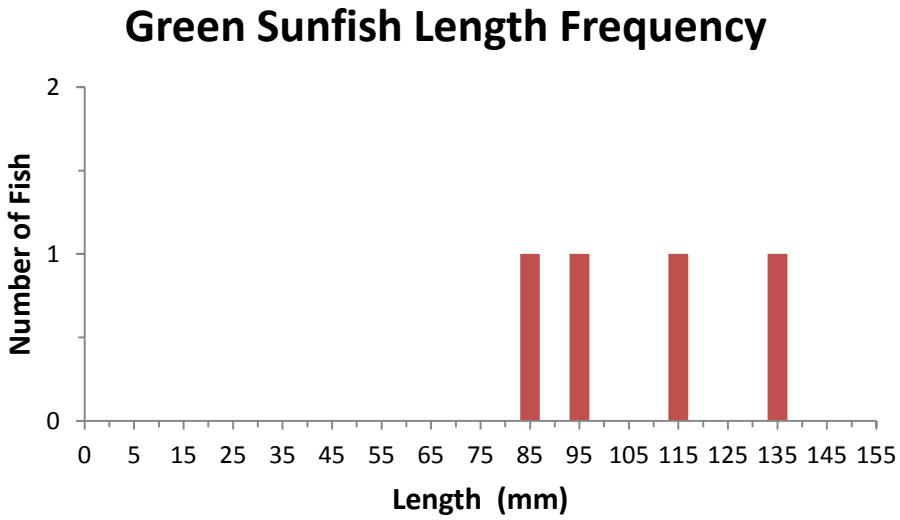


Figure 7. Green sunfish length frequencies.

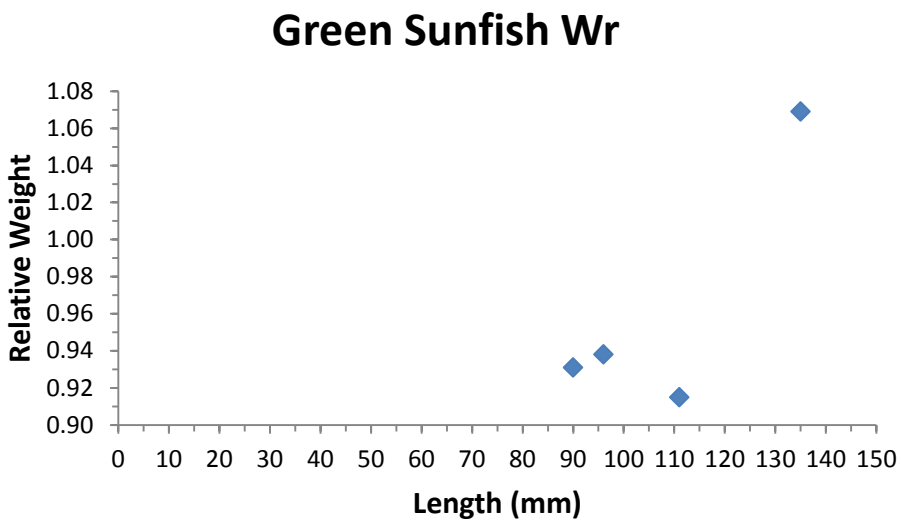


Figure 8. Green sunfish relative weights.

Table 1. Datasheet from survey.

#	Pass	Species	Length	Weight	#	Pass	Species	Length	Weight
1	1	BHS	200	86.5	22	1	SPD	59	1
2	1	SNF	111	24.5	23	1	SPD	43	0.5
3	1	SNF	135	52.5	24	1	SPD	61	1.5
4	1	SNF	90	13	25	1	SPD	52	0.5
5	1	SNF	96	16	26	2	SPD	90	8.5
6	1	SPD	93	10	27	2	FMW	69	4.5
7	1	SPD	81	8	28	2	SPD	80	5.5
8	1	SPD	83	7	29	2	SPD	68	3
9	1	FMW	66	4.5	30	2	SPD	83	6
10	1	SPD	73	4	31	2	SPD	62	2.5
11	1	SPD	72	5.5	32	2	SPD	61	2.5
12	1	SPD	61	2.5	33	2	SPD	66	2.5
13	1	SPD	61	2	34	2	SPD	57	1.5
14	1	SPD	46	1	35	2	SPD	62	2.5
15	1	SPD	62	2	36	2	FMW	58	2.5
16	1	SPD	65	2.5	37	2	FMW	55	2.5
17	1	SPD	60	1.5	38	2	SPD	61	3
18	1	SPD	58	1.5	39	2	SPD	62	2
19	1	FMW	48	2	40	2	SPD	59	1.5
20	1	SPD	58	2	41	2	SPD	53	1.5
21	1	FMW	48	1.5	42	2	FMW	47	0.5

Table 2. Number caught, percentage of catch, capture probability, and population estimates with 95% confidence intervals for each species.

Species	# Caught	% Catch	Capture P	Population Estimate	95% CI (±)
BHS	1	2	1.00	1.00	n/a
FMW	7	17	n/a	n/a	62.23
SNF	4	10	1.00	4.00	n/a
SPD	30	71	0.28	69.00	148.28

Photo of a bluehead sucker.

A bluehead sucker, displaying it’s well-defined scraping ridge and lateral notches.

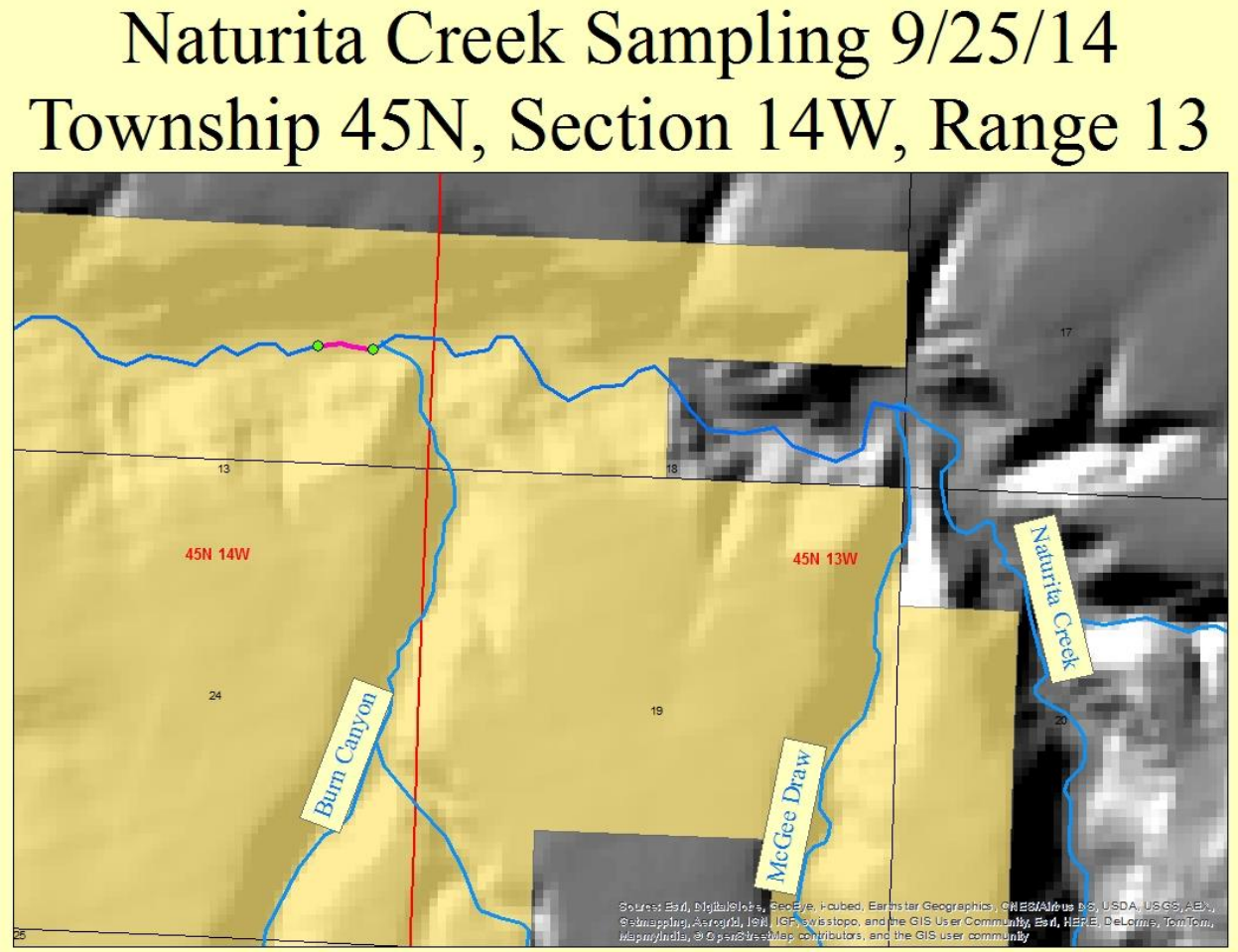
The survey crew electrofishing Naturita creek.

Uncompahgre Field Office Stream Surveys

September 2014

Naturita Creek Water Code: 41804

Naturita Creek, located on BLM lands managed by the Uncompahgre Field Office, was sampled on September 25, 2014. Naturita Creek is tributary to the San Miguel River. A backpack electroshocking unit it was used to sample the stream with one pass to determine species composition. A two-pass population estimate was not completed since only two bluehead suckers were collected. Native species blue headed sucker (*Catostomas discobolus*, BHS) and speckled dace (*Rhinicthys, osculus*, SPD) were the only species seen or collected. Personnel present were Ken Holsinger, Jedd Sondergaard, Tom Fresques, and Kristen Doyle, BLM.



Bluehead sucker

Naturita Creek

STREAM SURVEY FISH SAMPLING FORM 2014									
WATER: Naturita Creek				**DATE: 9/25/14**			**GEAR: BPE-1**		
Crew: Holsinger, Sondergaard, Fresques, Doyle					**Location: Below Confluence of Burn Canyon**				
#	**Pass**	**Species**	**Length**	**Weight**	**#**	**Pass**	**Species**	**Length**	**Weight**
1	1	BHS	151	35.4	42	1	SPD	101	10.1
2	1	SPD	81	6.6	43	1	SPD	76	4.1
3	1	SPD	99	11.6	44	1	SPD	79	4.7
4	1	SPD	81	6.5	45	1	SPD	87	7.1
5	1	SPD	94	10.8	46	1	SPD	63	3.5
6	1	SPD	90	8.7	47	1	SPD	87	6.5
7	1	SPD	72	5.3	48	1	SPD	72	3.5
8	1	SPD	71	6	49	1	SPD	68	4.4
9	1	SPD	88	9.2	50	1	SPD	87	2.7
10	1	SPD	89	7.4	51	1	SPD	75	5.2
11	1	SPD	87	7.5	52	1	SPD	91	9.8
12	1	SPD	82	6.8	53	1	SPD	72	4.3
13	1	SPD	90	7.5	54	1	SPD	66	3.2
14	1	SPD	86	7.9	55	1	SPD	79	1.8
15	1	SPD	72	5.3	56	1	SPD	63	3.7
16	1	SPD	67	3.2	57	1	SPD	49	1.9
17	1	SPD	91	8.4	58	1	SPD	44	1.8
18	1	SPD	99	135	59	1	SPD	79	42
19	1	SPD	74	6	60	1	SPD	91	74
20	1	SPD	90	9.1	61	1	SPD	42	1.5
21	1	SPD	51	--	62	1	SPD	41	0.7
22	1	SPD	91	8.1	63	1	SPD	42	0.7
23	1	BHS	101	12	64	1	SPD	73	4.7
24	1	SPD	82	7.3	65	1	SPD	73	4.1
25	1	SPD	74	6.3	66	1	SPD	70	4.8
26	1	SPD	78	6.5	67	1	SPD	69	4.4
27	1	SPD	79	7	68	1	SPD	72	4.2
28	1	SPD	82	7.2	69	1	SPD	72	4.1
29	1	SPD	81	6.7	70	1	SPD	46	2
30	1	SPD	73	5.4	71	1	SPD	67	4.3
31	1	SPD	35	0.9	72	1	SPD	68	3.5
32	1	SPD	67	5.6	73	1	SPD	48	1.3
33	1	SPD	68	5.1	74	1	SPD	39	1
34	1	SPD	67	5.5	75	1	SPD	32	--
35	1	SPD	51	3.6	76	1	SPD	34	--
36	1	SPD	87	8.3	77	1	SPD		
37	1	SPD	52	4.5	78	1	SPD		
38	1	SPD	71	6.4	79	1	SPD		
39	1	SPD	83	7.8	80	1	SPD		
40	1	SPD	62	2.4	81	1	SPD		

41	1	SPD	73	5.4	82	1	SPD		
GPS Coordinates: Start: 4227659.53, 205808.75 End: 4227681.96, 205989.40									
H2O Temp: 66.1°				**Reach Length**: 400 feet				**Stream Widths**:	1.
Conductivity: 1401µs				**Shocker Settings**: 100V					2.
Habitat (Riparian): Willow, cattail, juncus, horsetail, sweetclover, sumac, sedge									3.
									4.
									5.
									Avg: 7’
Habitat (Stream): Silty to rocky riffles, some decent pools									

Discussion:

Naturita Creek was sampled to determine species composition and to look for native fish use. It is likely that native fish occupation peaks in the spring during the spawning season as adult fish move out of the San Miguel River and into tributaries to spawn. The stream had good flow and a nice mix of small pools, riffles, and runs. Substrate consists of gravel and cobbles with some rock. Riparian vegetation is in good condition and consists primarily of willow, sedge, rush, sumac, cattail, horsetail, and riparian grasses.

Two bluehead suckers and speckled dace were the only species seen or collected at the site. It is possible that additional native fish use occurs during the spring spawning period.

Recommendations:

- Consider sampling BLM reaches in the spring during the spawning season to document the extent of adult native fish use

- Consider sampling further up the watershed on BLM lands to look for coldwater species assemblages and the upstream extent of warmwater native fish use

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Naturita Creek - | CROSS-SECTION NO.: 1

CROSS-SECTION LOCATION: Drop off end of seismic road near Paradox Basin Compressor Station

DATE: 6-27-17 | OBSERVERS: R. Smith, J. Sondergard

LEGAL DESCRIPTION | ¼ SECTION: NE | SECTION: 6 | TOWNSHIP: 45 (N/S) | RANGE: 14 (E/W) | PM: NM

COUNTY: Montrose | WATERSHED: San Miguel | WATER DIVISION: 4 | DOW WATER CODE:

MAP(S): USGS: 5897 ft. GPS 723540E 12S 4229334N

USFS:

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES/NO) | METER TYPE: M-M

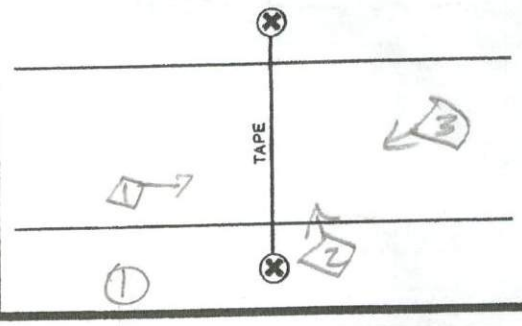
METER NUMBER: | DATE RATED: | CALIB/SPIN: ____ sec | TAPE WEIGHT: surveyed ____ lbs/foot | TAPE TENSION: surveyed ____ lbs

CHANNEL BED MATERIAL SIZE RANGE: gravels to 2-foot 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	8.70 / 8.70
② WS Upstream	20.0	8.58
③ WS Downstream	1.0	8.72
SLOPE	0.14' / 21.0 = .0067	

SKETCH



LEGEND:
Stake ⊗
Station ①
Photo ◇
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,

COMMENTS

Willow - Box Elder Riparian - very healthy & dense. Great bank stability & overhanging banks.

Cross section just upstream from 3 exposed rocks in channel.

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Naturita Creek | CROSS-SECTION NO.: 1 | DATE: 6-27-17 | SHEET ___ OF ___

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

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)
RS	1.2		6.83								
	3.9		6.39								
G	6.7		7.27								
RW	7.8		8.70	0				0			
	7.9		9.10	.3				0			
	8.4		9.10	.4				.16			
	8.8		9.10	.4				.47			
	9.2		9.30	.6				1.03			
	9.6		9.40	.7				1.31			
10.2	10.0	9.4	9.40	.7	.7			1.53	1.62		
	10.4	9.4	9.45	.75	.7			1.73	2.01		
10.6	10.8	9.5	9.45	.75	.8			2.14	1.94		
11.0	11.2		9.45	.75				1.97			
	11.6		9.6	.90				0.10			
	12.0		9.55	.85				0.0			
	12.4		9.7	1.0				0.0			
	12.8		9.7	1.0				1.42			
	13.2		10.1	1.4				0.77			
	13.6		10.1	1.4				0.0			
	14.0		10.1	1.4				0.13			
	14.4		10.1	1.4				1.61			
	14.8		10.0	1.3				1.17			
	15.2		10.0	1.3				1.12			
	15.6		10.0	1.3				0.45			
	16.0		9.75	1.05				0			
	16.6		9.7	1.00				0			
LW	16.7		8.70								
G	17.5		7.24								
	21.6		6.32								
LS	26.0		4.44								
TOTALS:											

End of Measurement | Time: 12:40 | Gage Reading: _____ ft | CALCULATIONS PERFORMED BY: | CALCULATIONS CHECKED BY:

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

LOCATION INFORMATION

STREAM NAME:	Naturita Creek
XS LOCATION:	End of seismic rd nr compressor station
XS NUMBER:	1
DATE:	27-Jun-17
OBSERVERS:	R. Smith, L. Fehlmann
1/4 SEC:	NE
SECTION:	6
TWP:	45N
RANGE:	14W
PM:	NM
COUNTY:	Montrose
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	41804
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:	0.0067

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

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

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 1

DATA POINTS= 33

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	RS	1.20	6.83			0.00		0.00	0.00	0.0%
		3.90	6.39			0.00		0.00	0.00	0.0%
1	G	6.70	7.29			0.00		0.00	0.00	0.0%
	RW	7.80	8.70	0.00	0.00	0.00		0.00	0.00	0.0%
		7.90	9.00	0.30	0.00	0.32	0.30	0.09	0.00	0.0%
		8.40	9.10	0.40	0.16	0.51	0.40	0.18	0.03	0.5%
		8.80	9.10	0.40	0.47	0.40	0.40	0.16	0.08	1.2%
		9.20	9.30	0.60	1.03	0.45	0.60	0.24	0.25	3.9%
		9.60	9.40	0.70	1.31	0.41	0.70	0.28	0.37	5.8%
		10.00	9.40	0.70	1.53	0.40	0.70	0.21	0.32	5.1%
		10.20	9.40	0.70	1.62	0.20	0.70	0.14	0.23	3.6%
		10.40	9.45	0.75	1.73	0.21	0.75	0.15	0.26	4.1%
		10.60	9.40	0.70	2.01	0.21	0.70	0.14	0.28	4.5%
		10.80	9.45	0.75	2.14	0.21	0.75	0.15	0.32	5.1%
		11.00	9.50	0.80	1.94	0.21	0.80	0.16	0.31	4.9%
		11.20	9.45	0.75	1.97	0.21	0.75	0.23	0.44	7.0%
		11.60	9.60	0.90	0.10	0.43	0.90	0.36	0.04	0.6%
		12.00	9.55	0.85	0.00	0.40	0.85	0.34	0.00	0.0%
		12.40	9.70	1.00	0.00	0.43	1.00	0.40	0.00	0.0%
		12.80	9.70	1.00	1.42	0.40	1.00	0.40	0.57	9.0%
		13.20	10.10	1.40	0.77	0.57	1.40	0.56	0.43	6.8%
		13.60	10.10	1.40	0.00	0.40	1.40	0.56	0.00	0.0%
		14.00	10.10	1.40	0.13	0.40	1.40	0.56	0.07	1.2%
		14.40	10.10	1.40	1.61	0.40	1.40	0.56	0.90	14.3%
		14.80	10.00	1.30	1.17	0.41	1.30	0.52	0.61	9.6%
		15.20	10.00	1.30	1.12	0.40	1.30	0.52	0.58	9.2%
		15.60	10.00	1.30	0.45	0.40	1.30	0.52	0.23	3.7%
		16.00	9.75	1.05	0.00	0.47	1.05	0.53	0.00	0.0%
		16.60	9.70	1.00	0.00	0.60	1.00	0.35	0.00	0.0%
	LW	16.70	8.70	0.00	0.00	1.00		0.00	0.00	0.0%
1	G	17.50	7.24			0.00		0.00	0.00	0.0%
		21.60	6.32			0.00		0.00	0.00	0.0%
	LS	26.00	4.44			0.00		0.00	0.00	0.0%
	TOTALS ----------					10.43	1.4 (Max.)	8.30	6.32	100.0%

Manning's n = 0.1373
Hydraulic Radius= 0.79572755

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	8.30	8.30	0.0%
8.45	8.30	10.57	27.3%
8.47	8.30	10.38	25.1%
8.49	8.30	10.20	22.9%
8.51	8.30	10.01	20.7%
8.53	8.30	9.83	18.5%
8.55	8.30	9.65	16.3%
8.57	8.30	9.47	14.1%
8.59	8.30	9.29	11.9%
8.61	8.30	9.11	9.7%
8.63	8.30	8.93	7.5%
8.65	8.30	8.75	5.4%
8.66	8.30	8.66	4.3%
8.67	8.30	8.57	3.2%
8.68	8.30	8.48	2.1%
8.69	8.30	8.39	1.1%
8.70	8.30	8.30	0.0%
8.71	8.30	8.21	-1.1%
8.72	8.30	8.12	-2.1%
8.73	8.30	8.03	-3.2%
8.74	8.30	7.94	-4.3%
8.75	8.30	7.86	-5.4%
8.77	8.30	7.68	-7.5%
8.79	8.30	7.50	-9.6%
8.81	8.30	7.32	-11.8%
8.83	8.30	7.15	-13.9%
8.85	8.30	6.97	-16.0%
8.87	8.30	6.79	-18.2%
8.89	8.30	6.62	-20.3%
8.91	8.30	6.44	-22.4%
8.93	8.30	6.26	-24.5%
8.95	8.30	6.09	-26.6%

WATERLINE AT ZERO
AREA ERROR = 8.700

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
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	7.29	10.77	2.06	2.81	22.17	13.83	100.0%	1.60	26.91	1.21
	7.70	10.23	1.75	2.40	17.86	12.84	92.9%	1.39	19.73	1.10
	7.75	10.16	1.71	2.35	17.35	12.72	92.0%	1.36	18.92	1.09
	7.80	10.10	1.67	2.30	16.85	12.60	91.1%	1.34	18.12	1.08
	7.85	10.03	1.63	2.25	16.34	12.48	90.2%	1.31	17.34	1.06
	7.90	9.96	1.59	2.20	15.84	12.36	89.4%	1.28	16.57	1.05
	7.95	9.90	1.55	2.15	15.35	12.24	88.5%	1.25	15.82	1.03
	8.00	9.83	1.51	2.10	14.86	12.12	87.6%	1.23	15.08	1.02
	8.05	9.76	1.47	2.05	14.37	12.00	86.8%	1.20	14.36	1.00
	8.10	9.70	1.43	2.00	13.88	11.88	85.9%	1.17	13.65	0.98
	8.15	9.63	1.39	1.95	13.40	11.76	85.0%	1.14	12.95	0.97
	8.20	9.56	1.35	1.90	12.92	11.64	84.1%	1.11	12.27	0.95
	8.25	9.50	1.31	1.85	12.44	11.51	83.3%	1.08	11.61	0.93
	8.30	9.43	1.27	1.80	11.97	11.39	82.4%	1.05	10.96	0.92
	8.35	9.36	1.23	1.75	11.50	11.27	81.5%	1.02	10.32	0.90
	8.40	9.30	1.19	1.70	11.03	11.15	80.7%	0.99	9.70	0.88
	8.45	9.23	1.14	1.65	10.57	11.03	79.8%	0.96	9.10	0.86
	8.50	9.17	1.10	1.60	10.11	10.91	78.9%	0.93	8.51	0.84
	8.55	9.10	1.06	1.55	9.65	10.79	78.1%	0.89	7.94	0.82
	8.60	9.03	1.02	1.50	9.20	10.67	77.2%	0.86	7.38	0.80
	8.65	8.97	0.98	1.45	8.75	10.55	76.3%	0.83	6.84	0.78
WL	8.70	8.90	0.93	1.40	8.30	10.43	75.4%	0.80	6.32	0.76
	8.75	8.88	0.88	1.35	7.86	10.33	74.7%	0.76	5.80	0.74
	8.80	8.86	0.84	1.30	7.41	10.22	73.9%	0.72	5.30	0.72
	8.85	8.83	0.79	1.25	6.97	10.12	73.2%	0.69	4.82	0.69
	8.90	8.81	0.74	1.20	6.53	10.02	72.5%	0.65	4.35	0.67
	8.95	8.79	0.69	1.15	6.09	9.92	71.7%	0.61	3.90	0.64
	9.00	8.77	0.64	1.10	5.65	9.81	71.0%	0.58	3.46	0.61
	9.05	8.51	0.61	1.05	5.22	9.51	68.8%	0.55	3.10	0.59
	9.10	7.86	0.61	1.00	4.80	8.80	63.7%	0.55	2.84	0.59
	9.15	7.75	0.57	0.95	4.41	8.64	62.5%	0.51	2.49	0.57
	9.20	7.65	0.53	0.90	4.02	8.48	61.3%	0.47	2.17	0.54
	9.25	7.54	0.48	0.85	3.64	8.32	60.1%	0.44	1.86	0.51
	9.30	7.44	0.44	0.80	3.27	8.15	59.0%	0.40	1.57	0.48
	9.35	7.23	0.40	0.75	2.90	7.90	57.1%	0.37	1.32	0.45
	9.40	6.43	0.40	0.70	2.54	7.04	50.9%	0.36	1.14	0.45
	9.45	5.83	0.38	0.65	2.24	6.37	46.1%	0.35	0.99	0.44
	9.50	5.29	0.37	0.60	1.96	5.77	41.7%	0.34	0.85	0.43
	9.55	5.15	0.33	0.55	1.70	5.58	40.3%	0.30	0.68	0.40
	9.60	4.48	0.33	0.50	1.46	4.84	35.0%	0.30	0.58	0.40
	9.65	4.34	0.29	0.45	1.24	4.64	33.6%	0.27	0.45	0.37
	9.70	3.80	0.27	0.40	1.03	4.05	29.3%	0.25	0.36	0.35
	9.75	3.15	0.27	0.35	0.85	3.38	24.4%	0.25	0.30	0.35
	9.80	3.02	0.23	0.30	0.70	3.21	23.2%	0.22	0.22	0.32
	9.85	2.89	0.19	0.25	0.55	3.05	22.1%	0.18	0.16	0.28
	9.90	2.76	0.15	0.20	0.41	2.88	20.9%	0.14	0.10	0.24
	9.95	2.63	0.10	0.15	0.27	2.72	19.7%	0.10	0.05	0.19
	10.00	1.70	0.09	0.10	0.15	1.75	12.7%	0.08	0.02	0.17
	10.05	1.45	0.05	0.05	0.07	1.48	10.7%	0.04	0.01	0.11
	10.10	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	6.32	cfs
CALCULATED FLOW (Qc)=	6.32	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	8.70	ft
CALCULATED WATERLINE (WLc)=	8.70	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	1.40	ft
MAX CALCULATED DEPTH (Dc)=	1.40	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.76	ft/sec
MANNING'S N=	0.137	
SLOPE=	0.0067	ft/ft
.4 * Qm =	2.5	cfs
2.5 * Qm=	15.8	cfs

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

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

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

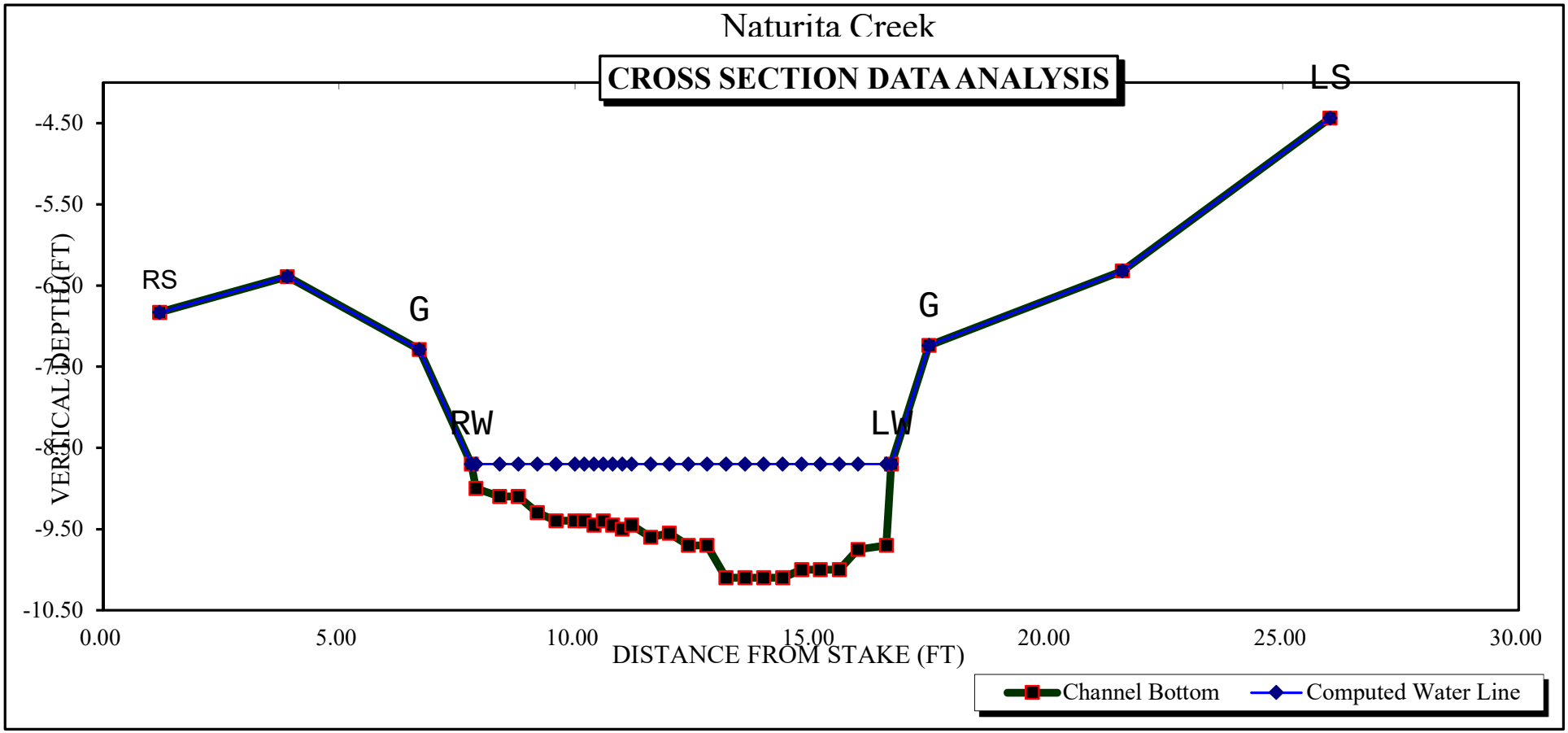
RECOMMENDATION BY: …….. AGENCY…….. DATE:……

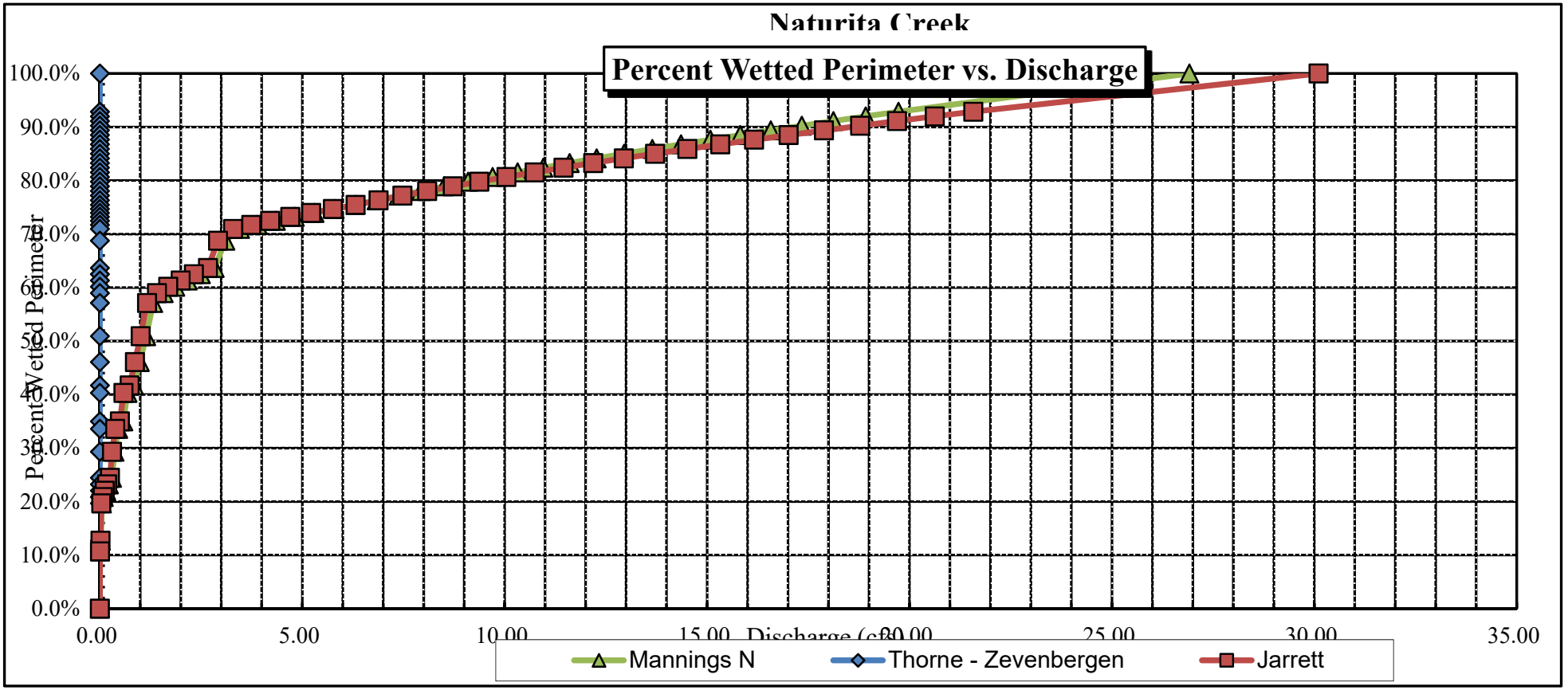
CWCB REVIEW BY: …….. DATE:……

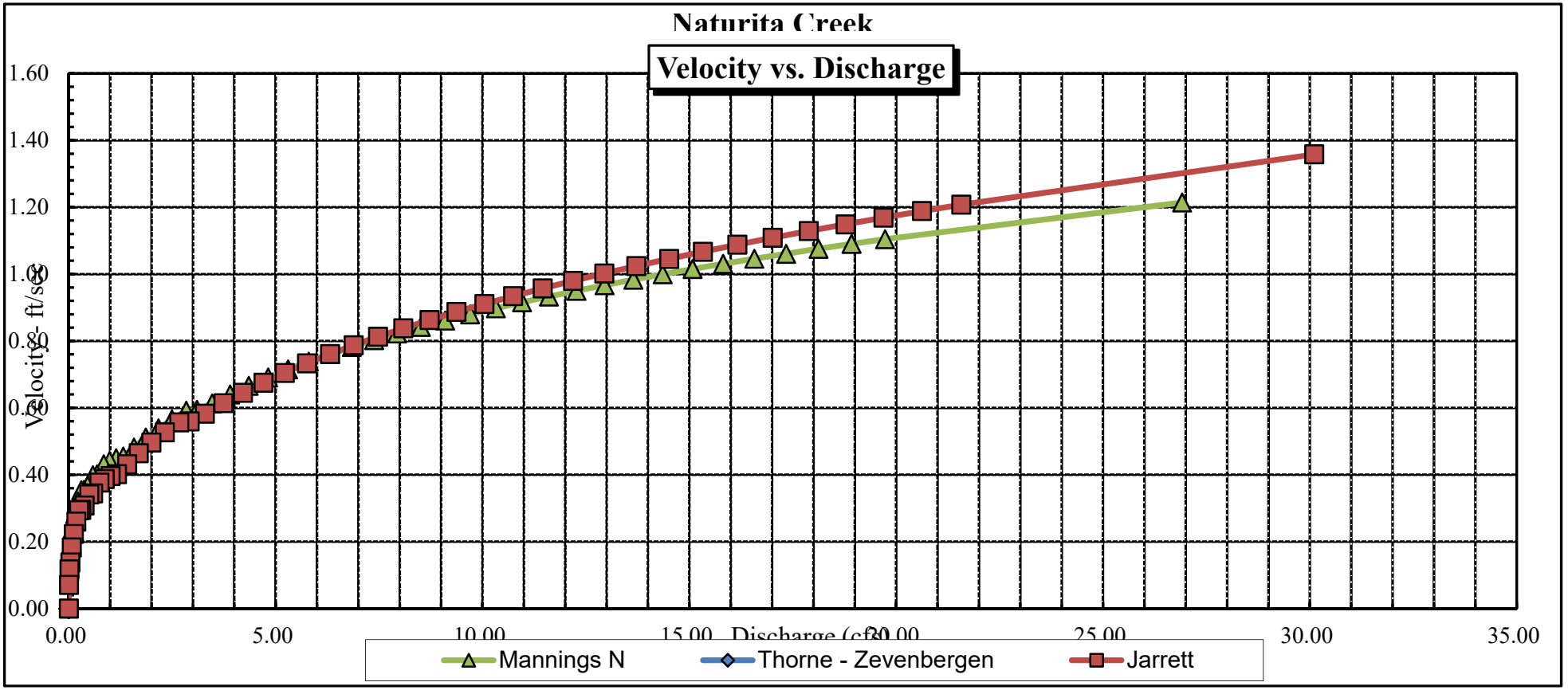
STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

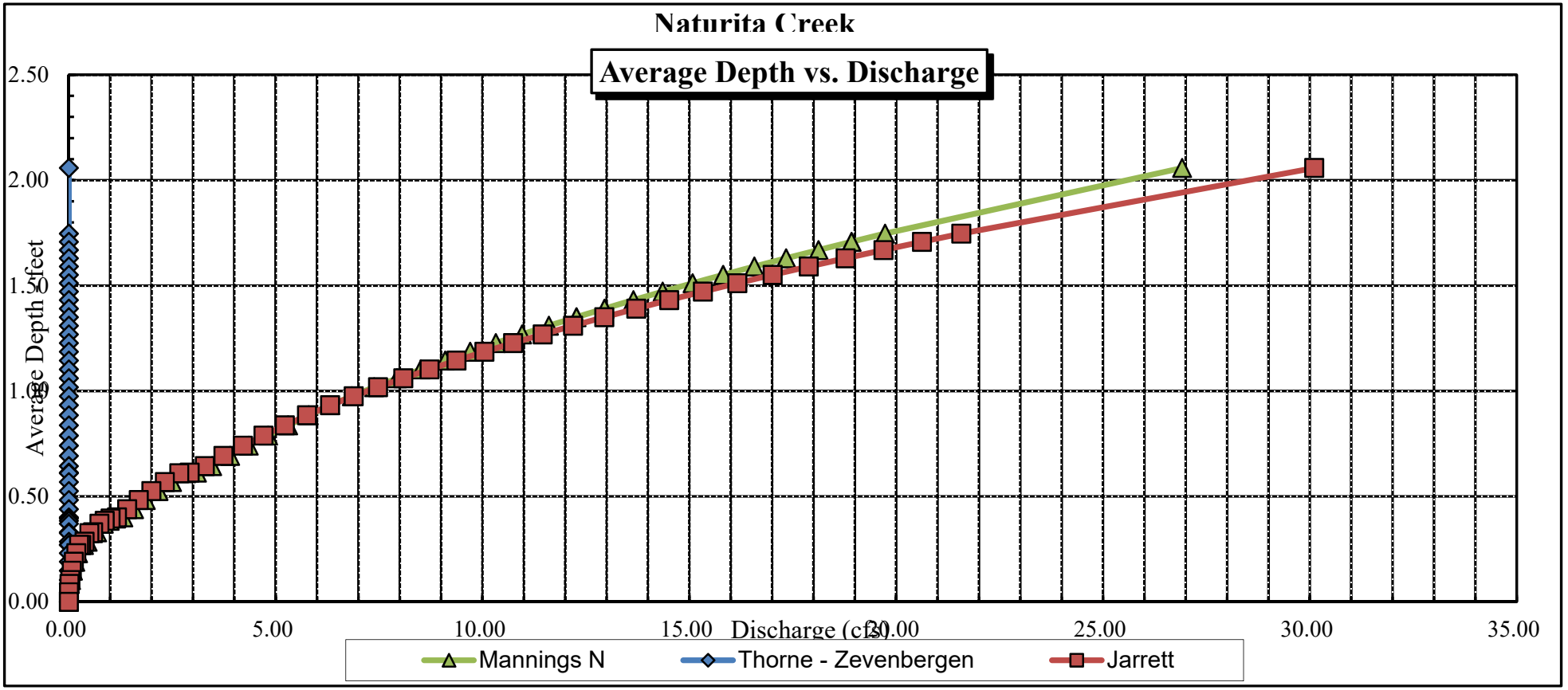
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

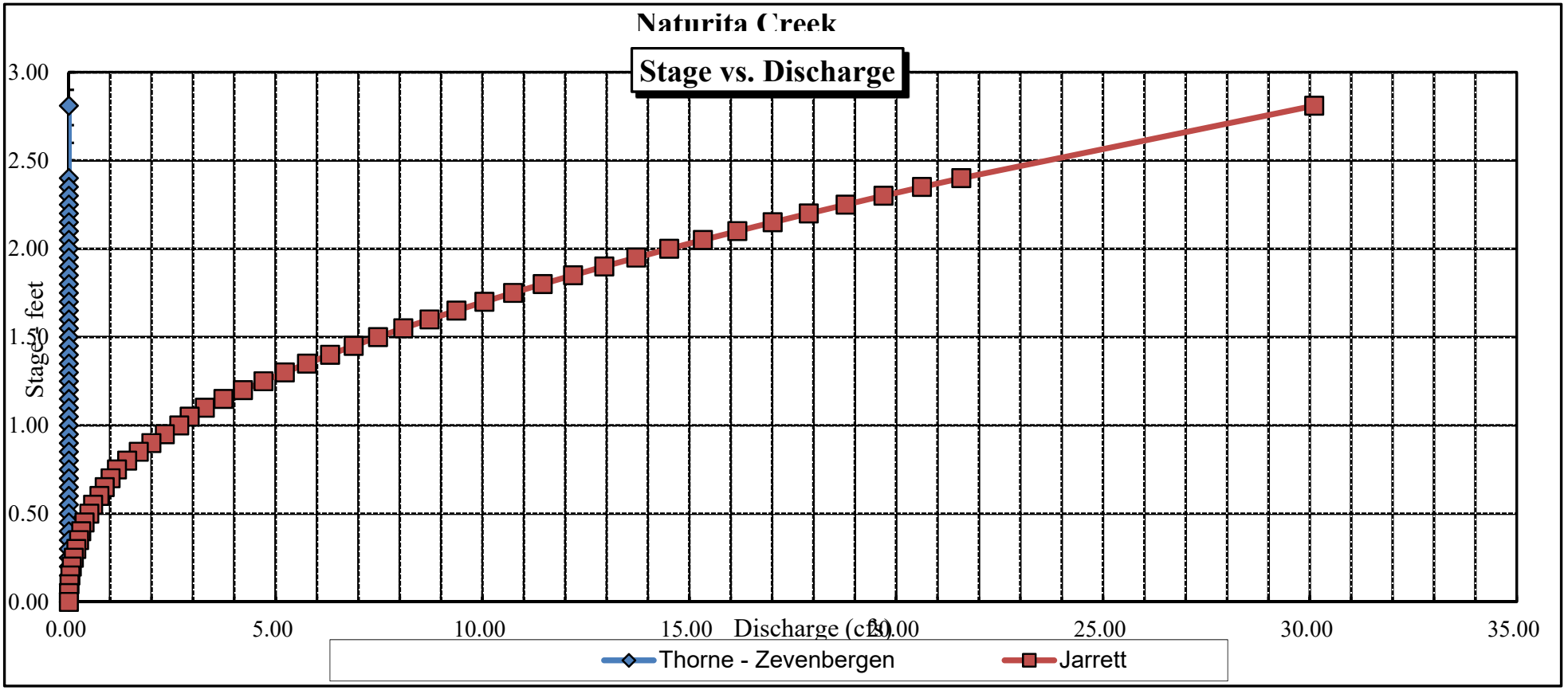
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	7.29	10.77	2.06	2.81	22.17	13.83	100.0%	1.60	30.11	1.36
	7.70	10.23	1.75	2.40	17.86	12.84	92.9%	1.39	21.58	1.21
	7.75	10.16	1.71	2.35	17.35	12.72	92.0%	1.36	20.62	1.19
	7.80	10.10	1.67	2.30	16.85	12.60	91.1%	1.34	19.69	1.17
	7.85	10.03	1.63	2.25	16.34	12.48	90.2%	1.31	18.78	1.15
	7.90	9.96	1.59	2.20	15.84	12.36	89.4%	1.28	17.89	1.13
	7.95	9.90	1.55	2.15	15.35	12.24	88.5%	1.25	17.01	1.11
	8.00	9.83	1.51	2.10	14.86	12.12	87.6%	1.23	16.16	1.09
	8.05	9.76	1.47	2.05	14.37	12.00	86.8%	1.20	15.33	1.07
	8.10	9.70	1.43	2.00	13.88	11.88	85.9%	1.17	14.51	1.05
	8.15	9.63	1.39	1.95	13.40	11.76	85.0%	1.14	13.72	1.02
	8.20	9.56	1.35	1.90	12.92	11.64	84.1%	1.11	12.94	1.00
	8.25	9.50	1.31	1.85	12.44	11.51	83.3%	1.08	12.19	0.98
	8.30	9.43	1.27	1.80	11.97	11.39	82.4%	1.05	11.45	0.96
	8.35	9.36	1.23	1.75	11.50	11.27	81.5%	1.02	10.74	0.93
	8.40	9.30	1.19	1.70	11.03	11.15	80.7%	0.99	10.05	0.91
	8.45	9.23	1.14	1.65	10.57	11.03	79.8%	0.96	9.37	0.89
	8.50	9.17	1.10	1.60	10.11	10.91	78.9%	0.93	8.72	0.86
	8.55	9.10	1.06	1.55	9.65	10.79	78.1%	0.89	8.09	0.84
	8.60	9.03	1.02	1.50	9.20	10.67	77.2%	0.86	7.48	0.81
	8.65	8.97	0.98	1.45	8.75	10.55	76.3%	0.83	6.89	0.79
WL	8.70	8.90	0.93	1.40	8.30	10.43	75.4%	0.80	6.32	0.76
	8.75	8.88	0.88	1.35	7.86	10.33	74.7%	0.76	5.76	0.73
	8.80	8.86	0.84	1.30	7.41	10.22	73.9%	0.72	5.22	0.70
	8.85	8.83	0.79	1.25	6.97	10.12	73.2%	0.69	4.71	0.68
	8.90	8.81	0.74	1.20	6.53	10.02	72.5%	0.65	4.21	0.65
	8.95	8.79	0.69	1.15	6.09	9.92	71.7%	0.61	3.74	0.61
	9.00	8.77	0.64	1.10	5.65	9.81	71.0%	0.58	3.29	0.58
	9.05	8.51	0.61	1.05	5.22	9.51	68.8%	0.55	2.92	0.56
	9.10	7.86	0.61	1.00	4.80	8.80	63.7%	0.55	2.67	0.56
	9.15	7.75	0.57	0.95	4.41	8.64	62.5%	0.51	2.32	0.53
	9.20	7.65	0.53	0.90	4.02	8.48	61.3%	0.47	2.00	0.50
	9.25	7.54	0.48	0.85	3.64	8.32	60.1%	0.44	1.69	0.46
	9.30	7.44	0.44	0.80	3.27	8.15	59.0%	0.40	1.41	0.43
	9.35	7.23	0.40	0.75	2.90	7.90	57.1%	0.37	1.17	0.40
	9.40	6.43	0.40	0.70	2.54	7.04	50.9%	0.36	1.01	0.40
	9.45	5.83	0.38	0.65	2.24	6.37	46.1%	0.35	0.87	0.39
	9.50	5.29	0.37	0.60	1.96	5.77	41.7%	0.34	0.74	0.38
	9.55	5.15	0.33	0.55	1.70	5.58	40.3%	0.30	0.59	0.34
	9.60	4.48	0.33	0.50	1.46	4.84	35.0%	0.30	0.50	0.34
	9.65	4.34	0.29	0.45	1.24	4.64	33.6%	0.27	0.38	0.31
	9.70	3.80	0.27	0.40	1.03	4.05	29.3%	0.25	0.30	0.30
	9.75	3.15	0.27	0.35	0.85	3.38	24.4%	0.25	0.25	0.29
	9.80	3.02	0.23	0.30	0.70	3.21	23.2%	0.22	0.18	0.26
	9.85	2.89	0.19	0.25	0.55	3.05	22.1%	0.18	0.12	0.22
	9.90	2.76	0.15	0.20	0.41	2.88	20.9%	0.14	0.07	0.18
	9.95	2.63	0.10	0.15	0.27	2.72	19.7%	0.10	0.04	0.14
	10.00	1.70	0.09	0.10	0.15	1.75	12.7%	0.08	0.02	0.12
	10.05	1.45	0.05	0.05	0.07	1.48	10.7%	0.04	0.00	0.07
	10.10	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!


Naturita Creek
CROSS SECTION DATA ANALYSIS
LS
RS
G
G
RW
LW
-4.50
-5.50
-6.50
-7.50
-8.50
-9.50
-10.50
VERTICAL DEPTH (FT)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


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


Naturita Creek
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
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Mannings N
Thorne - Zevenbergen
Jarrett


Naturita Creek
Average Depth vs. Discharge
Average Depth - feet
2.50
2.00
1.50
1.00
0.50
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Naturita Creek
Stage vs. Discharge
Stage, feet
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

Data Input & Proofing

STREAM NAME:	Naturita Creek
XS LOCATION:	End of seismic rd nr compressor station
XS NUMBER:	1
DATE:	6/27/2017
OBSERVERS:	R. Smith, L. Fehlmann
1/4 SEC:	NE
SECTION:	6
TWP:	45N
RANGE:	14W
PM:	NM
COUNTY:	Montrose
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	41804
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.0067 ft / ft

CHECKED BY:.....DATE.....

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

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
			Total Data Points = 33					
	RS	1.20	6.83			0.00	0.00	0.00
		3.90	6.39			0.00	0.00	0.00
1	G	6.70	7.29			0.00	0.00	0.00
	RW	7.80	8.70	0.00	0.00	0.00	0.00	0.00
		7.90	9.00	0.30	0.00	0.09	0.00	8.70
		8.40	9.10	0.40	0.16	0.18	0.03	8.70
		8.80	9.10	0.40	0.47	0.16	0.08	8.70
		9.20	9.30	0.60	1.03	0.24	0.25	8.70
		9.60	9.40	0.70	1.31	0.28	0.37	8.70
		10.00	9.40	0.70	1.53	0.21	0.32	8.70
		10.20	9.40	0.70	1.62	0.14	0.23	8.70
		10.40	9.45	0.75	1.73	0.15	0.26	8.70
		10.60	9.40	0.70	2.01	0.14	0.28	8.70
		10.80	9.45	0.75	2.14	0.15	0.32	8.70
		11.00	9.50	0.80	1.94	0.16	0.31	8.70
		11.20	9.45	0.75	1.97	0.23	0.44	8.70
		11.60	9.60	0.90	0.10	0.36	0.04	8.70
		12.00	9.55	0.85	0.00	0.34	0.00	8.70
		12.40	9.70	1.00	0.00	0.40	0.00	8.70
		12.80	9.70	1.00	1.42	0.40	0.57	8.70
		13.20	10.10	1.40	0.77	0.56	0.43	8.70
		13.60	10.10	1.40	0.00	0.56	0.00	8.70
		14.00	10.10	1.40	0.13	0.56	0.07	8.70
		14.40	10.10	1.40	1.61	0.56	0.90	8.70
		14.80	10.00	1.30	1.17	0.52	0.61	8.70
		15.20	10.00	1.30	1.12	0.52	0.58	8.70
		15.60	10.00	1.30	0.45	0.52	0.23	8.70
		16.00	9.75	1.05	0.00	0.53	0.00	8.70
		16.60	9.70	1.00	0.00	0.35	0.00	8.70
	LW	16.70	8.70	0.00	0.00	0.00	0.00	0.00
1	G	17.50	7.24			0.00	0.00	0.00
		21.60	6.32			0.00	0.00	0.00
	LS	26.00	4.44			0.00	0.00	0.00
					Totals	8.30	6.32	

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Naturita Creek | CROSS-SECTION NO.: 2

CROSS-SECTION LOCATION: Drop off end of seismic road near Paradox Basin compressor station

DATE: 6-27-17 | OBSERVERS: R. Smith, J. Sondergard

LEGAL DESCRIPTION | ¼ SECTION: NE | SECTION: 6 | TOWNSHIP: 45 (N/S) | RANGE: 14 E/W | PM: NM

COUNTY: Montrose | WATERSHED: San Miguel | WATER DIVISION: 4 | DOW WATER CODE:

MAP(S): USGS: GPS 723540 mE

USFS: Zone 12S 4229334 mN

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO | METER TYPE: M-M

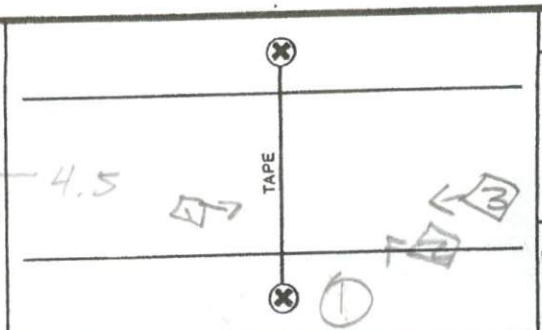
METER NUMBER: | DATE RATED: | CALIB/SPIN: _____ sec | TAPE WEIGHT: surveyed _____ lbs/foot | TAPE TENSION: surveyed _____ lbs

CHANNEL BED MATERIAL SIZE RANGE: gravel to 2-foot boulders | PHOTOGRAPHS TAKEN: (YES/NO) | NUMBER OF PHOTOGRAPHS: (3)

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	surveyed
(X) Tape @ Stake RB	0.0	surveyed
(1) WS @ Tape LB/RB	0.0	9.30/9.30
(2) WS Upstream	9.0	9.26
(3) WS Downstream	10.0	9.48
SLOPE	0.22/19.0 = .012	

SKETCH



LEGEND: Stake (X) 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

Cross section just downstream from 3 exposed rocks in channel.

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Naduda Creek | CROSS-SECTION NO.: 2 | DATE: 6-27-17 | SHEET 1 OF 1

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: _____ ft | TIME: 1:10

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)
RS	1.0		7.36								
G	2.0		7.73								
RW	4.3		9.30	ϕ				ϕ			
	5.0		9.50	.2				ϕ			
	5.5		9.85	.55				ϕ			
	6.0		9.95	.65				ϕ			
	6.5		10.1	.80				.26			
	6.9		10.15	.85				.52			
	7.3		10.4	1.10				0.73			
	7.7		10.25	.95				0.76			
8.3 >	8.1	~~10.3~~ >	10.2	.90	< 1.00			2.71	< 2.04		
8.5 <	8.5	~~10.3~~ >	10.3	1.00	< 1.00			2.45	> 1.28		
8.7 <	8.9		10.3	1.00				1.38			
	9.3		10.3	1.00				.40			
	9.7		10.3	1.00				.94			
10.3 >	10.1	10.6 >	10.6	1.30	< 1.30			1.61	< 1.91		
	10.5		10.6	1.30				1.45			
	10.9		10.2	0.9				1.73			
	11.3		10.2	0.9				1.40			
	11.7		10.1	0.8				0.82			
	12.1		10.0	0.7				0.64			
	12.5		10.1	0.8				0.40			
	12.9		9.85	0.55				0.62			
	13.3		9.9	0.6				0.09			
	13.7		9.9	0.6				ϕ			
	14.4		9.6	0.3				ϕ			
LW	14.5		9.30	ϕ							
G	15.5		7.75								
RS	17.3		6.24								
TOTALS:											

End of Measurement | Time: 1:45 | Gage Reading: _____ ft | CALCULATIONS PERFORMED BY: | CALCULATIONS CHECKED BY:

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

LOCATION INFORMATION

STREAM NAME:	Naturita Creek
XS LOCATION:	End of seismic rd nr compressor station
XS NUMBER:	2
DATE:	27-Jun-17
OBSERVERS:	R. Smith, L. Fehlmann
1/4 SEC:	NE
SECTION:	6
TWP:	45N
RANGE:	14W
PM:	NM
COUNTY:	San Miguel
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	41804
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:	0.012

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

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

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 2

DATA POINTS= 32

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	RS	1.00	7.36			0.00		0.00	0.00	0.0%
1	G	2.00	7.73			0.00		0.00	0.00	0.0%
	RW	4.30	9.30	0.00	0.00	0.00		0.00	0.00	0.0%
		5.00	9.50	0.20	0.00	0.73	0.20	0.12	0.00	0.0%
		5.50	9.85	0.55	0.00	0.61	0.55	0.28	0.00	0.0%
		6.00	9.95	0.65	0.00	0.51	0.65	0.33	0.00	0.0%
		6.50	10.10	0.80	0.26	0.52	0.80	0.36	0.09	1.3%
		6.90	10.15	0.85	0.52	0.40	0.85	0.34	0.18	2.4%
		7.30	10.40	1.10	0.73	0.47	1.10	0.44	0.32	4.4%
		7.70	10.25	0.95	0.76	0.43	0.95	0.38	0.29	4.0%
		8.10	10.20	0.90	2.71	0.40	0.90	0.27	0.73	10.1%
		8.30	10.30	1.00	2.04	0.22	1.00	0.20	0.41	5.6%
		8.50	10.30	1.00	2.45	0.20	1.00	0.20	0.49	6.8%
		8.70	10.30	1.00	1.28	0.20	1.00	0.20	0.26	3.5%
		8.90	10.30	1.00	1.38	0.20	1.00	0.30	0.41	5.7%
		9.30	10.30	1.00	0.40	0.40	1.00	0.40	0.16	2.2%
		9.70	10.30	1.00	0.94	0.40	1.00	0.40	0.38	5.2%
		10.10	10.60	1.30	1.61	0.50	1.30	0.39	0.63	8.7%
		10.30	10.60	1.30	1.91	0.20	1.30	0.26	0.50	6.8%
		10.50	10.60	1.30	1.43	0.20	1.30	0.39	0.56	7.7%
		10.90	10.20	0.90	1.73	0.57	0.90	0.36	0.62	8.6%
		11.30	10.20	0.90	1.40	0.40	0.90	0.36	0.50	6.9%
		11.70	10.10	0.80	0.82	0.41	0.80	0.32	0.26	3.6%
		12.10	10.00	0.70	0.64	0.41	0.70	0.28	0.18	2.5%
		12.50	10.10	0.80	0.40	0.41	0.80	0.32	0.13	1.8%
		12.90	9.85	0.55	0.62	0.47	0.55	0.22	0.14	1.9%
		13.30	9.90	0.60	0.09	0.40	0.60	0.24	0.02	0.3%
		13.70	9.90	0.60	0.00	0.40	0.60	0.33	0.00	0.0%
		14.40	9.60	0.30	0.00	0.76	0.30	0.12	0.00	0.0%
	LW	14.50	9.30	0.00	0.00	0.32		0.00	0.00	0.0%
1	G	15.50	7.75			0.00		0.00	0.00	0.0%
	LS	17.30	6.24			0.00		0.00	0.00	0.0%
	TOTALS ----------					11.15	1.3 (Max.)	7.80	7.25	100.0%

Manning's n = 0.1379
Hydraulic Radius= 0.69928678

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	7.80	7.80	0.0%
9.05	7.80	10.42	33.5%
9.07	7.80	10.20	30.8%
9.09	7.80	9.99	28.1%
9.11	7.80	9.78	25.3%
9.13	7.80	9.56	22.6%
9.15	7.80	9.35	19.9%
9.17	7.80	9.14	17.2%
9.19	7.80	8.93	14.5%
9.21	7.80	8.73	11.9%
9.23	7.80	8.52	9.2%
9.25	7.80	8.31	6.6%
9.26	7.80	8.21	5.3%
9.27	7.80	8.11	3.9%
9.28	7.80	8.00	2.6%
9.29	7.80	7.90	1.3%
9.30	7.80	7.80	0.0%
9.31	7.80	7.70	-1.3%
9.32	7.80	7.60	-2.6%
9.33	7.80	7.50	-3.9%
9.34	7.80	7.40	-5.2%
9.35	7.80	7.29	-6.5%
9.37	7.80	7.10	-9.0%
9.39	7.80	6.90	-11.6%
9.41	7.80	6.70	-14.1%
9.43	7.80	6.51	-16.6%
9.45	7.80	6.31	-19.1%
9.47	7.80	6.12	-21.5%
9.49	7.80	5.93	-24.0%
9.51	7.80	5.74	-26.4%
9.53	7.80	5.55	-28.8%
9.55	7.80	5.37	-31.2%

WATERLINE AT ZERO
AREA ERROR = 9.300

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
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	7.75	13.47	1.94	2.85	26.14	15.75	100.0%	1.66	43.27	1.65
	8.30	12.31	1.55	2.30	19.06	14.12	89.6%	1.35	27.47	1.44
	8.35	12.20	1.51	2.25	18.44	13.97	88.7%	1.32	26.19	1.42
	8.40	12.10	1.47	2.20	17.83	13.82	87.8%	1.29	24.95	1.40
	8.45	11.99	1.44	2.15	17.23	13.67	86.8%	1.26	23.73	1.38
	8.50	11.89	1.40	2.10	16.64	13.53	85.9%	1.23	22.54	1.35
	8.55	11.78	1.36	2.05	16.04	13.38	84.9%	1.20	21.37	1.33
	8.60	11.68	1.32	2.00	15.46	13.23	84.0%	1.17	20.24	1.31
	8.65	11.57	1.29	1.95	14.88	13.08	83.1%	1.14	19.13	1.29
	8.70	11.47	1.25	1.90	14.30	12.93	82.1%	1.11	18.05	1.26
	8.75	11.36	1.21	1.85	13.73	12.78	81.2%	1.07	16.99	1.24
	8.80	11.26	1.17	1.80	13.16	12.64	80.2%	1.04	15.97	1.21
	8.85	11.15	1.13	1.75	12.60	12.49	79.3%	1.01	14.97	1.19
	8.90	11.04	1.09	1.70	12.05	12.34	78.4%	0.98	14.00	1.16
	8.95	10.94	1.05	1.65	11.50	12.19	77.4%	0.94	13.05	1.14
	9.00	10.83	1.01	1.60	10.95	12.04	76.5%	0.91	12.14	1.11
	9.05	10.73	0.97	1.55	10.42	11.90	75.5%	0.88	11.25	1.08
	9.10	10.62	0.93	1.50	9.88	11.75	74.6%	0.84	10.39	1.05
	9.15	10.52	0.89	1.45	9.35	11.60	73.7%	0.81	9.56	1.02
	9.20	10.41	0.85	1.40	8.83	11.45	72.7%	0.77	8.76	0.99
	9.25	10.31	0.81	1.35	8.31	11.30	71.8%	0.74	7.99	0.96
WL	9.30	10.20	0.76	1.30	7.80	11.15	70.8%	0.70	7.25	0.93
	9.35	10.01	0.73	1.25	7.29	10.92	69.3%	0.67	6.58	0.90
	9.40	9.82	0.69	1.20	6.80	10.68	67.8%	0.64	5.94	0.87
	9.45	9.62	0.66	1.15	6.31	10.45	66.4%	0.60	5.32	0.84
	9.50	9.43	0.62	1.10	5.84	10.22	64.9%	0.57	4.74	0.81
	9.55	9.35	0.57	1.05	5.37	10.08	64.0%	0.53	4.16	0.78
	9.60	9.26	0.53	1.00	4.90	9.94	63.1%	0.49	3.61	0.74
	9.65	9.07	0.49	0.95	4.44	9.72	61.7%	0.46	3.11	0.70
	9.70	8.88	0.45	0.90	4.00	9.51	60.4%	0.42	2.65	0.66
	9.75	8.69	0.41	0.85	3.56	9.29	59.0%	0.38	2.21	0.62
	9.80	8.50	0.37	0.80	3.13	9.08	57.7%	0.34	1.81	0.58
	9.85	8.32	0.33	0.75	2.71	8.87	56.3%	0.31	1.45	0.53
	9.90	7.07	0.33	0.70	2.31	7.59	48.2%	0.30	1.23	0.53
	9.95	6.74	0.29	0.65	1.97	7.24	46.0%	0.27	0.97	0.49
	10.00	6.49	0.25	0.60	1.63	6.97	44.2%	0.23	0.73	0.45
	10.05	5.85	0.23	0.55	1.33	6.29	39.9%	0.21	0.55	0.42
	10.10	5.20	0.20	0.50	1.05	5.61	35.6%	0.19	0.41	0.39
	10.15	4.60	0.18	0.45	0.81	5.00	31.7%	0.16	0.28	0.35
	10.20	3.92	0.15	0.40	0.58	4.30	27.3%	0.14	0.18	0.31
	10.25	3.29	0.12	0.35	0.40	3.62	23.0%	0.11	0.11	0.27
	10.30	1.53	0.16	0.30	0.25	1.80	11.4%	0.14	0.08	0.31
	10.35	1.20	0.15	0.25	0.18	1.41	8.9%	0.13	0.05	0.30
	10.40	0.87	0.15	0.20	0.13	1.02	6.5%	0.12	0.04	0.29
	10.45	0.75	0.12	0.15	0.09	0.86	5.5%	0.10	0.02	0.25
	10.50	0.63	0.08	0.10	0.05	0.71	4.5%	0.07	0.01	0.21
	10.55	0.52	0.04	0.05	0.02	0.55	3.5%	0.04	0.00	0.14
	10.60	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	7.25	cfs
CALCULATED FLOW (Qc)=	7.25	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	9.30	ft
CALCULATED WATERLINE (WLc)=	9.30	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	1.30	ft
MAX CALCULATED DEPTH (Dc)=	1.30	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.93	ft/sec
MANNING'S N=	0.138	
SLOPE=	0.012	ft/ft
.4 * Qm =	2.9	cfs
2.5 * Qm=	18.1	cfs

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

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

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

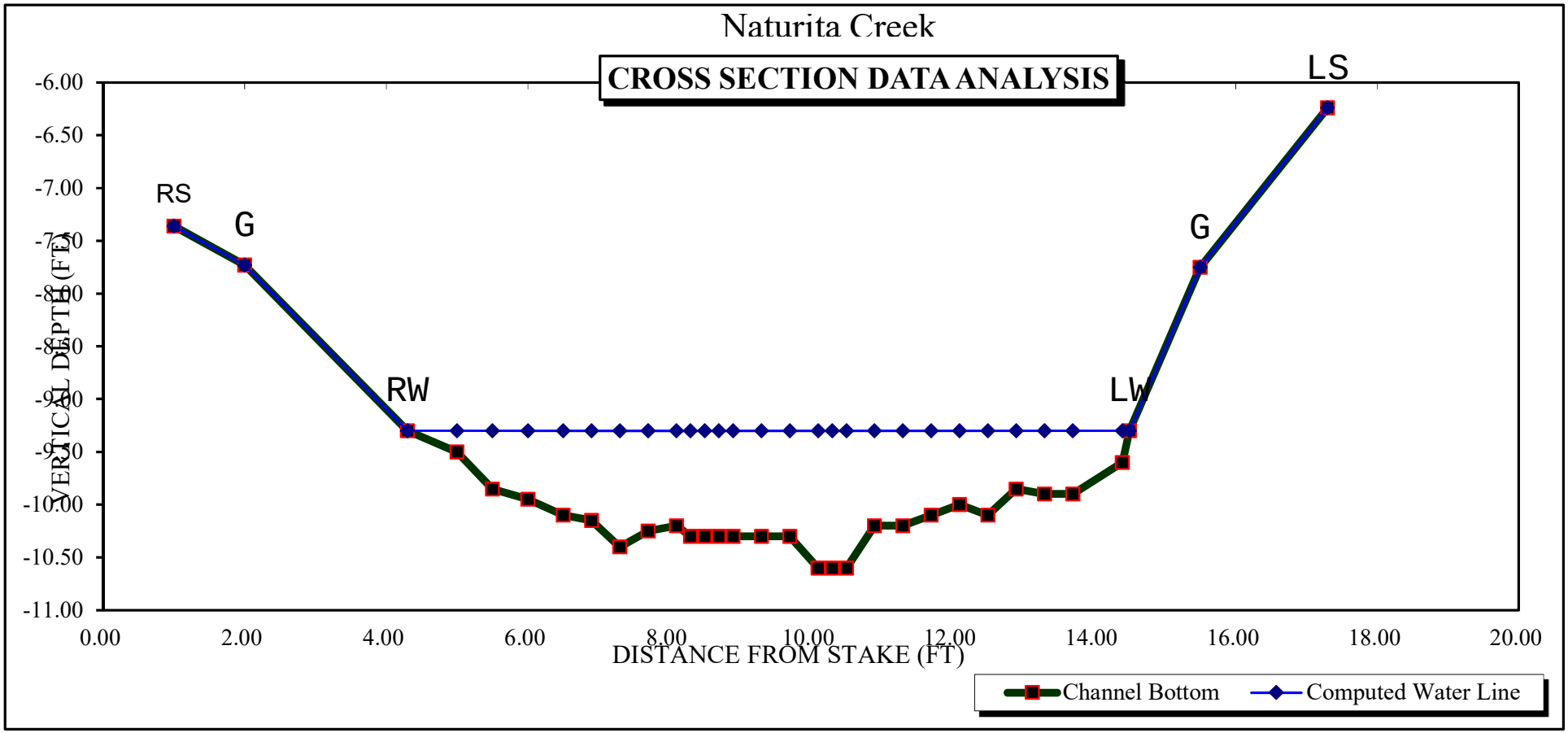
RECOMMENDATION BY: ………………...………..……............................... AGENCY..……………………......…....…....……...... DATE:.......…..….......……………

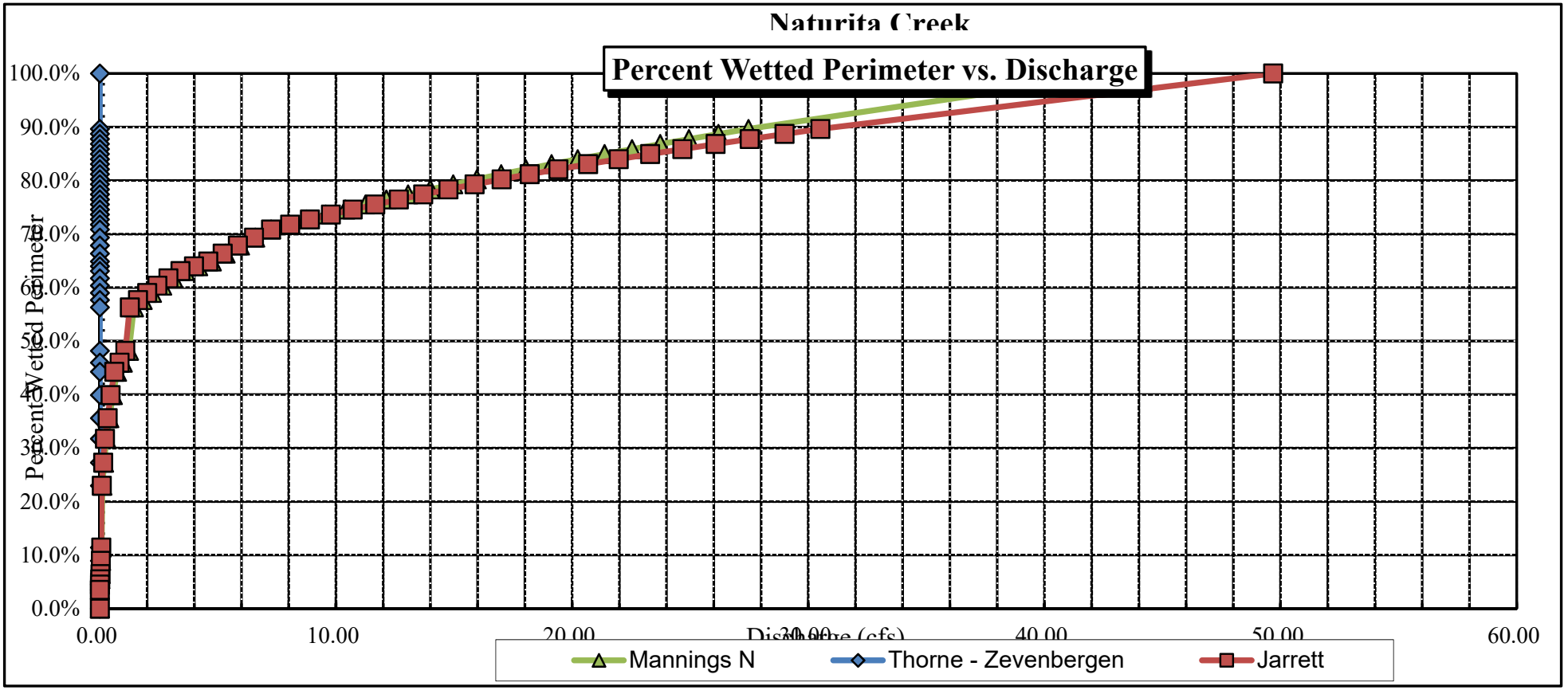
CWCB REVIEW BY: ..…………………………....…………………………………………………...…............. DATE:..................……………...…

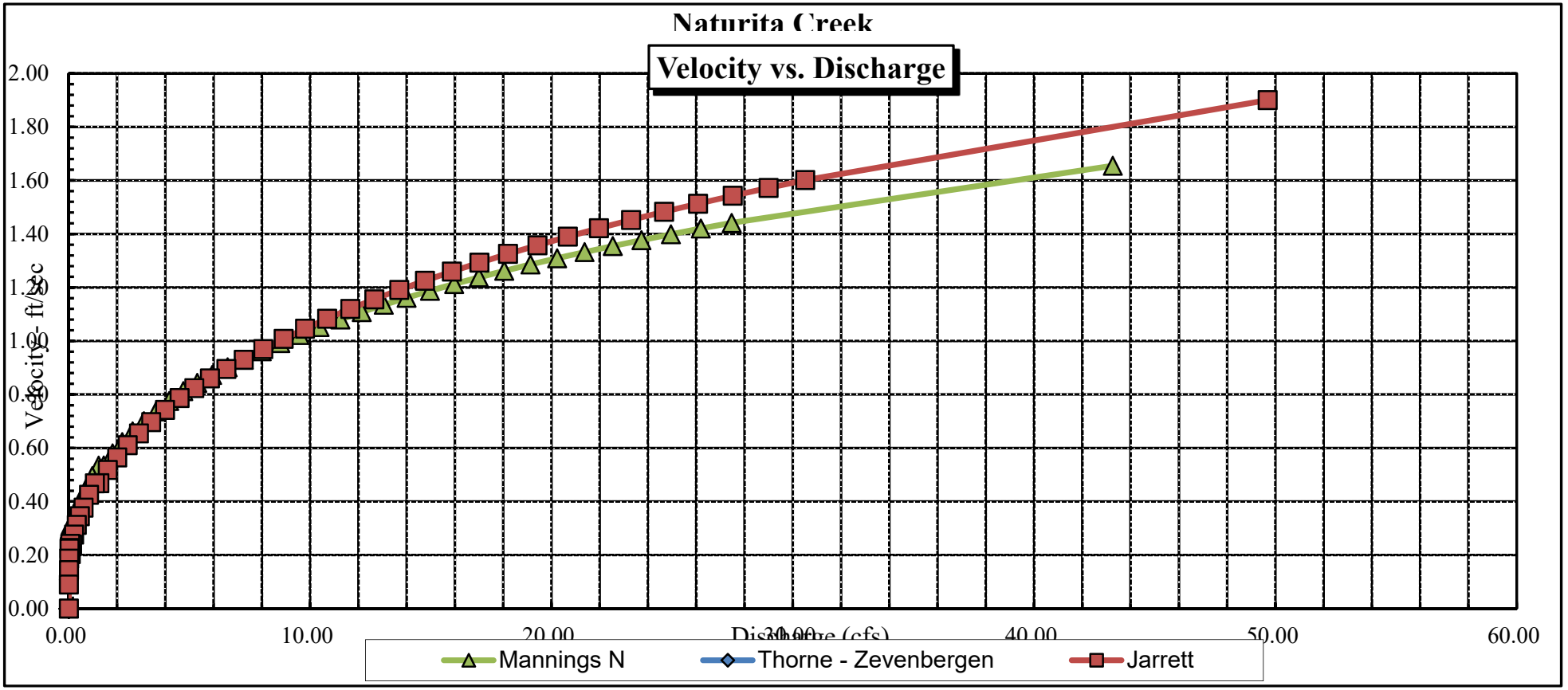
STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 2 Jarrett Variable Manning's n Correction Applied

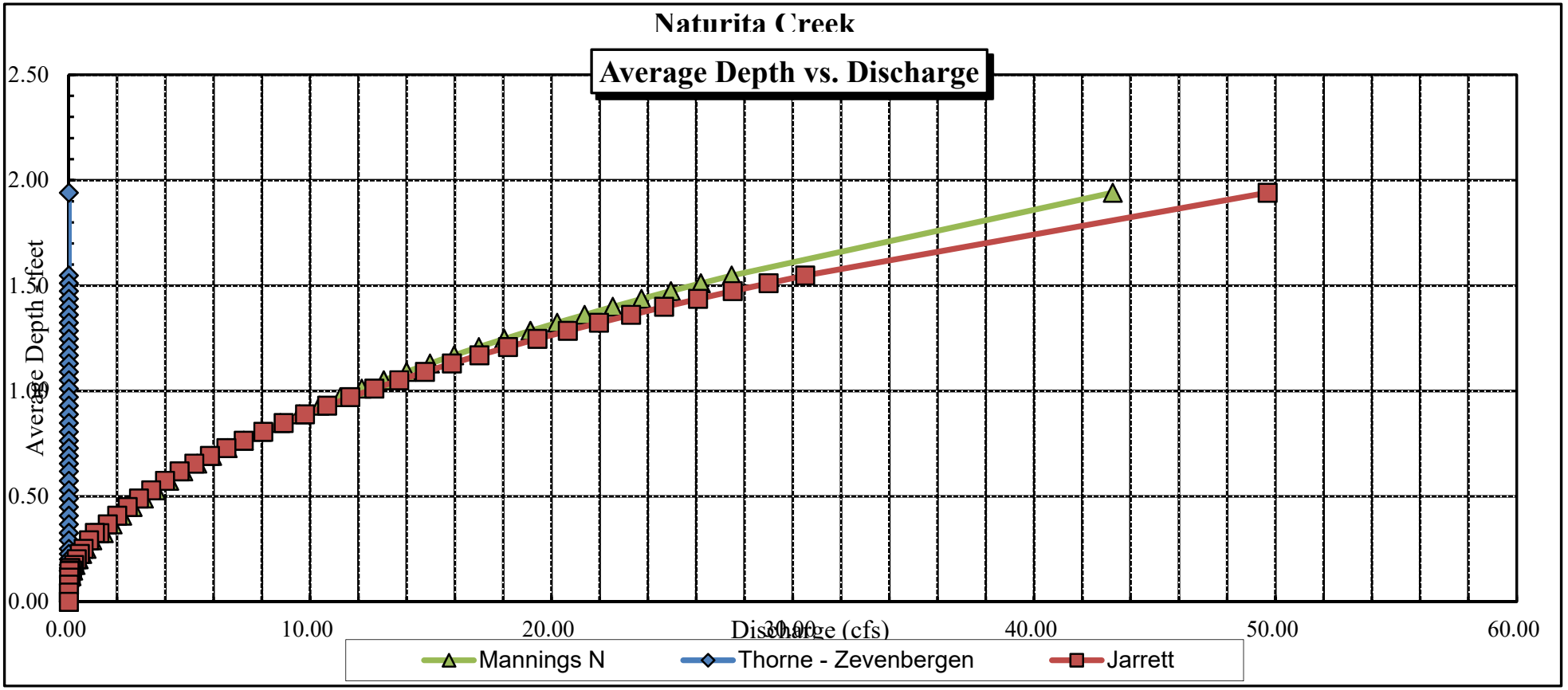
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

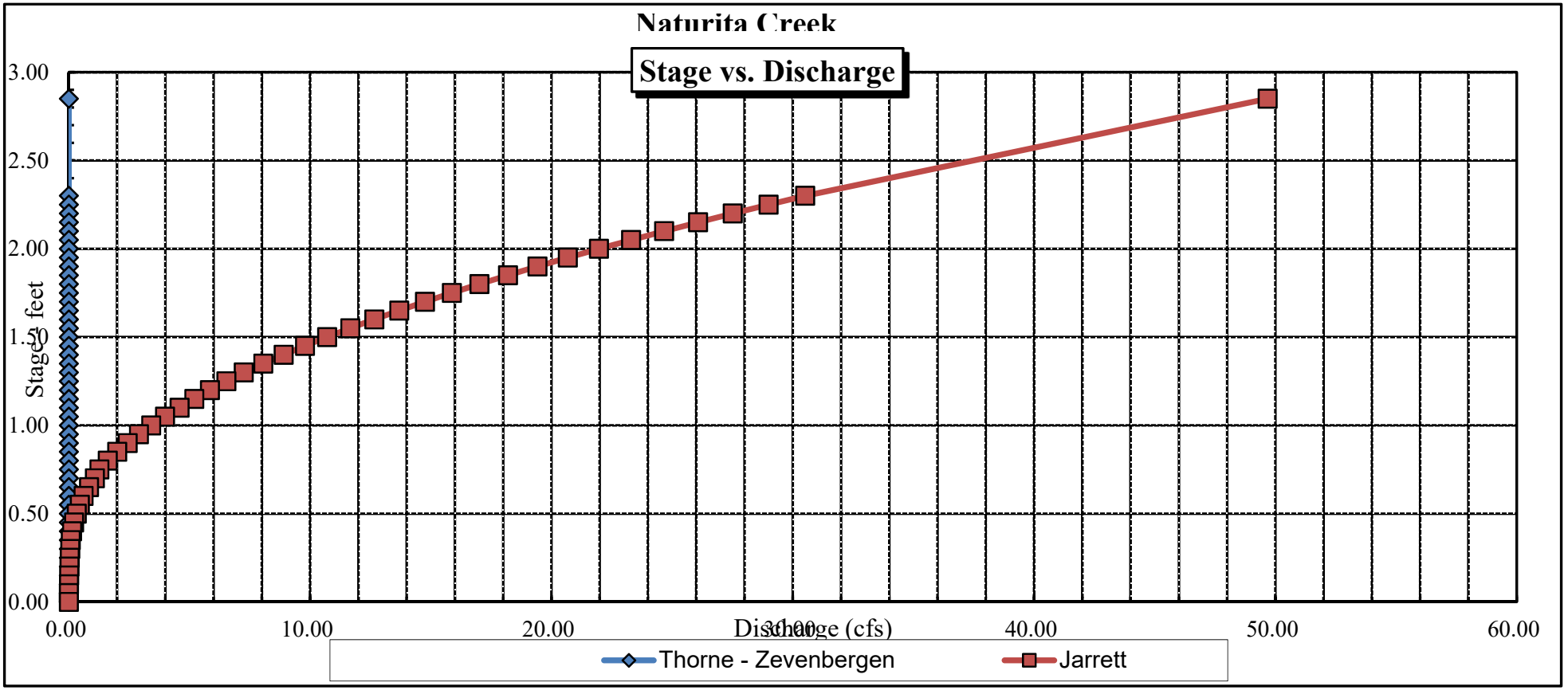
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	7.75	13.47	1.94	2.85	26.14	15.75	100.0%	1.66	49.68	1.90
	8.30	12.31	1.55	2.30	19.06	14.12	89.6%	1.35	30.51	1.60
	8.35	12.20	1.51	2.25	18.44	13.97	88.7%	1.32	29.00	1.57
	8.40	12.10	1.47	2.20	17.83	13.82	87.8%	1.29	27.52	1.54
	8.45	11.99	1.44	2.15	17.23	13.67	86.8%	1.26	26.08	1.51
	8.50	11.89	1.40	2.10	16.64	13.53	85.9%	1.23	24.67	1.48
	8.55	11.78	1.36	2.05	16.04	13.38	84.9%	1.20	23.30	1.45
	8.60	11.68	1.32	2.00	15.46	13.23	84.0%	1.17	21.97	1.42
	8.65	11.57	1.29	1.95	14.88	13.08	83.1%	1.14	20.68	1.39
	8.70	11.47	1.25	1.90	14.30	12.93	82.1%	1.11	19.42	1.36
	8.75	11.36	1.21	1.85	13.73	12.78	81.2%	1.07	18.20	1.33
	8.80	11.26	1.17	1.80	13.16	12.64	80.2%	1.04	17.02	1.29
	8.85	11.15	1.13	1.75	12.60	12.49	79.3%	1.01	15.87	1.26
	8.90	11.04	1.09	1.70	12.05	12.34	78.4%	0.98	14.76	1.23
	8.95	10.94	1.05	1.65	11.50	12.19	77.4%	0.94	13.69	1.19
	9.00	10.83	1.01	1.60	10.95	12.04	76.5%	0.91	12.66	1.16
	9.05	10.73	0.97	1.55	10.42	11.90	75.5%	0.88	11.66	1.12
	9.10	10.62	0.93	1.50	9.88	11.75	74.6%	0.84	10.71	1.08
	9.15	10.52	0.89	1.45	9.35	11.60	73.7%	0.81	9.79	1.05
	9.20	10.41	0.85	1.40	8.83	11.45	72.7%	0.77	8.90	1.01
	9.25	10.31	0.81	1.35	8.31	11.30	71.8%	0.74	8.06	0.97
WL	9.30	10.20	0.76	1.30	7.80	11.15	70.8%	0.70	7.25	0.93
	9.35	10.01	0.73	1.25	7.29	10.92	69.3%	0.67	6.53	0.90
	9.40	9.82	0.69	1.20	6.80	10.68	67.8%	0.64	5.85	0.86
	9.45	9.62	0.66	1.15	6.31	10.45	66.4%	0.60	5.20	0.82
	9.50	9.43	0.62	1.10	5.84	10.22	64.9%	0.57	4.59	0.79
	9.55	9.35	0.57	1.05	5.37	10.08	64.0%	0.53	3.99	0.74
	9.60	9.26	0.53	1.00	4.90	9.94	63.1%	0.49	3.42	0.70
	9.65	9.07	0.49	0.95	4.44	9.72	61.7%	0.46	2.91	0.65
	9.70	8.88	0.45	0.90	4.00	9.51	60.4%	0.42	2.44	0.61
	9.75	8.69	0.41	0.85	3.56	9.29	59.0%	0.38	2.01	0.56
	9.80	8.50	0.37	0.80	3.13	9.08	57.7%	0.34	1.62	0.52
	9.85	8.32	0.33	0.75	2.71	8.87	56.3%	0.31	1.27	0.47
	9.90	7.07	0.33	0.70	2.31	7.59	48.2%	0.30	1.08	0.47
	9.95	6.74	0.29	0.65	1.97	7.24	46.0%	0.27	0.84	0.43
	10.00	6.49	0.25	0.60	1.63	6.97	44.2%	0.23	0.62	0.38
	10.05	5.85	0.23	0.55	1.33	6.29	39.9%	0.21	0.46	0.35
	10.10	5.20	0.20	0.50	1.05	5.61	35.6%	0.19	0.33	0.31
	10.15	4.60	0.18	0.45	0.81	5.00	31.7%	0.16	0.22	0.28
	10.20	3.92	0.15	0.40	0.58	4.30	27.3%	0.14	0.14	0.24
	10.25	3.29	0.12	0.35	0.40	3.62	23.0%	0.11	0.08	0.20
	10.30	1.53	0.16	0.30	0.25	1.80	11.4%	0.14	0.06	0.24
	10.35	1.20	0.15	0.25	0.18	1.41	8.9%	0.13	0.04	0.23
	10.40	0.87	0.15	0.20	0.13	1.02	6.5%	0.12	0.03	0.22
	10.45	0.75	0.12	0.15	0.09	0.86	5.5%	0.10	0.02	0.19
	10.50	0.63	0.08	0.10	0.05	0.71	4.5%	0.07	0.01	0.14
	10.55	0.52	0.04	0.05	0.02	0.55	3.5%	0.04	0.00	0.09
	10.60	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!


Naturita Creek
CROSS SECTION DATA ANALYSIS
LS
RS
G
G
RW
LW
-6.00
-6.50
-7.00
-10.00
-10.50
-11.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
VERTICAL DEPTH (FT)
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


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


Naturita Creek
Velocity vs. Discharge
Velocity - ft/sec
2.00
1.80
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
Mannings N
Thorne - Zevenbergen
Jarrett


Naturita Creek
Average Depth vs. Discharge
Average Depth - feet
2.50
2.00
1.50
1.00
0.50
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Naturita Creek
Stage vs. Discharge
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Stage, feet
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

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

LOCATION INFORMATION

STREAM NAME:	Naturita Creek
XS LOCATION:	End of seismic rd nr compressor station
XS NUMBER:	2
DATE:	27-Jun-17
OBSERVERS:	R. Smith, L. Fehlmann
1/4 SEC:	NE
SECTION:	6
TWP:	45N
RANGE:	14W
PM:	NM
COUNTY:	San Miguel
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	41804
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:	0.012

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

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

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 2

DATA POINTS= 32

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	RS	1.00	7.36			0.00		0.00	0.00	0.0%
1	G	2.00	7.73			0.00		0.00	0.00	0.0%
	RW	4.30	9.30	0.00	0.00	0.00		0.00	0.00	0.0%
		5.00	9.50	0.20	0.00	0.73	0.20	0.12	0.00	0.0%
		5.50	9.85	0.55	0.00	0.61	0.55	0.28	0.00	0.0%
		6.00	9.95	0.65	0.00	0.51	0.65	0.33	0.00	0.0%
		6.50	10.10	0.80	0.26	0.52	0.80	0.36	0.09	1.3%
		6.90	10.15	0.85	0.52	0.40	0.85	0.34	0.18	2.4%
		7.30	10.40	1.10	0.73	0.47	1.10	0.44	0.32	4.4%
		7.70	10.25	0.95	0.76	0.43	0.95	0.38	0.29	4.0%
		8.10	10.20	0.90	2.71	0.40	0.90	0.27	0.73	10.1%
		8.30	10.30	1.00	2.04	0.22	1.00	0.20	0.41	5.6%
		8.50	10.30	1.00	2.45	0.20	1.00	0.20	0.49	6.8%
		8.70	10.30	1.00	1.28	0.20	1.00	0.20	0.26	3.5%
		8.90	10.30	1.00	1.38	0.20	1.00	0.30	0.41	5.7%
		9.30	10.30	1.00	0.40	0.40	1.00	0.40	0.16	2.2%
		9.70	10.30	1.00	0.94	0.40	1.00	0.40	0.38	5.2%
		10.10	10.60	1.30	1.61	0.50	1.30	0.39	0.63	8.7%
		10.30	10.60	1.30	1.91	0.20	1.30	0.26	0.50	6.8%
		10.50	10.60	1.30	1.43	0.20	1.30	0.39	0.56	7.7%
		10.90	10.20	0.90	1.73	0.57	0.90	0.36	0.62	8.6%
		11.30	10.20	0.90	1.40	0.40	0.90	0.36	0.50	6.9%
		11.70	10.10	0.80	0.82	0.41	0.80	0.32	0.26	3.6%
		12.10	10.00	0.70	0.64	0.41	0.70	0.28	0.18	2.5%
		12.50	10.10	0.80	0.40	0.41	0.80	0.32	0.13	1.8%
		12.90	9.85	0.55	0.62	0.47	0.55	0.22	0.14	1.9%
		13.30	9.90	0.60	0.09	0.40	0.60	0.24	0.02	0.3%
		13.70	9.90	0.60	0.00	0.40	0.60	0.33	0.00	0.0%
		14.40	9.60	0.30	0.00	0.76	0.30	0.12	0.00	0.0%
	LW	14.50	9.30	0.00	0.00	0.32		0.00	0.00	0.0%
1	G	15.50	7.75			0.00		0.00	0.00	0.0%
	LS	17.30	6.24			0.00		0.00	0.00	0.0%
	TOTALS ----------					11.15	1.3 (Max.)	7.80	7.25	100.0%

Manning's n = 0.1379
Hydraulic Radius= 0.69928678

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	7.80	7.80	0.0%
9.05	7.80	10.42	33.5%
9.07	7.80	10.20	30.8%
9.09	7.80	9.99	28.1%
9.11	7.80	9.78	25.3%
9.13	7.80	9.56	22.6%
9.15	7.80	9.35	19.9%
9.17	7.80	9.14	17.2%
9.19	7.80	8.93	14.5%
9.21	7.80	8.73	11.9%
9.23	7.80	8.52	9.2%
9.25	7.80	8.31	6.6%
9.26	7.80	8.21	5.3%
9.27	7.80	8.11	3.9%
9.28	7.80	8.00	2.6%
9.29	7.80	7.90	1.3%
9.30	7.80	7.80	0.0%
9.31	7.80	7.70	-1.3%
9.32	7.80	7.60	-2.6%
9.33	7.80	7.50	-3.9%
9.34	7.80	7.40	-5.2%
9.35	7.80	7.29	-6.5%
9.37	7.80	7.10	-9.0%
9.39	7.80	6.90	-11.6%
9.41	7.80	6.70	-14.1%
9.43	7.80	6.51	-16.6%
9.45	7.80	6.31	-19.1%
9.47	7.80	6.12	-21.5%
9.49	7.80	5.93	-24.0%
9.51	7.80	5.74	-26.4%
9.53	7.80	5.55	-28.8%
9.55	7.80	5.37	-31.2%

WATERLINE AT ZERO
AREA ERROR = 9.300

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 2 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	7.75	13.47	1.94	2.85	26.14	15.75	100.0%	1.66	43.27	1.65
	8.30	12.31	1.55	2.30	19.06	14.12	89.6%	1.35	27.47	1.44
	8.35	12.20	1.51	2.25	18.44	13.97	88.7%	1.32	26.19	1.42
	8.40	12.10	1.47	2.20	17.83	13.82	87.8%	1.29	24.95	1.40
	8.45	11.99	1.44	2.15	17.23	13.67	86.8%	1.26	23.73	1.38
	8.50	11.89	1.40	2.10	16.64	13.53	85.9%	1.23	22.54	1.35
	8.55	11.78	1.36	2.05	16.04	13.38	84.9%	1.20	21.37	1.33
	8.60	11.68	1.32	2.00	15.46	13.23	84.0%	1.17	20.24	1.31
	8.65	11.57	1.29	1.95	14.88	13.08	83.1%	1.14	19.13	1.29
	8.70	11.47	1.25	1.90	14.30	12.93	82.1%	1.11	18.05	1.26
	8.75	11.36	1.21	1.85	13.73	12.78	81.2%	1.07	16.99	1.24
	8.80	11.26	1.17	1.80	13.16	12.64	80.2%	1.04	15.97	1.21
	8.85	11.15	1.13	1.75	12.60	12.49	79.3%	1.01	14.97	1.19
	8.90	11.04	1.09	1.70	12.05	12.34	78.4%	0.98	14.00	1.16
	8.95	10.94	1.05	1.65	11.50	12.19	77.4%	0.94	13.05	1.14
	9.00	10.83	1.01	1.60	10.95	12.04	76.5%	0.91	12.14	1.11
	9.05	10.73	0.97	1.55	10.42	11.90	75.5%	0.88	11.25	1.08
	9.10	10.62	0.93	1.50	9.88	11.75	74.6%	0.84	10.39	1.05
	9.15	10.52	0.89	1.45	9.35	11.60	73.7%	0.81	9.56	1.02
	9.20	10.41	0.85	1.40	8.83	11.45	72.7%	0.77	8.76	0.99
	9.25	10.31	0.81	1.35	8.31	11.30	71.8%	0.74	7.99	0.96
WL	9.30	10.20	0.76	1.30	7.80	11.15	70.8%	0.70	7.25	0.93
	9.35	10.01	0.73	1.25	7.29	10.92	69.3%	0.67	6.58	0.90
	9.40	9.82	0.69	1.20	6.80	10.68	67.8%	0.64	5.94	0.87
	9.45	9.62	0.66	1.15	6.31	10.45	66.4%	0.60	5.32	0.84
	9.50	9.43	0.62	1.10	5.84	10.22	64.9%	0.57	4.74	0.81
	9.55	9.35	0.57	1.05	5.37	10.08	64.0%	0.53	4.16	0.78
	9.60	9.26	0.53	1.00	4.90	9.94	63.1%	0.49	3.61	0.74
	9.65	9.07	0.49	0.95	4.44	9.72	61.7%	0.46	3.11	0.70
	9.70	8.88	0.45	0.90	4.00	9.51	60.4%	0.42	2.65	0.66
	9.75	8.69	0.41	0.85	3.56	9.29	59.0%	0.38	2.21	0.62
	9.80	8.50	0.37	0.80	3.13	9.08	57.7%	0.34	1.81	0.58
	9.85	8.32	0.33	0.75	2.71	8.87	56.3%	0.31	1.45	0.53
	9.90	7.07	0.33	0.70	2.31	7.59	48.2%	0.30	1.23	0.53
	9.95	6.74	0.29	0.65	1.97	7.24	46.0%	0.27	0.97	0.49
	10.00	6.49	0.25	0.60	1.63	6.97	44.2%	0.23	0.73	0.45
	10.05	5.85	0.23	0.55	1.33	6.29	39.9%	0.21	0.55	0.42
	10.10	5.20	0.20	0.50	1.05	5.61	35.6%	0.19	0.41	0.39
	10.15	4.60	0.18	0.45	0.81	5.00	31.7%	0.16	0.28	0.35
	10.20	3.92	0.15	0.40	0.58	4.30	27.3%	0.14	0.18	0.31
	10.25	3.29	0.12	0.35	0.40	3.62	23.0%	0.11	0.11	0.27
	10.30	1.53	0.16	0.30	0.25	1.80	11.4%	0.14	0.08	0.31
	10.35	1.20	0.15	0.25	0.18	1.41	8.9%	0.13	0.05	0.30
	10.40	0.87	0.15	0.20	0.13	1.02	6.5%	0.12	0.04	0.29
	10.45	0.75	0.12	0.15	0.09	0.86	5.5%	0.10	0.02	0.25
	10.50	0.63	0.08	0.10	0.05	0.71	4.5%	0.07	0.01	0.21
	10.55	0.52	0.04	0.05	0.02	0.55	3.5%	0.04	0.00	0.14
	10.60	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	7.25	cfs
CALCULATED FLOW (Qc)=	7.25	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	9.30	ft
CALCULATED WATERLINE (WLc)=	9.30	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	1.30	ft
MAX CALCULATED DEPTH (Dc)=	1.30	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.93	ft/sec
MANNING'S N=	0.138	
SLOPE=	0.012	ft/ft
.4 * Qm =	2.9	cfs
2.5 * Qm=	18.1	cfs

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

FLOW (CFS)	PERIOD
___________	________

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

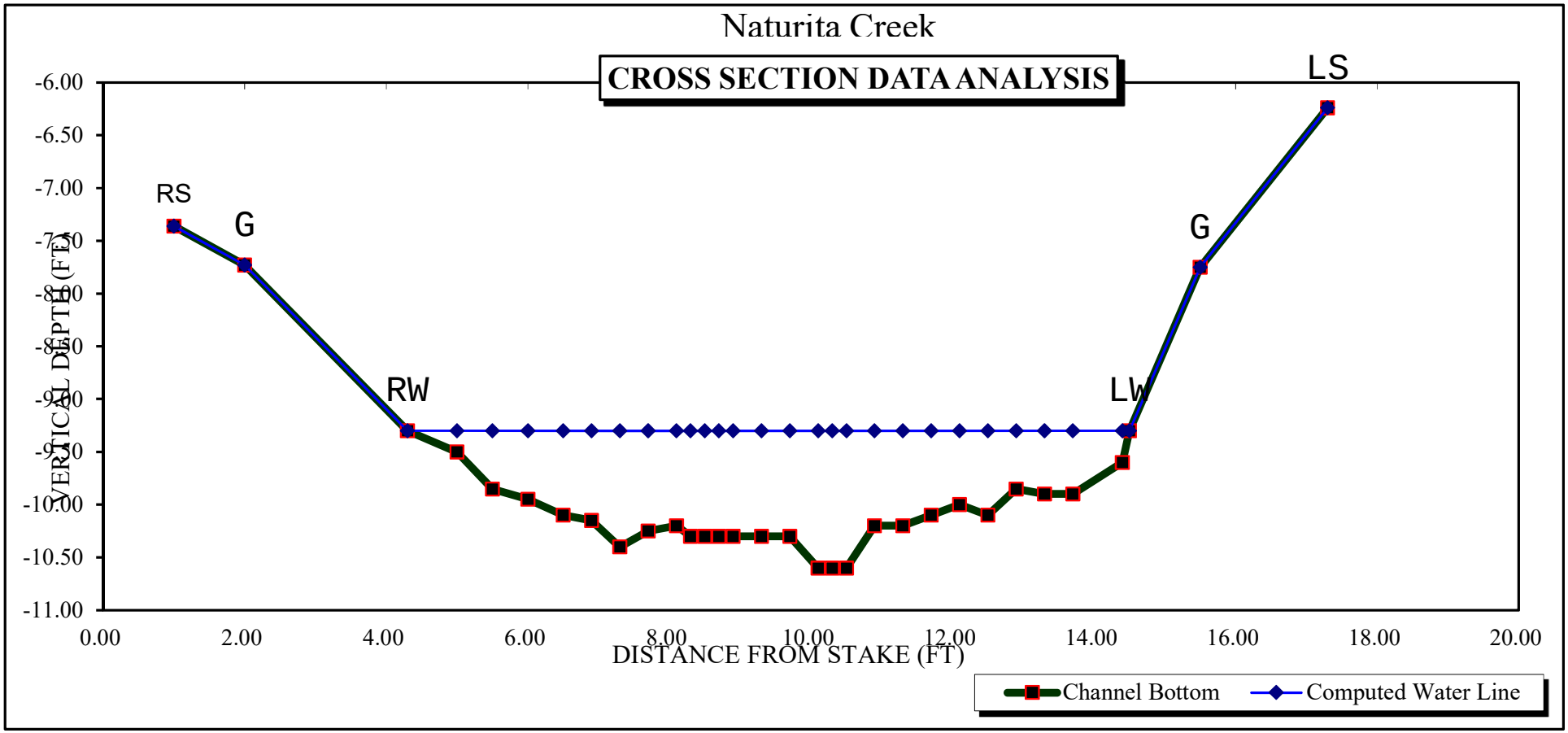
RECOMMENDATION BY: ……………… AGENCY……………… DATE:………………

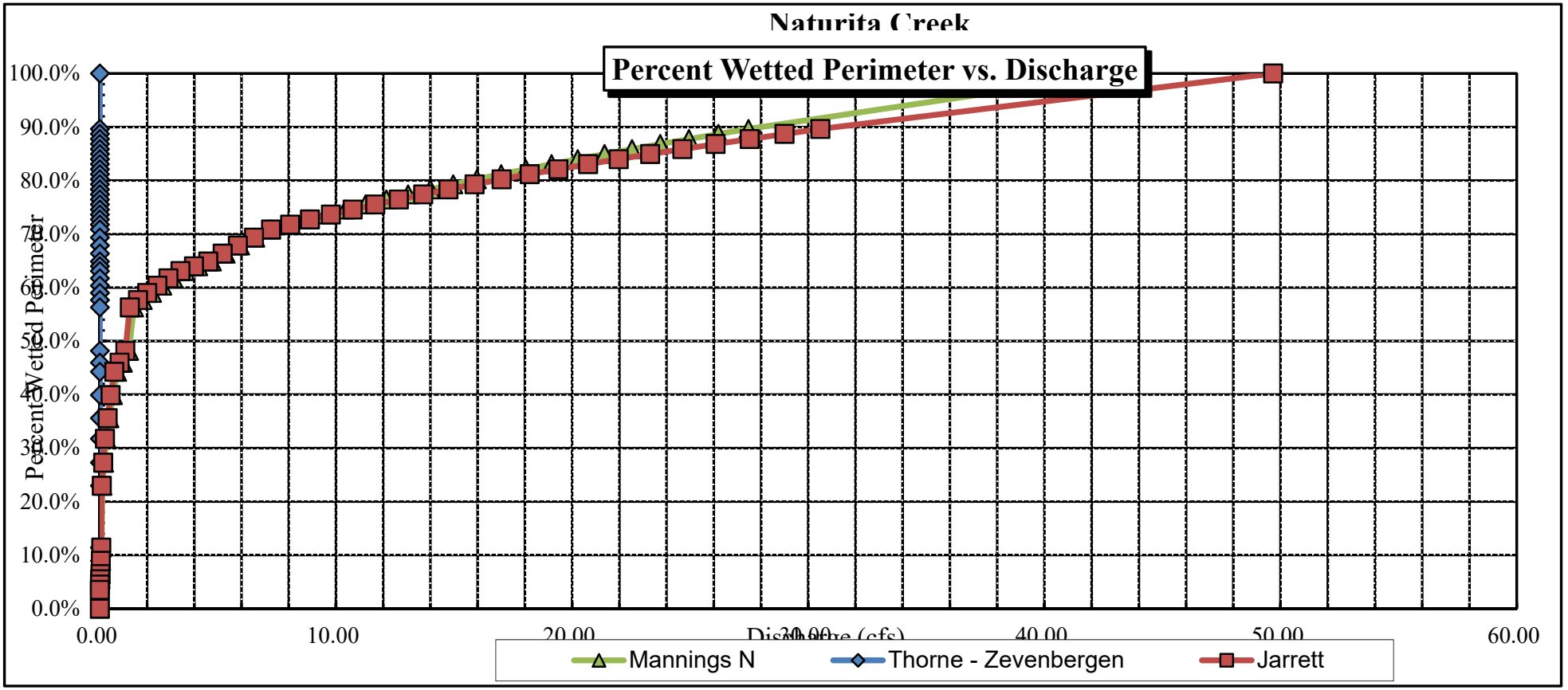
CWCB REVIEW BY: ……………… DATE:………………

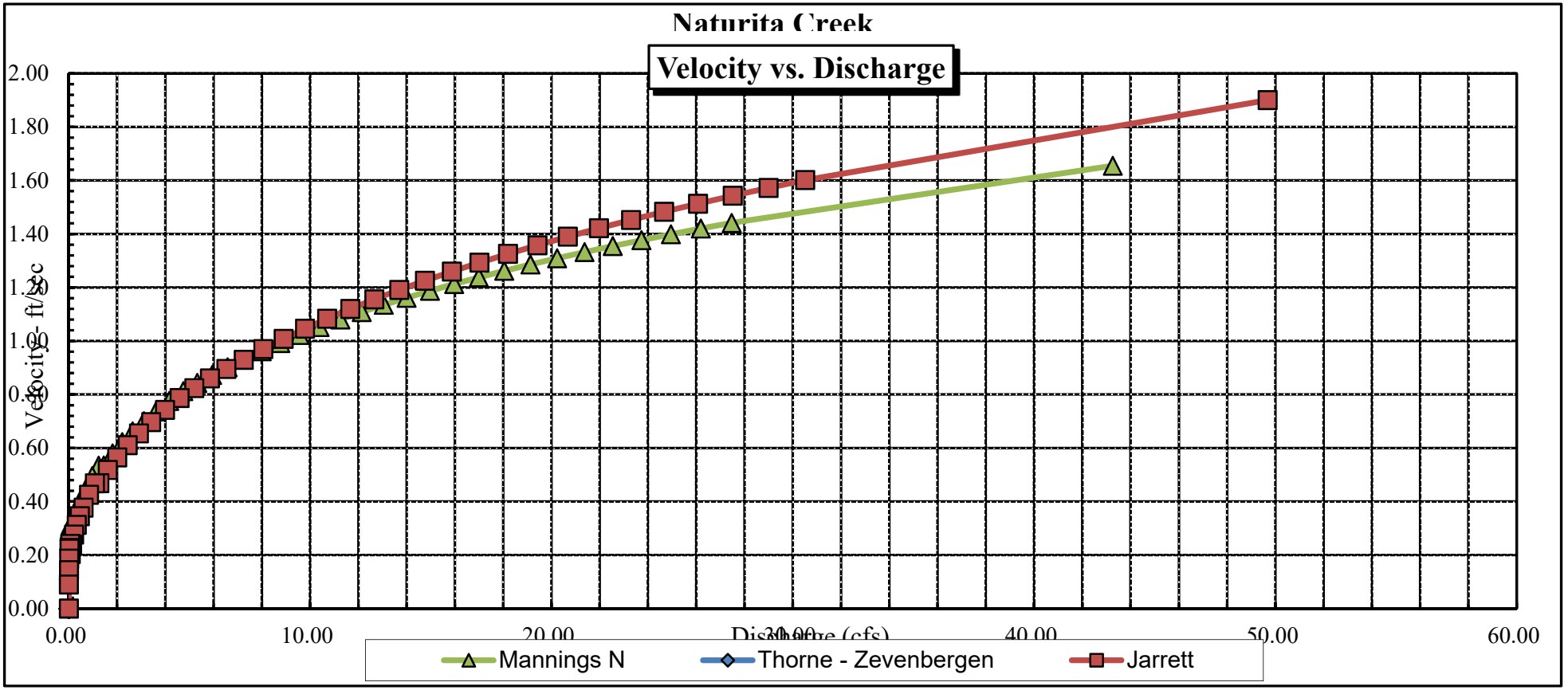
STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd nr compressor station
XS NUMBER: 2 Jarrett Variable Manning's n Correction Applied

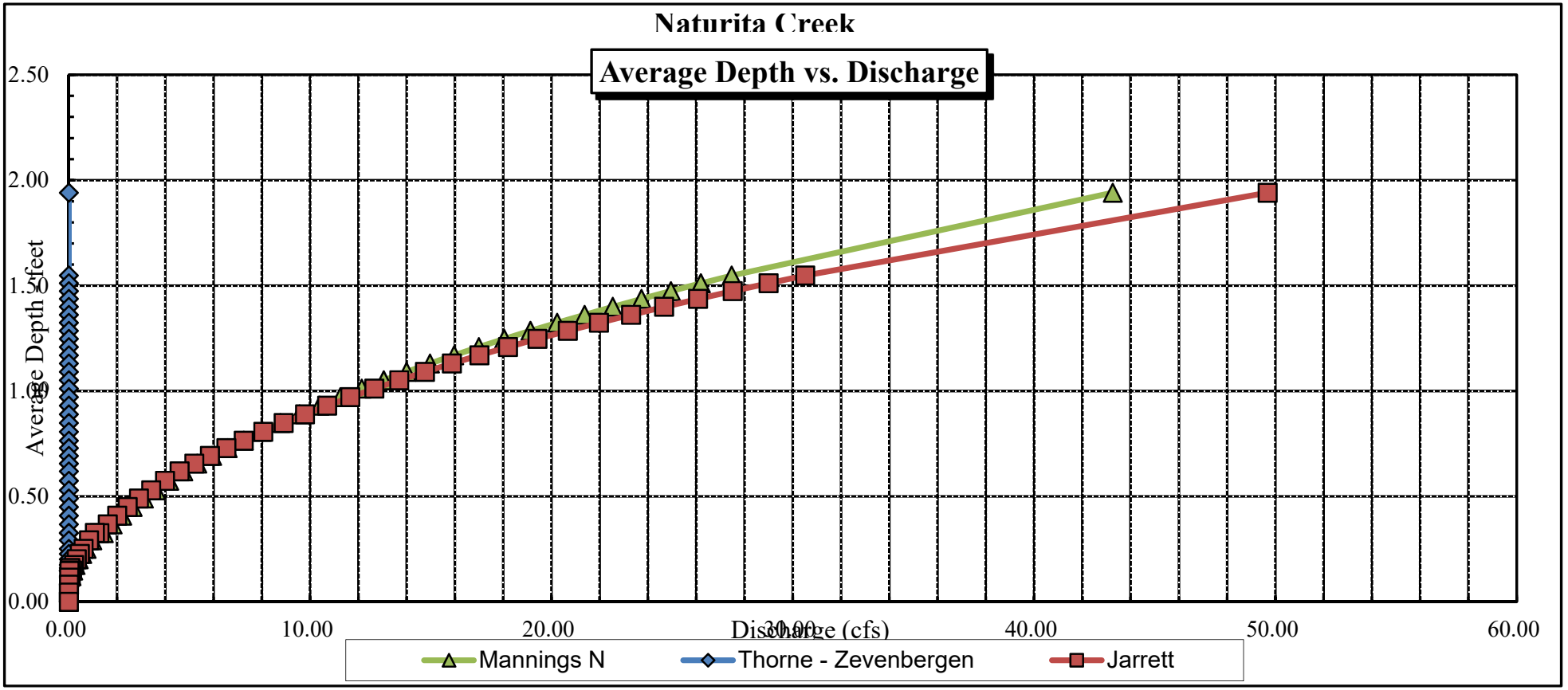
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

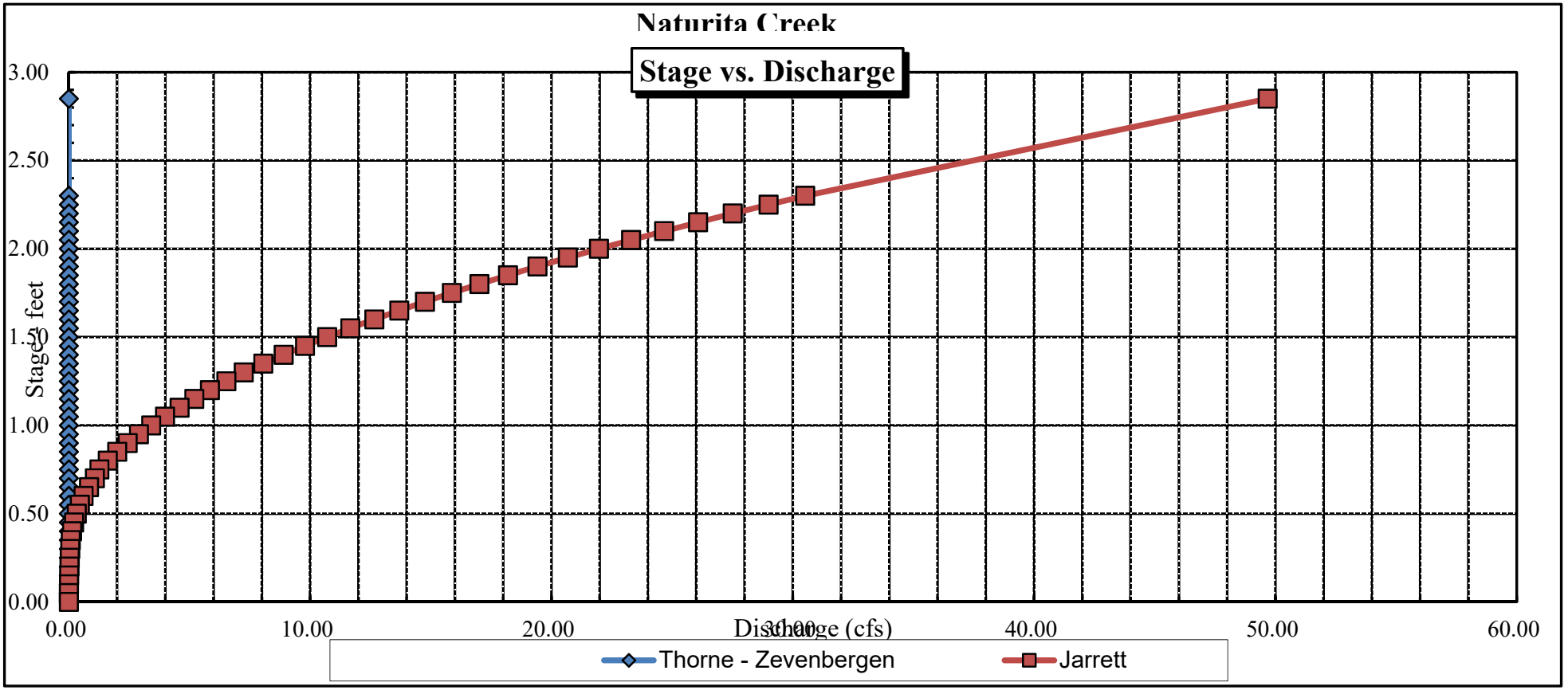
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	7.75	13.47	1.94	2.85	26.14	15.75	100.0%	1.66	49.68	1.90
	8.30	12.31	1.55	2.30	19.06	14.12	89.6%	1.35	30.51	1.60
	8.35	12.20	1.51	2.25	18.44	13.97	88.7%	1.32	29.00	1.57
	8.40	12.10	1.47	2.20	17.83	13.82	87.8%	1.29	27.52	1.54
	8.45	11.99	1.44	2.15	17.23	13.67	86.8%	1.26	26.08	1.51
	8.50	11.89	1.40	2.10	16.64	13.53	85.9%	1.23	24.67	1.48
	8.55	11.78	1.36	2.05	16.04	13.38	84.9%	1.20	23.30	1.45
	8.60	11.68	1.32	2.00	15.46	13.23	84.0%	1.17	21.97	1.42
	8.65	11.57	1.29	1.95	14.88	13.08	83.1%	1.14	20.68	1.39
	8.70	11.47	1.25	1.90	14.30	12.93	82.1%	1.11	19.42	1.36
	8.75	11.36	1.21	1.85	13.73	12.78	81.2%	1.07	18.20	1.33
	8.80	11.26	1.17	1.80	13.16	12.64	80.2%	1.04	17.02	1.29
	8.85	11.15	1.13	1.75	12.60	12.49	79.3%	1.01	15.87	1.26
	8.90	11.04	1.09	1.70	12.05	12.34	78.4%	0.98	14.76	1.23
	8.95	10.94	1.05	1.65	11.50	12.19	77.4%	0.94	13.69	1.19
	9.00	10.83	1.01	1.60	10.95	12.04	76.5%	0.91	12.66	1.16
	9.05	10.73	0.97	1.55	10.42	11.90	75.5%	0.88	11.66	1.12
	9.10	10.62	0.93	1.50	9.88	11.75	74.6%	0.84	10.71	1.08
	9.15	10.52	0.89	1.45	9.35	11.60	73.7%	0.81	9.79	1.05
	9.20	10.41	0.85	1.40	8.83	11.45	72.7%	0.77	8.90	1.01
	9.25	10.31	0.81	1.35	8.31	11.30	71.8%	0.74	8.06	0.97
WL	9.30	10.20	0.76	1.30	7.80	11.15	70.8%	0.70	7.25	0.93
	9.35	10.01	0.73	1.25	7.29	10.92	69.3%	0.67	6.53	0.90
	9.40	9.82	0.69	1.20	6.80	10.68	67.8%	0.64	5.85	0.86
	9.45	9.62	0.66	1.15	6.31	10.45	66.4%	0.60	5.20	0.82
	9.50	9.43	0.62	1.10	5.84	10.22	64.9%	0.57	4.59	0.79
	9.55	9.35	0.57	1.05	5.37	10.08	64.0%	0.53	3.99	0.74
	9.60	9.26	0.53	1.00	4.90	9.94	63.1%	0.49	3.42	0.70
	9.65	9.07	0.49	0.95	4.44	9.72	61.7%	0.46	2.91	0.65
	9.70	8.88	0.45	0.90	4.00	9.51	60.4%	0.42	2.44	0.61
	9.75	8.69	0.41	0.85	3.56	9.29	59.0%	0.38	2.01	0.56
	9.80	8.50	0.37	0.80	3.13	9.08	57.7%	0.34	1.62	0.52
	9.85	8.32	0.33	0.75	2.71	8.87	56.3%	0.31	1.27	0.47
	9.90	7.07	0.33	0.70	2.31	7.59	48.2%	0.30	1.08	0.47
	9.95	6.74	0.29	0.65	1.97	7.24	46.0%	0.27	0.84	0.43
	10.00	6.49	0.25	0.60	1.63	6.97	44.2%	0.23	0.62	0.38
	10.05	5.85	0.23	0.55	1.33	6.29	39.9%	0.21	0.46	0.35
	10.10	5.20	0.20	0.50	1.05	5.61	35.6%	0.19	0.33	0.31
	10.15	4.60	0.18	0.45	0.81	5.00	31.7%	0.16	0.22	0.28
	10.20	3.92	0.15	0.40	0.58	4.30	27.3%	0.14	0.14	0.24
	10.25	3.29	0.12	0.35	0.40	3.62	23.0%	0.11	0.08	0.20
	10.30	1.53	0.16	0.30	0.25	1.80	11.4%	0.14	0.06	0.24
	10.35	1.20	0.15	0.25	0.18	1.41	8.9%	0.13	0.04	0.23
	10.40	0.87	0.15	0.20	0.13	1.02	6.5%	0.12	0.03	0.22
	10.45	0.75	0.12	0.15	0.09	0.86	5.5%	0.10	0.02	0.19
	10.50	0.63	0.08	0.10	0.05	0.71	4.5%	0.07	0.01	0.14
	10.55	0.52	0.04	0.05	0.02	0.55	3.5%	0.04	0.00	0.09
	10.60	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!


Naturita Creek
CROSS SECTION DATA ANALYSIS
LS
RS
G
G
RW
LW
-6.00
-6.50
-7.00
-10.00
-10.50
-11.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
VERTICAL DEPTH (FT)
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


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


Naturita Creek
Velocity vs. Discharge
Velocity - ft/sec
2.00
1.80
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
Mannings N
Thorne - Zevenbergen
Jarrett


Naturita Creek
Average Depth vs. Discharge
Average Depth - feet
2.50
2.00
1.50
1.00
0.50
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Naturita Creek
Stage vs. Discharge
Stage - feet
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

Data Input & Proofing

STREAM NAME:	Naturita Creek
XS LOCATION:	End of seismic rd nr compressor station
XS NUMBER:	2
DATE:	6/27/2017
OBSERVERS:	R. Smith, L. Fehlmann
1/4 SEC:	NE
SECTION:	6
TWP:	45N
RANGE:	14W
PM:	NM
COUNTY:	San Miguel
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	41804
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.012 ft / ft

CHECKED BY:.....DATE.....

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

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
			Total Data Points = 32					
	RS	1.00	7.36			0.00	0.00	0.00
1	G	2.00	7.73			0.00	0.00	0.00
	RW	4.30	9.30	0.00	0.00	0.00	0.00	0.00
		5.00	9.50	0.20	0.00	0.12	0.00	9.30
		5.50	9.85	0.55	0.00	0.28	0.00	9.30
		6.00	9.95	0.65	0.00	0.33	0.00	9.30
		6.50	10.10	0.80	0.26	0.36	0.09	9.30
		6.90	10.15	0.85	0.52	0.34	0.18	9.30
		7.30	10.40	1.10	0.73	0.44	0.32	9.30
		7.70	10.25	0.95	0.76	0.38	0.29	9.30
		8.10	10.20	0.90	2.71	0.27	0.73	9.30
		8.30	10.30	1.00	2.04	0.20	0.41	9.30
		8.50	10.30	1.00	2.45	0.20	0.49	9.30
		8.70	10.30	1.00	1.28	0.20	0.26	9.30
		8.90	10.30	1.00	1.38	0.30	0.41	9.30
		9.30	10.30	1.00	0.40	0.40	0.16	9.30
		9.70	10.30	1.00	0.94	0.40	0.38	9.30
		10.10	10.60	1.30	1.61	0.39	0.63	9.30
		10.30	10.60	1.30	1.91	0.26	0.50	9.30
		10.50	10.60	1.30	1.43	0.39	0.56	9.30
		10.90	10.20	0.90	1.73	0.36	0.62	9.30
		11.30	10.20	0.90	1.40	0.36	0.50	9.30
		11.70	10.10	0.80	0.82	0.32	0.26	9.30
		12.10	10.00	0.70	0.64	0.28	0.18	9.30
		12.50	10.10	0.80	0.40	0.32	0.13	9.30
		12.90	9.85	0.55	0.62	0.22	0.14	9.30
		13.30	9.90	0.60	0.09	0.24	0.02	9.30
		13.70	9.90	0.60	0.00	0.33	0.00	9.30
		14.40	9.60	0.30	0.00	0.12	0.00	9.30
	LW	14.50	9.30	0.00	0.00	0.00	0.00	0.00
1	G	15.50	7.75			0.00	0.00	0.00
	LS	17.30	6.24			0.00	0.00	0.00
					Totals	7.80	7.25	

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Naturita Creek | CROSS-SECTION NO.: 1

CROSS-SECTION LOCATION: Drop off end of seismic road near Paradox Basin Compressor Station

DATE: 10-3-17 | OBSERVERS: R. Smith, J. Sondergard

LEGAL DESCRIPTION | ¼ SECTION: NE | SECTION: 6 | TOWNSHIP: 45 (N)/S | RANGE: 14 E/(W) | PM: NM

COUNTY: Montrose | WATERSHED: San Miguel | WATER DIVISION: 4 | DOW WATER CODE: 41804

MAP(S): USGS:

USFS:

SUPPLEMENTAL DATA

FLAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) NO | METER TYPE: M-M

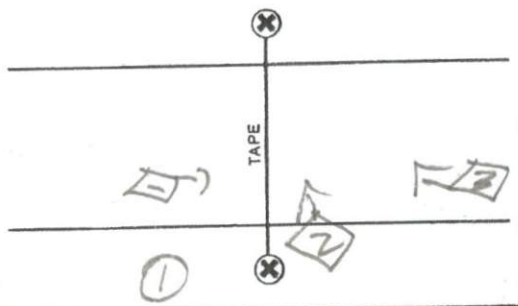
METER NUMBER: | DATE RATED: | CALIB/SPIN: _____ sec | TAPE WEIGHT: surveyed lbs/foot | TAPE TENSION: surveyed lbs

CHANNEL BED MATERIAL SIZE RANGE: | PHOTOGRAPHS TAKEN: YES/NO | NUMBER OF PHOTOGRAPHS:

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(1) Tape @ Stake LB	0.0	surveyed
(2) Tape @ Stake RB	0.0	surveyed
( ) WS @ Tape LB/RB	0.0	8.90/8.90
( ) WS Upstream	20.0	8.78
( ) WS Downstream	1.0	8.92
SLOPE	0.14/21.0 = .0067	

SKETCH



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: Naturita Creek | CROSS-SECTION NO.: 1 | DATE: 10-3-17 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: ____ ft | TIME: 1:40 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)
G	1.9		7.29								
RW	3.0		8.90	0				0			
	3.2		8.95	.05				0			
	3.6		8.9	0				0			
	4.0		8.9	0				0			
	4.4		9.2	.3				.31			
	4.8		9.25	.35				.58			
	5.2		9.3	.4				.72			
	5.6		9.1	.2				.92			
	6		9.05	.15				.90			
	6.4		9.0	.10				.50			
	6.8		8.9	0				0			
	7.2		9.5	0.6				.63			
	7.6	9.80	9.65	0.75				.04			
	8.0	<8.2>	9.80	0.9	<.9			1.26	<1.08		
	8.4		9.80	0.9				.61			
	8.8		9.90	1.0				0			
	9.2		9.8	.9				0			
	9.6		9.8	.9				.29			
	10.0	<10.2	9.5	.6	<.6			1.27	<1.24		
	10.4	<10.6	9.65	.75	<.85			.53	>.80		
	10.8	<11.0	9.70	.8	<.70			.96	<.29		
	11.2		9.65	.75				.19			
	11.6		9.60	.7				.05			
LW	11.8		8.90	0				0			
G	12.6		7.24								

Water surface elevation is 1.6 feet below bankfull.

TOTALS:

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

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

LOCATION INFORMATION

STREAM NAME:	Naturita Creek
XS LOCATION:	End of seismic rd. nr compressor station
XS NUMBER:	1
DATE:	3-Oct-17
OBSERVERS:	R. Smith. J. Sondergard
1/4 SEC:	NE
SECTION:	6
TWP:	45N
RANGE:	14W
PM:	NM
COUNTY:	Montrose
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	41804
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:	0.0067

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

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

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd. nr compressor station
XS NUMBER: 1

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	G&RS	1.90	7.29			0.00		0.00	0.00	0.0%
	RW	3.00	8.90	0.00	0.00	0.00		0.00	0.00	0.0%
		3.20	8.95	0.05	0.00	0.21	0.05	0.02	0.00	0.0%
		3.60	8.90	0.00	0.00	0.40		0.00	0.00	0.0%
		4.00	8.90	0.00	0.00	0.00		0.00	0.00	0.0%
		4.40	9.20	0.30	0.31	0.50	0.30	0.12	0.04	1.7%
		4.80	9.25	0.35	0.58	0.40	0.35	0.14	0.08	3.7%
		5.20	9.30	0.40	0.72	0.40	0.40	0.16	0.12	5.3%
		5.60	9.10	0.20	0.92	0.45	0.20	0.08	0.07	3.4%
		6.00	9.05	0.15	0.90	0.40	0.15	0.06	0.05	2.5%
		6.40	9.00	0.10	0.50	0.40	0.10	0.04	0.02	0.9%
		6.80	8.90	0.00	0.00	0.41		0.00	0.00	0.0%
		7.20	9.50	0.60	0.63	0.72	0.60	0.24	0.15	6.9%
		7.60	9.65	0.75	0.04	0.43	0.75	0.30	0.01	0.5%
		8.00	9.80	0.90	1.26	0.43	0.90	0.27	0.34	15.5%
		8.20	9.80	0.90	1.08	0.20	0.90	0.18	0.19	8.9%
		8.40	9.80	0.90	0.61	0.20	0.90	0.27	0.16	7.5%
		8.80	9.90	1.00	0.00	0.41	1.00	0.40	0.00	0.0%
		9.20	9.80	0.90	0.00	0.41	0.90	0.36	0.00	0.0%
		9.60	9.80	0.90	0.29	0.40	0.90	0.36	0.10	4.8%
		10.00	9.50	0.60	1.27	0.50	0.60	0.18	0.23	10.4%
		10.20	9.50	0.60	1.24	0.20	0.60	0.12	0.15	6.8%
		10.40	9.65	0.75	0.53	0.25	0.75	0.15	0.08	3.6%
		10.60	9.75	0.85	0.80	0.22	0.85	0.17	0.14	6.2%
		10.80	9.70	0.80	0.96	0.21	0.80	0.16	0.15	7.0%
		11.00	9.60	0.70	0.29	0.22	0.70	0.14	0.04	1.9%
		11.20	9.65	0.75	0.19	0.21	0.75	0.23	0.04	2.0%
		11.60	9.60	0.70	0.05	0.40	0.70	0.21	0.01	0.5%
	LW	11.80	8.90	0.00	0.00	0.73		0.00	0.00	0.0%
1	G&LS	12.60	7.24			0.00		0.00	0.00	0.0%
	TOTALS ----------					9.72	1 (Max.)	4.35	2.19	100.0%

Manning's n = 0.1414
Hydraulic Radius= 0.44743771

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd. nr compressor station
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	4.35	4.35	0.0%
8.65	4.35	6.59	51.4%
8.67	4.35	6.40	47.2%
8.69	4.35	6.22	43.1%
8.71	4.35	6.04	38.9%
8.73	4.35	5.86	34.8%
8.75	4.35	5.68	30.6%
8.77	4.35	5.50	26.5%
8.79	4.35	5.33	22.4%
8.81	4.35	5.15	18.3%
8.83	4.35	4.97	14.2%
8.85	4.35	4.79	10.1%
8.86	4.35	4.70	8.1%
8.87	4.35	4.61	6.1%
8.88	4.35	4.53	4.1%
8.89	4.35	4.44	2.0%
8.90	4.35	4.35	0.0%
8.91	4.35	4.27	-1.9%
8.92	4.35	4.19	-3.8%
8.93	4.35	4.11	-5.6%
8.94	4.35	4.03	-7.4%
8.95	4.35	3.95	-9.1%
8.97	4.35	3.80	-12.5%
8.99	4.35	3.66	-15.9%
9.01	4.35	3.52	-19.2%
9.03	4.35	3.38	-22.4%
9.05	4.35	3.24	-25.5%
9.07	4.35	3.11	-28.5%
9.09	4.35	2.98	-31.4%
9.11	4.35	2.86	-34.3%
9.13	4.35	2.74	-37.0%
9.15	4.35	2.62	-39.8%

WATERLINE AT ZERO
AREA ERROR = 8.900

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd. nr compressor station
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	7.29	10.68	1.88	2.61	20.03	13.86	100.0%	1.45	22.02	1.10
	7.90	9.97	1.38	2.00	13.73	12.44	89.8%	1.10	12.61	0.92
	7.95	9.91	1.34	1.95	13.24	12.33	88.9%	1.07	11.94	0.90
	8.00	9.85	1.29	1.90	12.74	12.21	88.1%	1.04	11.27	0.88
	8.05	9.79	1.25	1.85	12.25	12.10	87.3%	1.01	10.63	0.87
	8.10	9.73	1.21	1.80	11.76	11.98	86.4%	0.98	9.99	0.85
	8.15	9.67	1.17	1.75	11.28	11.86	85.6%	0.95	9.38	0.83
	8.20	9.62	1.12	1.70	10.80	11.75	84.8%	0.92	8.78	0.81
	8.25	9.56	1.08	1.65	10.32	11.63	83.9%	0.89	8.19	0.79
	8.30	9.50	1.04	1.60	9.84	11.51	83.1%	0.85	7.62	0.77
	8.35	9.44	0.99	1.55	9.37	11.40	82.2%	0.82	7.07	0.75
	8.40	9.38	0.95	1.50	8.90	11.28	81.4%	0.79	6.53	0.73
	8.45	9.32	0.90	1.45	8.43	11.17	80.6%	0.75	6.01	0.71
	8.50	9.27	0.86	1.40	7.96	11.05	79.7%	0.72	5.50	0.69
	8.55	9.21	0.81	1.35	7.50	10.93	78.9%	0.69	5.02	0.67
	8.60	9.15	0.77	1.30	7.04	10.82	78.1%	0.65	4.55	0.65
	8.65	9.09	0.72	1.25	6.59	10.70	77.2%	0.62	4.10	0.62
	8.70	9.03	0.68	1.20	6.13	10.59	76.4%	0.58	3.67	0.60
	8.75	8.97	0.63	1.15	5.68	10.47	75.5%	0.54	3.25	0.57
	8.80	8.92	0.59	1.10	5.24	10.35	74.7%	0.51	2.86	0.55
	8.85	8.86	0.54	1.05	4.79	10.24	73.9%	0.47	2.48	0.52
WL	8.90	8.40	0.52	1.00	4.35	9.72	70.1%	0.45	2.19	0.50
	8.95	7.49	0.53	0.95	3.95	8.71	62.9%	0.45	2.01	0.51
	9.00	7.17	0.50	0.90	3.59	8.31	60.0%	0.43	1.76	0.49
	9.05	6.66	0.49	0.85	3.24	7.71	55.6%	0.42	1.56	0.48
	9.10	6.14	0.48	0.80	2.92	7.11	51.3%	0.41	1.39	0.48
	9.15	5.93	0.44	0.75	2.62	6.81	49.1%	0.38	1.19	0.45
	9.20	5.71	0.41	0.70	2.33	6.50	46.9%	0.36	1.01	0.43
	9.25	5.17	0.40	0.65	2.06	5.87	42.4%	0.35	0.88	0.43
	9.30	4.62	0.39	0.60	1.81	5.24	37.8%	0.35	0.77	0.42
	9.35	4.57	0.35	0.55	1.58	5.13	37.0%	0.31	0.62	0.39
	9.40	4.52	0.30	0.50	1.35	5.02	36.2%	0.27	0.49	0.36
	9.45	4.48	0.25	0.45	1.13	4.91	35.4%	0.23	0.36	0.32
	9.50	4.23	0.21	0.40	0.91	4.60	33.2%	0.20	0.26	0.29
	9.55	3.95	0.18	0.35	0.70	4.23	30.6%	0.17	0.18	0.26
	9.60	3.67	0.14	0.30	0.51	3.87	27.9%	0.13	0.11	0.22
	9.65	2.70	0.13	0.25	0.35	2.84	20.5%	0.12	0.08	0.21
	9.70	2.30	0.10	0.20	0.23	2.39	17.3%	0.10	0.04	0.18
	9.75	1.80	0.07	0.15	0.13	1.85	13.4%	0.07	0.02	0.14
	9.80	0.80	0.05	0.10	0.04	0.82	6.0%	0.05	0.00	0.11
	9.85	0.40	0.03	0.05	0.01	0.41	3.0%	0.02	0.00	0.07
	9.90	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd. nr compressor station
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.19	cfs
CALCULATED FLOW (Qc)=	2.19	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	8.90	ft
CALCULATED WATERLINE (WLc)=	8.90	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	1.00	ft
MAX CALCULATED DEPTH (Dc)=	1.00	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.50	ft/sec
MANNING'S N=	0.141	
SLOPE=	0.0067	ft/ft
.4 * Qm =	0.9	cfs
2.5 * Qm=	5.5	cfs

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

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

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

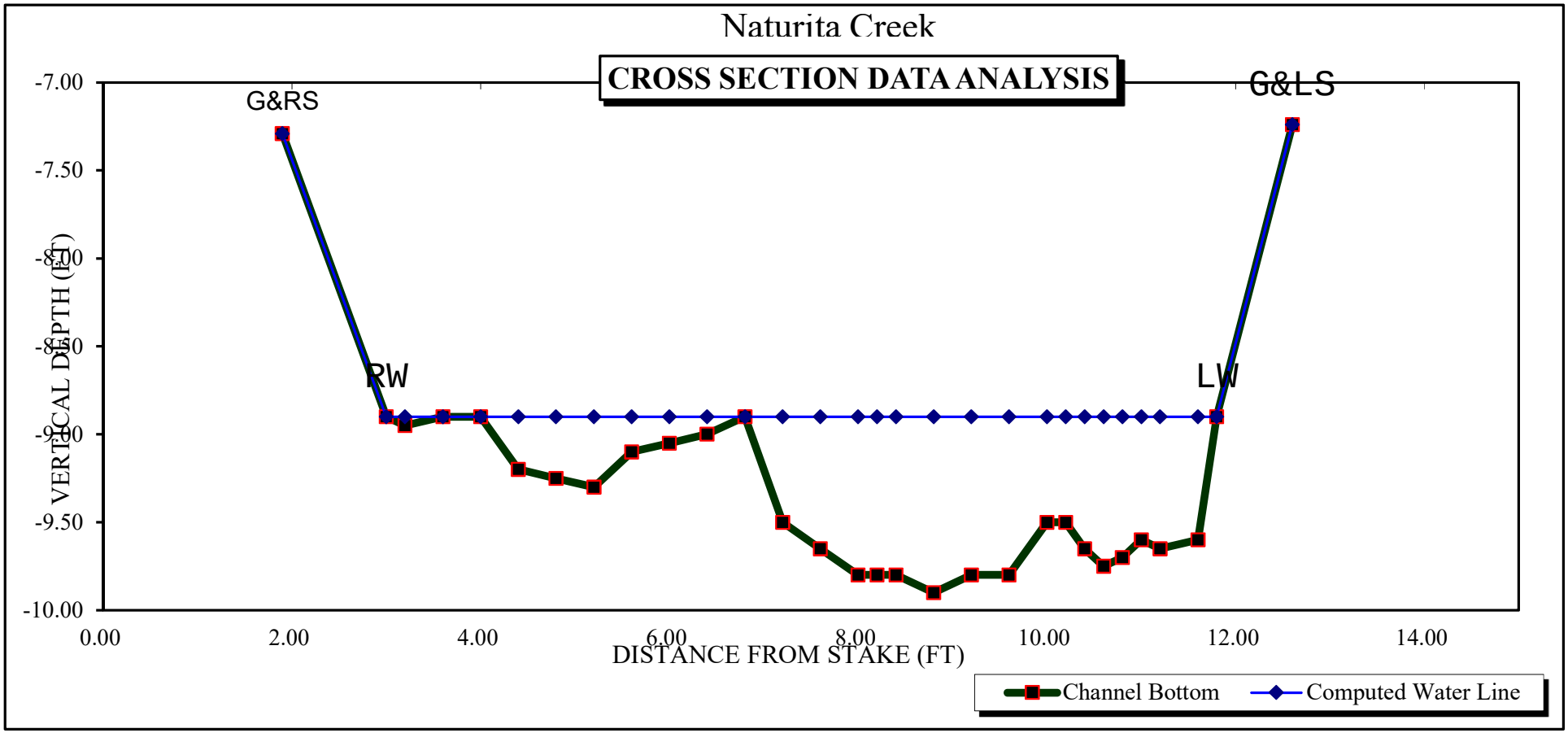
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

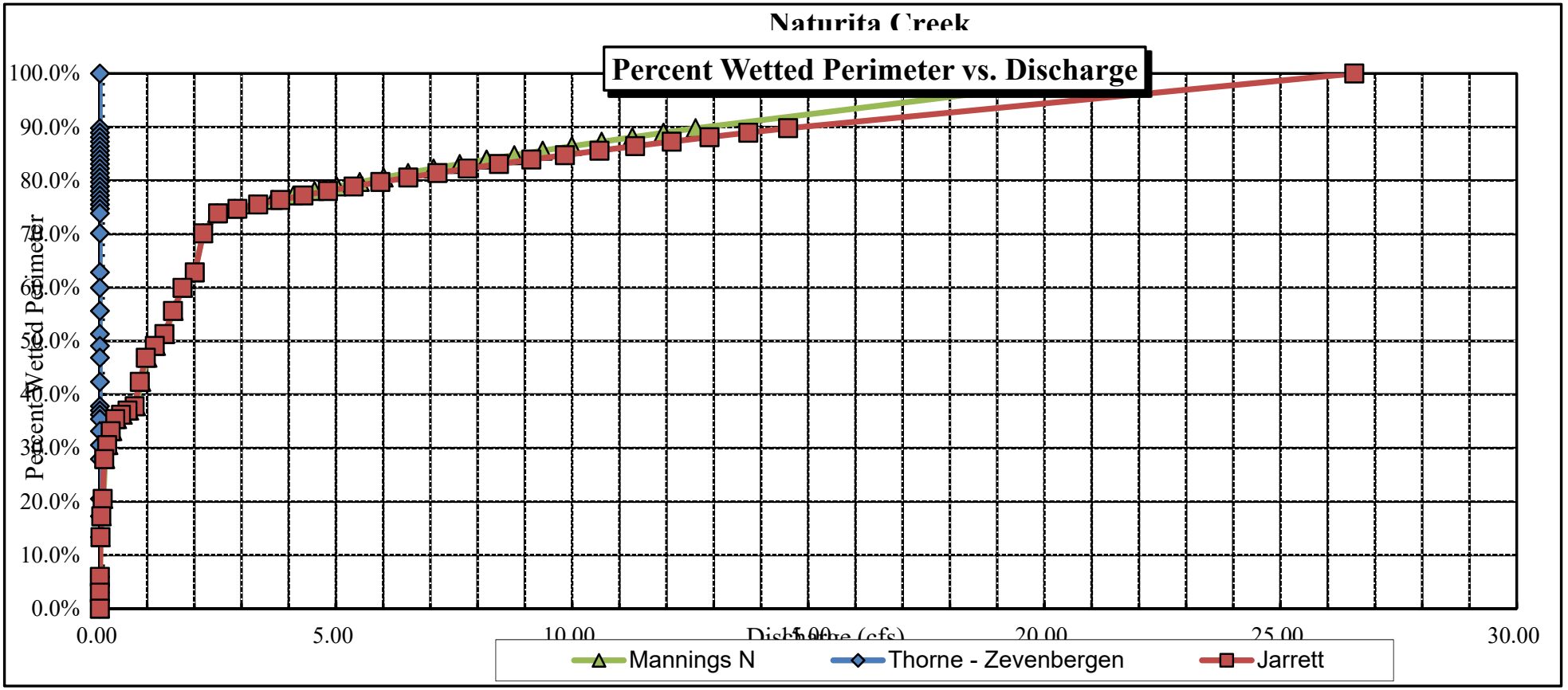
CWCB REVIEW BY: ..... DATE:.....

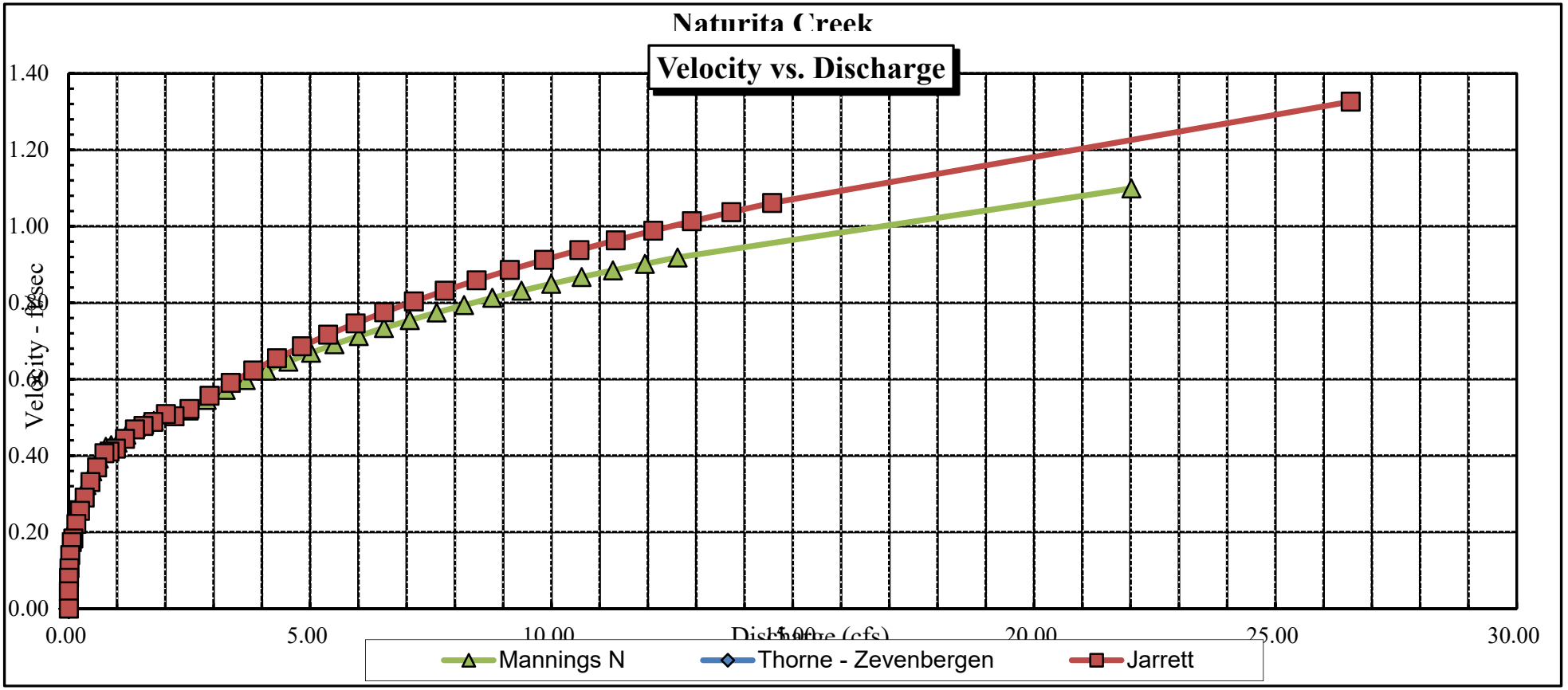
STREAM NAME: Naturita Creek
XS LOCATION: End of seismic rd. nr compressor station
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

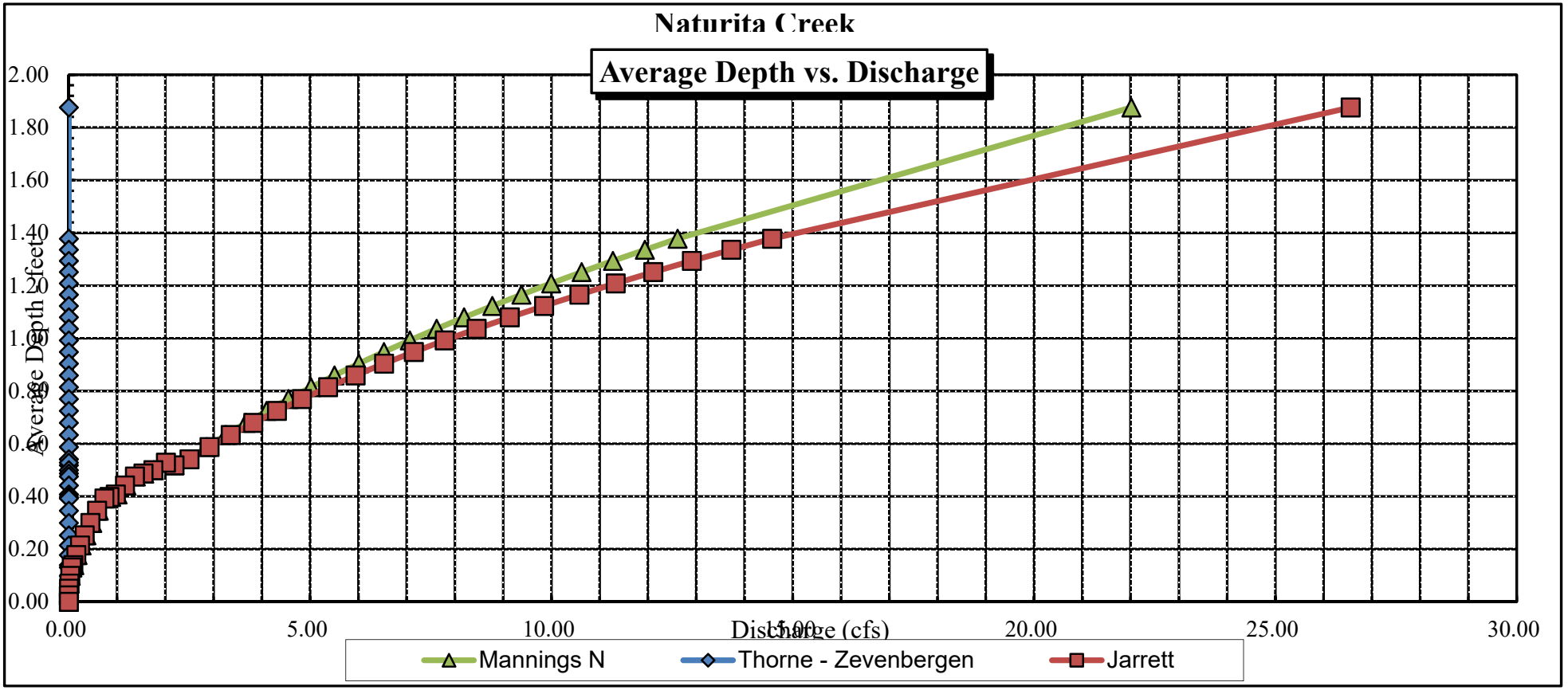
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

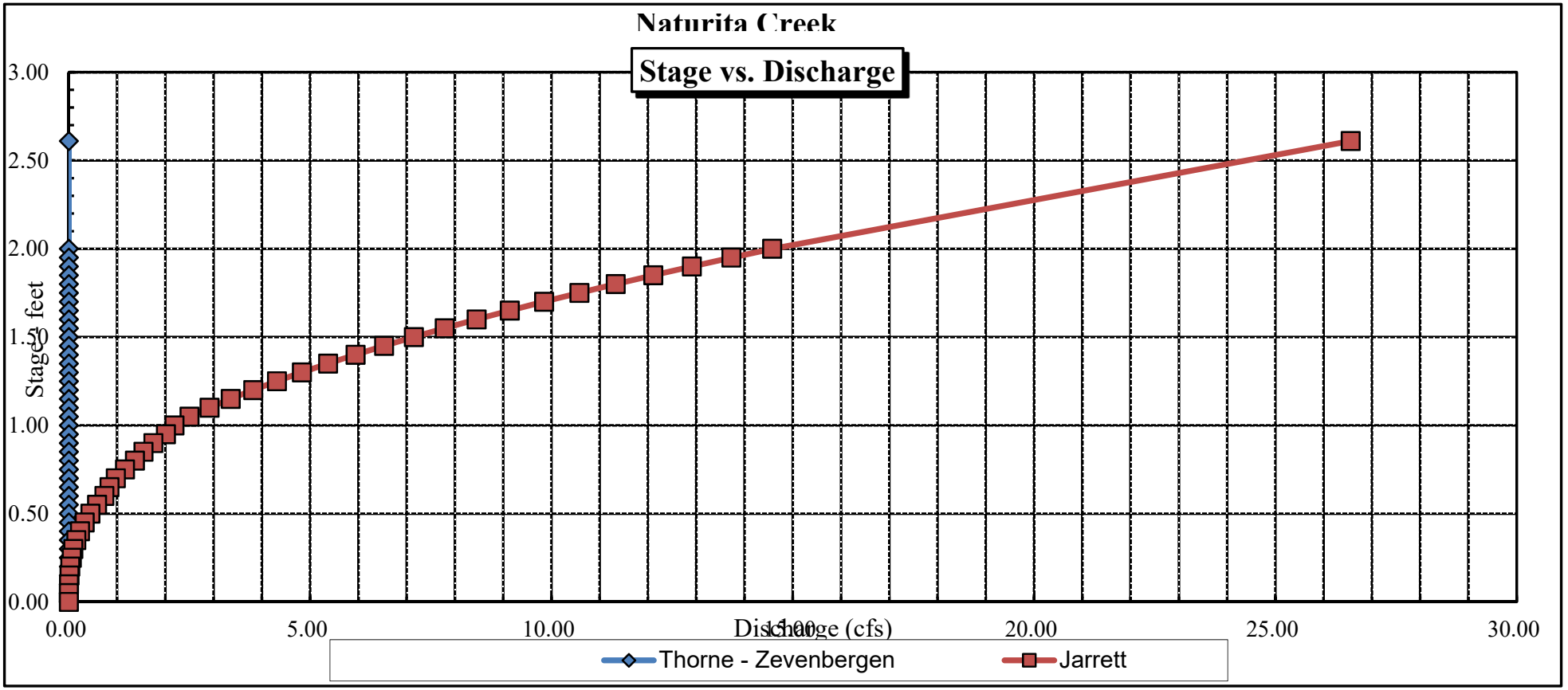
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	7.29	10.68	1.88	2.61	20.03	13.86	100.0%	1.45	26.56	1.33
	7.90	9.97	1.38	2.00	13.73	12.44	89.8%	1.10	14.57	1.06
	7.95	9.91	1.34	1.95	13.24	12.33	88.9%	1.07	13.73	1.04
	8.00	9.85	1.29	1.90	12.74	12.21	88.1%	1.04	12.91	1.01
	8.05	9.79	1.25	1.85	12.25	12.10	87.3%	1.01	12.11	0.99
	8.10	9.73	1.21	1.80	11.76	11.98	86.4%	0.98	11.33	0.96
	8.15	9.67	1.17	1.75	11.28	11.86	85.6%	0.95	10.58	0.94
	8.20	9.62	1.12	1.70	10.80	11.75	84.8%	0.92	9.85	0.91
	8.25	9.56	1.08	1.65	10.32	11.63	83.9%	0.89	9.14	0.89
	8.30	9.50	1.04	1.60	9.84	11.51	83.1%	0.85	8.45	0.86
	8.35	9.44	0.99	1.55	9.37	11.40	82.2%	0.82	7.79	0.83
	8.40	9.38	0.95	1.50	8.90	11.28	81.4%	0.79	7.15	0.80
	8.45	9.32	0.90	1.45	8.43	11.17	80.6%	0.75	6.53	0.78
	8.50	9.27	0.86	1.40	7.96	11.05	79.7%	0.72	5.94	0.75
	8.55	9.21	0.81	1.35	7.50	10.93	78.9%	0.69	5.37	0.72
	8.60	9.15	0.77	1.30	7.04	10.82	78.1%	0.65	4.83	0.69
	8.65	9.09	0.72	1.25	6.59	10.70	77.2%	0.62	4.31	0.65
	8.70	9.03	0.68	1.20	6.13	10.59	76.4%	0.58	3.82	0.62
	8.75	8.97	0.63	1.15	5.68	10.47	75.5%	0.54	3.35	0.59
	8.80	8.92	0.59	1.10	5.24	10.35	74.7%	0.51	2.91	0.56
	8.85	8.86	0.54	1.05	4.79	10.24	73.9%	0.47	2.50	0.52
WL	8.90	8.40	0.52	1.00	4.35	9.72	70.1%	0.45	2.19	0.50
	8.95	7.49	0.53	0.95	3.95	8.71	62.9%	0.45	2.01	0.51
	9.00	7.17	0.50	0.90	3.59	8.31	60.0%	0.43	1.75	0.49
	9.05	6.66	0.49	0.85	3.24	7.71	55.6%	0.42	1.55	0.48
	9.10	6.14	0.48	0.80	2.92	7.11	51.3%	0.41	1.37	0.47
	9.15	5.93	0.44	0.75	2.62	6.81	49.1%	0.38	1.16	0.44
	9.20	5.71	0.41	0.70	2.33	6.50	46.9%	0.36	0.97	0.42
	9.25	5.17	0.40	0.65	2.06	5.87	42.4%	0.35	0.84	0.41
	9.30	4.62	0.39	0.60	1.81	5.24	37.8%	0.35	0.74	0.41
	9.35	4.57	0.35	0.55	1.58	5.13	37.0%	0.31	0.58	0.37
	9.40	4.52	0.30	0.50	1.35	5.02	36.2%	0.27	0.45	0.33
	9.45	4.48	0.25	0.45	1.13	4.91	35.4%	0.23	0.33	0.29
	9.50	4.23	0.21	0.40	0.91	4.60	33.2%	0.20	0.23	0.26
	9.55	3.95	0.18	0.35	0.70	4.23	30.6%	0.17	0.16	0.22
	9.60	3.67	0.14	0.30	0.51	3.87	27.9%	0.13	0.09	0.18
	9.65	2.70	0.13	0.25	0.35	2.84	20.5%	0.12	0.06	0.17
	9.70	2.30	0.10	0.20	0.23	2.39	17.3%	0.10	0.03	0.14
	9.75	1.80	0.07	0.15	0.13	1.85	13.4%	0.07	0.01	0.11
	9.80	0.80	0.05	0.10	0.04	0.82	6.0%	0.05	0.00	0.08
	9.85	0.40	0.03	0.05	0.01	0.41	3.0%	0.02	0.00	0.05
	9.90	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!


Naturita Creek
CROSS SECTION DATA ANALYSIS
G&RS
RW
LW
G&LS
-7.00
-7.50
-8.00
-8.50
-9.00
-9.50
-10.00
VERTICAL DEPTH (FT)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


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


Naturita Creek
Velocity vs. Discharge
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
Mannings N
Thorne - Zevenbergen
Jarrett


Naturita Creek
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
5.00
10.00
15.00
20.00
25.00
30.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Naturita Creek
Stage vs. Discharge
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Stage, feet
0.00
5.00
10.00
15.00
20.00
25.00
30.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

Data Input & Proofing

STREAM NAME:	Naturita Creek
XS LOCATION:	End of seismic rd. nr compressor station
XS NUMBER:	1
DATE:	10/3/2017
OBSERVERS:	R. Smith. J. Sondergard
1/4 SEC:	NE
SECTION:	6
TWP:	45N
RANGE:	14W
PM:	NM
COUNTY:	Montrose
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	41804
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.0067 ft / ft

CHECKED BY:.....DATE.....

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

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
			Total Data Points = 30					
1	G&RS	1.90	7.29			0.00	0.00	0.00
	RW	3.00	8.90	0.00	0.00	0.00	0.00	0.00
		3.20	8.95	0.05	0.00	0.02	0.00	8.90
		3.60	8.90	0.00	0.00	0.00	0.00	0.00
		4.00	8.90	0.00	0.00	0.00	0.00	0.00
		4.40	9.20	0.30	0.31	0.12	0.04	8.90
		4.80	9.25	0.35	0.58	0.14	0.08	8.90
		5.20	9.30	0.40	0.72	0.16	0.12	8.90
		5.60	9.10	0.20	0.92	0.08	0.07	8.90
		6.00	9.05	0.15	0.90	0.06	0.05	8.90
		6.40	9.00	0.10	0.50	0.04	0.02	8.90
		6.80	8.90	0.00	0.00	0.00	0.00	0.00
		7.20	9.50	0.60	0.63	0.24	0.15	8.90
		7.60	9.65	0.75	0.04	0.30	0.01	8.90
		8.00	9.80	0.90	1.26	0.27	0.34	8.90
		8.20	9.80	0.90	1.08	0.18	0.19	8.90
		8.40	9.80	0.90	0.61	0.27	0.16	8.90
		8.80	9.90	1.00	0.00	0.40	0.00	8.90
		9.20	9.80	0.90	0.00	0.36	0.00	8.90
		9.60	9.80	0.90	0.29	0.36	0.10	8.90
		10.00	9.50	0.60	1.27	0.18	0.23	8.90
		10.20	9.50	0.60	1.24	0.12	0.15	8.90
		10.40	9.65	0.75	0.53	0.15	0.08	8.90
		10.60	9.75	0.85	0.80	0.17	0.14	8.90
		10.80	9.70	0.80	0.96	0.16	0.15	8.90
		11.00	9.60	0.70	0.29	0.14	0.04	8.90
		11.20	9.65	0.75	0.19	0.23	0.04	8.90
		11.60	9.60	0.70	0.05	0.21	0.01	8.90
	LW	11.80	8.90	0.00	0.00	0.00	0.00	0.00
					Totals	4.35	2.19