Stream: Willow Creek

Executive Summary

Water Division: 4
Water District: 62
CDOW#: 44040
CWCB ID: 10/4/A-003

Segment: Confluence with Sugar Creek to Confluence with Blue Mesa Reservoir

Upper Terminus: CONFLUENCE WITH SUGAR CREEK
(Latitude 38° 25’ 37.03”N) (Longitude 107° 02’ 58.24”W)

Lower Terminus: CONFLUENCE WITH BLUE MESA RESERVOIR
(Latitude 38° 28’ 14.74”N) (Longitude 107° 03’ 48.66”W)

Watershed: Upper Gunnison (HUC#: 14020002**)**
Counties: Gunnison
Length: 3.59 miles
USGS Quad: Big Mesa
Flow Recommendation: 2.3 cfs (April 1 – June 30)
0.5 cfs (July 1 – March 31)

Staff Analysis and Recommendation

Summary

The information contained in this report and the associated instream flow file folder forms the basis for staff's instream flow recommendation to be considered by the Board. It is staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5.40.

Colorado's Instream Flow Program was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (see 37-92-102 (3) C.R.S.). The statute vests the CWCB with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's Instream Flow Program, the statute directs the CWCB to request instream flow recommendations from other state and federal agencies. The Bureau of Land Management (BLM) recommended this segment of Willow Creek to the CWCB for inclusion into the Instream Flow Program. Willow Creek is being considered for inclusion into the Instream Flow Program because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

Willow Creek is approximately 18.8 miles long. It begins at an elevation of 10,100 feet and generally flows north until it terminates at the confluence with Blue Mesa Reservoir at an elevation of 7,516 feet. Of the 3.59 mile segment addressed by this report, approximately 87.5% of the segment is located on federal lands. Willow Creek is located within Gunnison County and has a total drainage area of approximately 73 square miles.

The subject of this report is a segment of the Willow Creek beginning at the confluence with Sugar Creek and extending downstream to the confluence with Blue Mesa Reservoir. The proposed segment is located approximately 8 miles southwest of Gunnison. Staff has received only one recommendation for this segment, from the BLM. The recommendation for this segment is discussed below.

Instream Flow Recommendation

The BLM is recommending 2.3 cfs (April 1 – June 30) and 0.5 cfs (July 1 – March 31) based on their data collection efforts and staff's water availability analyses.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Confluence w/ Sugar Creek	Confluence w/ Blue Mesa Reservoir	3.59	12.5%	87.5%

7% of the public lands are part of the Curecanti National Recreation Area and are managed by the National Park Service and the remaining 93% are managed by the BLM.

Biological Data

This segment of Willow Creek is a moderate gradient stream, with moderate to large substrate size, punctuated by large boulders. The proposed reach is confined by a canyon, and some portions of the creek are further confined by the construction and maintenance of a county road. The riparian community is in good condition and composed of willow, alders, and cottonwood. The creek supports a good diversity and biomass of aquatic macroinvertebrates, including mayfly, caddisfly, and stonefly. The creek provides a good mix of pools, riffles, and runs for fish habitat, and some of the deeper pools are critical for year-round survival of the fish population. The fish population appears to change in response to hydrologic conditions. Historical surveys have documented speckled dace in the creek system. Recent surveys have documented white suckers. It is likely that the creek is repopulated from stocks in Blue Mesa Reservoir after dry periods.

There are also numerous wildlife species that depend on the creek. There have been numerous sightings of chorus frog and salamanders. In addition, bird inventories have documented Audubon's warbler, yellow warbler, Wilson's warbler, green towhee, warbling vireo, broad-tailed hummingbird, red-tailed hawk, common nighthawk, and brown-head cowbird. Finally, the riparian habitat along the creek is considered critical brood-rearing habitat for the Gunnison sage grouse, because the stream is close to leks (display areas) and nesting areas in adjacent uplands.

Field Survey Data

BLM staff used the R2Cross methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2Cross method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge.

Biological Flow Recommendation

The CWCB staff relied upon the biological expertise of the cooperating agencies to interpret output from the R2Cross data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, four data sets were collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected (Date), the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria. It is believed that recommendations that fall outside of the accuracy range of

the model, over 250% of the measured discharge or under 40% of the measured discharge may not give an accurate estimate of the necessary instream flow required.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
BLM	06/04/2007	0.49	0.2-1.2	Out of range	0.74
BLM	06/04/2007	0.26	0.1-0.7	Out of range	0.47
BLM	06/04/2007	0.38	0.2-0.9	Out of range	0.33
BLM	06/04/2008	5.09	2.0-12.7	2.34	Out of range

The summer flow recommendation, which met 3 of 3 criteria and is within the accuracy range of the R2CROSS model is 2.3 cfs. The winter flow amount, which meets 2 of 3 criteria, is 0.5 cfs. The winter flow recommendation was derived by averaging the results of the data sets.

Hydrologic Data and Analysis

After receiving the cooperating agency's biologic recommendation, the CWCB staff conducted an evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. This evaluation was done through a computation that is, in essence, a "water balance". In concept a "water balance" computation can be viewed as an accounting exercise. When done in its most rigorous form, the water balance parses precipitation into all the avenues water pursues after it is deposited as rain, snow, or ice. In other words, given a specified amount of water deposition (input), the balance tries to account for all water depletions (losses) until a selected end point is reached. Water losses include depletions due to evaporation and transpiration, deliveries into ground water storage, temporary surface storage, incorporations into plant and animal tissue and so forth. These losses are individually or collectively subtracted from the input to reveal the net amount of stream runoff as represented by the discharge measured by stream gages. Of course, the measured stream flow need not be the end point of interest; indeed, when looking at issues of water use to extinction stream flow measurements may only describe intermediate steps in the complex accounting process that is a water balance carried out to a net value of zero.

In its analysis, CWCB staff has attempted to use this idea of balancing inputs and losses to determine if water is available for the recommended Instream Flow Appropriation. Of course, this analysis must be a practical exercise rather than a lengthy, and costly, scientific investigation. As a result, staff has simplified the process by lumping together some variables and employing certain rational and scientifically supportable assumptions. The process may be described through the following description of the steps used to complete the evaluation for this particular stream.

The first step required in determining water availability is a determination of the hydrologic regime at the Lower Terminus (LT) of the recommended ISF reach. In the best case this means looking at the data from a gage at the LT. Further, this data, in the best case, has been collected for a long period of time (the longer the better) including wet and dry periods. In the case of **Willow Creek** no such gage is available at the LT. In fact, there is no gage on Willow Creek. It is thus necessary to describe the normal flow regime at Willow Creek above the LT through a

"representative" gage station. The gage station selected for this purpose was CURECANTI CREEK NEAR SAPINERO, CO. (USGS 09125000); it has a period of record (POR) of 27 years collected between 1945 and 1972. The gage is at an elevation of 7,867.43 ft above mean sea level (amsl) and has a drainage area of 35 mi^2. The hydrograph (plot of discharge over time) produced from this gage includes the consumptive uses of some diversions. However, the existence of these diversions does not preclude use of the data from the gage. To make the measured data transferable to Willow Creek above the LT, the consumptive portions of these diversions were added back to the measured hydrograph. The resulting "adjusted" hydrograph could then be used on Willow Creek above the LT by multiplying the "adjusted" gage discharge values by an area ratio; specifically, the area of Willow Creek above the LT (73.03 mi^2) to Curecanti Creek near Sapinero, CO (35 mi^2). The resulting proportioned hydrograph was itself "adjusted" (decreased) to reflect consumptive irrigation depletions upstream of the LT. The final hydrograph thus represents a distribution of flow over time that has been reduced to reflect existing human uses.

{The Following discussion is based upon the US Geological Survey's *Techniques of Water-Resources Investigations* Series, *Book 4: Hydrologic Analysis and Interpretation, Chapter A3: Statistical Methods in Water Resources* (Chapter 3: Describing Uncertainty) by D.R. Helsel and R. M. Hirsch. This technical reference provides the scientific background and guidance important to the systematic interpretation of hydrologic data. The document is available online and is a valuable aid to understanding and interpreting the analyses described here.}

The next step in producing a representation of the discharge at Willow Creek is to compute the Geometric Mean of the area-prorated "adjusted" data values from the Curecanti Creek near Sapinero, CO hydrograph. This step is of value because of the inherent statistical weaknesses found in any collection of data intended to measure natural stream discharge. Without getting into the details of statistical theory, it is worth noting that a set of discharge measurements is inherently inaccurate, no matter how well collected, due to the difficulties attendant to data collection, especially hydrologic data. To give deference to this fact and to increase the value of the hydrograph product of this analysis, the Geometric Means of the data were computed and plotted along with the 95% Confidence Intervals about the data. The resultant hydrograph, including recommended Instream Flow values, is displayed in Figure 1 with the data displayed in Table 2.

Figure 1

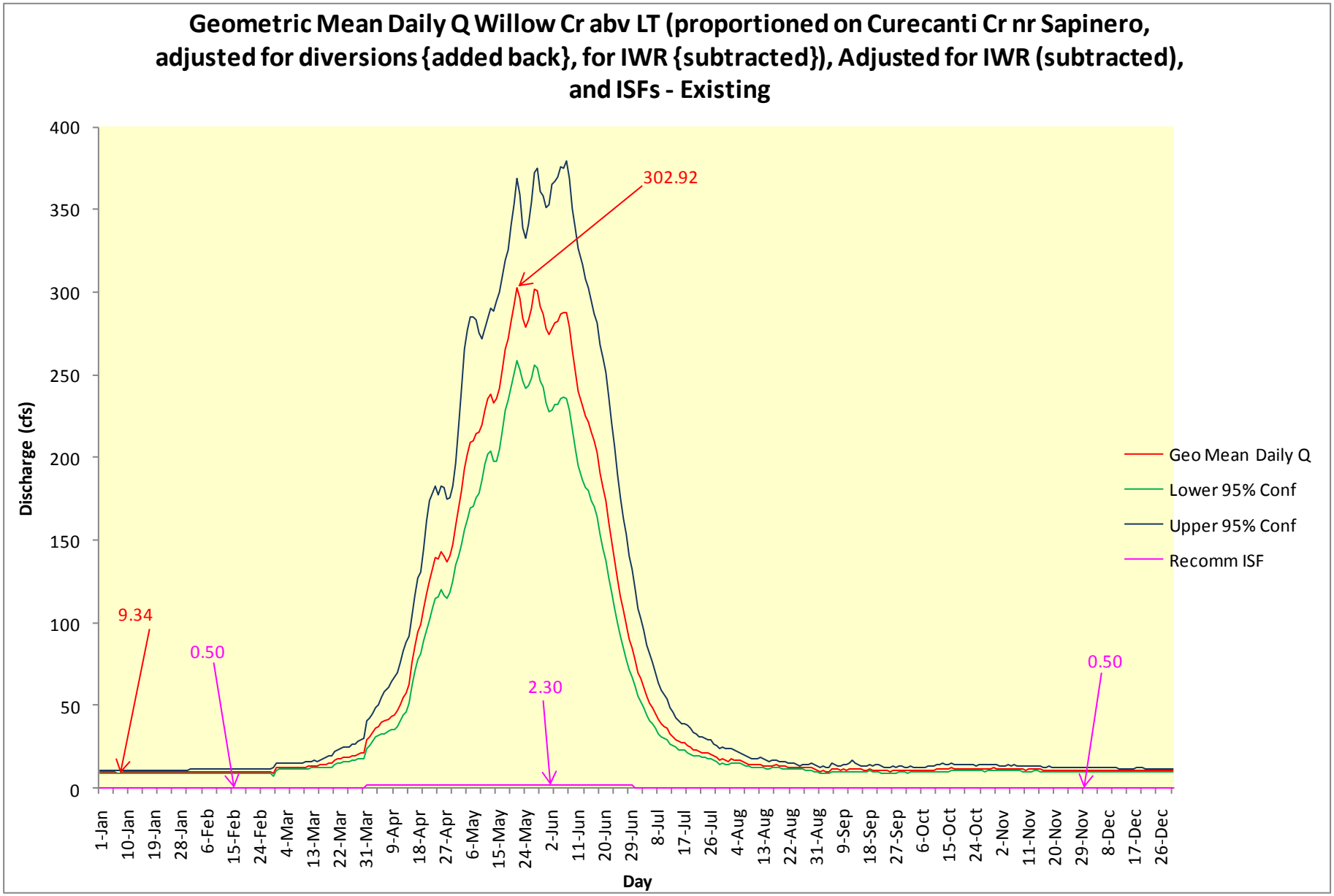

Geometric Mean Daily Q Willow Cr abv LT (proportioned on Curecanti Cr nr Sapinero, adjusted for diversions {added back}, for IWR {subtracted}), Adjusted for IWR (subtracted), and ISFs - Existing
Discharge (cfs)
400
350
300
250
200
150
100
50
0
302.92
9.34
0.50
2.30
0.50
Geo Mean Daily Q
Lower 95% Conf
Upper 95% Conf
Recomm ISF
1-Jan
10-Jan
19-Jan
28-Jan
6-Feb
15-Feb
24-Feb
4-Mar
13-Mar
22-Mar
31-Mar
9-Apr
18-Apr
27-Apr
6-May
15-May
24-May
2-Jun
11-Jun
20-Jun
29-Jun
8-Jul
17-Jul
26-Jul
4-Aug
13-Aug
22-Aug
31-Aug
9-Sep
18-Sep
27-Sep
6-Oct
15-Oct
24-Oct
2-Nov
11-Nov
20-Nov
29-Nov
8-Dec
17-Dec
26-Dec
Day

Table 2. Geometric Mean Discharge and Recommended Instream Flows			
Date	Existing	Recommended	Proportioned Adjusted GM (abv gage)
	ISF	ISF	Adj (-) for Irr & OoB in Willow Cr abv LT
1-Jan		0.50	9.62
2-Jan		0.50	9.57
3-Jan		0.50	9.59
4-Jan		0.50	9.56
5-Jan		0.50	9.53
6-Jan		0.50	9.43
7-Jan		0.50	9.35
8-Jan		0.50	9.34
9-Jan		0.50	9.42
10-Jan		0.50	9.50
11-Jan		0.50	9.50
12-Jan		0.50	9.40
13-Jan		0.50	9.46
14-Jan		0.50	9.48
15-Jan		0.50	9.50
16-Jan		0.50	9.51
17-Jan		0.50	9.48
18-Jan		0.50	9.44
19-Jan		0.50	9.45
20-Jan		0.50	9.49
21-Jan		0.50	9.55
22-Jan		0.50	9.53
23-Jan		0.50	9.51
24-Jan		0.50	9.50
25-Jan		0.50	9.54
26-Jan		0.50	9.52
27-Jan		0.50	9.56
28-Jan		0.50	9.61
29-Jan		0.50	9.59
30-Jan		0.50	9.61
31-Jan		0.50	9.70
1-Feb		0.50	9.97
2-Feb		0.50	9.99
3-Feb		0.50	9.95
4-Feb		0.50	9.96
5-Feb		0.50	9.89
6-Feb		0.50	9.87
7-Feb		0.50	9.90
8-Feb		0.50	9.95
9-Feb		0.50	9.94
10-Feb		0.50	10.00
11-Feb		0.50	9.88
12-Feb		0.50	9.94
13-Feb		0.50	9.95
14-Feb		0.50	9.97
15-Feb		0.50	9.93
16-Feb		0.50	9.92
17-Feb		0.50	9.89
18-Feb		0.50	9.90

19-Feb		0.50	9.90
20-Feb		0.50	9.95
21-Feb		0.50	10.01
22-Feb		0.50	10.04
23-Feb		0.50	10.06
24-Feb		0.50	10.11
25-Feb		0.50	10.16
26-Feb		0.50	10.15
27-Feb		0.50	10.21
28-Feb		0.50	10.27
29-Feb		0.50	9.03
1-Mar		0.50	12.36
2-Mar		0.50	12.61
3-Mar		0.50	12.52
4-Mar		0.50	12.57
5-Mar		0.50	12.61
6-Mar		0.50	12.63
7-Mar		0.50	12.69
8-Mar		0.50	12.78
9-Mar		0.50	12.87
10-Mar		0.50	12.79
11-Mar		0.50	12.91
12-Mar		0.50	13.06
13-Mar		0.50	13.62
14-Mar		0.50	13.70
15-Mar		0.50	13.62
16-Mar		0.50	13.98
17-Mar		0.50	14.18
18-Mar		0.50	14.59
19-Mar		0.50	14.92
20-Mar		0.50	14.94
21-Mar		0.50	16.59
22-Mar		0.50	17.36
23-Mar		0.50	17.83
24-Mar		0.50	18.50
25-Mar		0.50	18.41
26-Mar		0.50	18.59
27-Mar		0.50	19.45
28-Mar		0.50	19.83
29-Mar		0.50	20.67
30-Mar		0.50	21.11
31-Mar		0.50	21.44
1-Apr		2.30	29.15
2-Apr		2.30	30.86
3-Apr		2.30	33.39
4-Apr		2.30	36.67
5-Apr		2.30	37.61
6-Apr		2.30	39.44
7-Apr		2.30	40.35
8-Apr		2.30	41.96
9-Apr		2.30	43.34
10-Apr		2.30	43.98
11-Apr		2.30	46.46
12-Apr		2.30	50.28

13-Apr		2.30	54.45
14-Apr		2.30	57.54
15-Apr		2.30	62.94
16-Apr		2.30	75.86
17-Apr		2.30	85.77
18-Apr		2.30	94.30
19-Apr		2.30	98.53
20-Apr		2.30	108.24
21-Apr		2.30	117.33
22-Apr		2.30	125.44
23-Apr		2.30	132.82
24-Apr		2.30	139.43
25-Apr		2.30	138.47
26-Apr		2.30	143.23
27-Apr		2.30	140.53
28-Apr		2.30	136.77
29-Apr		2.30	140.21
30-Apr		2.30	147.77
1-May		2.30	158.85
2-May		2.30	169.31
3-May		2.30	180.39
4-May		2.30	193.66
5-May		2.30	201.74
6-May		2.30	209.29
7-May		2.30	210.34
8-May		2.30	214.43
9-May		2.30	214.90
10-May		2.30	220.06
11-May		2.30	228.77
12-May		2.30	235.24
13-May		2.30	238.06
14-May		2.30	233.28
15-May		2.30	235.27
16-May		2.30	241.92
17-May		2.30	253.33
18-May		2.30	265.76
19-May		2.30	271.76
20-May		2.30	282.19
21-May		2.30	291.80
22-May		2.30	302.92
23-May		2.30	296.46
24-May		2.30	284.41
25-May		2.30	278.95
26-May		2.30	283.06
27-May		2.30	290.74
28-May		2.30	301.44
29-May		2.30	301.06
30-May		2.30	291.18
31-May		2.30	287.09
1-Jun		2.30	278.25
2-Jun		2.30	274.48
3-Jun		2.30	278.21
4-Jun		2.30	281.51
5-Jun		2.30	282.41

6-Jun		2.30	286.83
7-Jun		2.30	287.47
8-Jun		2.30	287.55
9-Jun		2.30	278.82
10-Jun		2.30	264.80
11-Jun		2.30	252.06
12-Jun		2.30	240.29
13-Jun		2.30	230.77
14-Jun		2.30	225.03
15-Jun		2.30	221.79
16-Jun		2.30	214.96
17-Jun		2.30	210.19
18-Jun		2.30	202.98
19-Jun		2.30	191.03
20-Jun		2.30	181.76
21-Jun		2.30	173.80
22-Jun		2.30	160.57
23-Jun		2.30	149.31
24-Jun		2.30	137.37
25-Jun		2.30	125.93
26-Jun		2.30	116.07
27-Jun		2.30	107.68
28-Jun		2.30	98.91
29-Jun		2.30	90.28
30-Jun		2.30	84.51
1-Jul		0.50	78.00
2-Jul		0.50	69.80
3-Jul		0.50	65.93
4-Jul		0.50	61.42
5-Jul		0.50	55.33
6-Jul		0.50	51.43
7-Jul		0.50	48.34
8-Jul		0.50	45.02
9-Jul		0.50	41.25
10-Jul		0.50	38.66
11-Jul		0.50	37.36
12-Jul		0.50	36.07
13-Jul		0.50	32.78
14-Jul		0.50	30.98
15-Jul		0.50	29.51
16-Jul		0.50	28.10
17-Jul		0.50	27.32
18-Jul		0.50	27.21
19-Jul		0.50	25.99
20-Jul		0.50	24.82
21-Jul		0.50	23.38
22-Jul		0.50	23.18
23-Jul		0.50	22.50
24-Jul		0.50	21.71
25-Jul		0.50	21.64
26-Jul		0.50	21.19
27-Jul		0.50	20.82
28-Jul		0.50	19.24
29-Jul		0.50	18.92

30-Jul		0.50	17.17
31-Jul		0.50	17.73
1-Aug		0.50	16.71
2-Aug		0.50	16.43
3-Aug		0.50	17.38
4-Aug		0.50	16.97
5-Aug		0.50	17.24
6-Aug		0.50	16.76
7-Aug		0.50	15.85
8-Aug		0.50	15.05
9-Aug		0.50	14.54
10-Aug		0.50	14.22
11-Aug		0.50	14.32
12-Aug		0.50	14.21
13-Aug		0.50	14.44
14-Aug		0.50	13.69
15-Aug		0.50	13.25
16-Aug		0.50	13.31
17-Aug		0.50	13.75
18-Aug		0.50	14.06
19-Aug		0.50	13.57
20-Aug		0.50	13.17
21-Aug		0.50	13.13
22-Aug		0.50	12.76
23-Aug		0.50	12.92
24-Aug		0.50	12.72
25-Aug		0.50	12.74
26-Aug		0.50	12.19
27-Aug		0.50	12.27
28-Aug		0.50	12.12
29-Aug		0.50	12.06
30-Aug		0.50	12.33
31-Aug		0.50	11.20
1-Sep		0.50	10.63
2-Sep		0.50	10.24
3-Sep		0.50	10.40
4-Sep		0.50	10.24
5-Sep		0.50	10.26
6-Sep		0.50	11.22
7-Sep		0.50	11.41
8-Sep		0.50	11.19
9-Sep		0.50	10.95
10-Sep		0.50	11.22
11-Sep		0.50	11.09
12-Sep		0.50	11.51
13-Sep		0.50	11.73
14-Sep		0.50	11.73
15-Sep		0.50	11.28
16-Sep		0.50	11.21
17-Sep		0.50	11.05
18-Sep		0.50	11.06
19-Sep		0.50	11.55
20-Sep		0.50	10.71
21-Sep		0.50	11.15

22-Sep		0.50	11.10
23-Sep		0.50	10.49
24-Sep		0.50	10.36
25-Sep		0.50	10.31
26-Sep		0.50	10.24
27-Sep		0.50	10.51
28-Sep		0.50	10.51
29-Sep		0.50	10.93
30-Sep		0.50	11.05
1-Oct		0.50	10.59
2-Oct		0.50	10.33
3-Oct		0.50	10.78
4-Oct		0.50	10.72
5-Oct		0.50	10.72
6-Oct		0.50	10.64
7-Oct		0.50	10.59
8-Oct		0.50	10.60
9-Oct		0.50	10.83
10-Oct		0.50	11.08
11-Oct		0.50	11.10
12-Oct		0.50	11.61
13-Oct		0.50	11.41
14-Oct		0.50	11.37
15-Oct		0.50	11.38
16-Oct		0.50	11.70
17-Oct		0.50	12.08
18-Oct		0.50	11.74
19-Oct		0.50	11.67
20-Oct		0.50	11.91
21-Oct		0.50	12.00
22-Oct		0.50	11.88
23-Oct		0.50	11.91
24-Oct		0.50	11.80
25-Oct		0.50	11.57
26-Oct		0.50	11.80
27-Oct		0.50	11.71
28-Oct		0.50	11.54
29-Oct		0.50	11.62
30-Oct		0.50	11.74
31-Oct		0.50	12.06
1-Nov		0.50	11.89
2-Nov		0.50	11.44
3-Nov		0.50	11.45
4-Nov		0.50	11.71
5-Nov		0.50	11.79
6-Nov		0.50	11.64
7-Nov		0.50	11.74
8-Nov		0.50	11.60
9-Nov		0.50	11.49
10-Nov		0.50	11.18
11-Nov		0.50	11.10
12-Nov		0.50	11.23
13-Nov		0.50	11.31
14-Nov		0.50	11.34

15-Nov		0.50	11.37
16-Nov		0.50	11.34
17-Nov		0.50	11.09
18-Nov		0.50	10.90
19-Nov		0.50	10.99
20-Nov		0.50	10.87
21-Nov		0.50	11.02
22-Nov		0.50	11.05
23-Nov		0.50	11.06
24-Nov		0.50	10.91
25-Nov		0.50	10.91
26-Nov		0.50	10.89
27-Nov		0.50	10.70
28-Nov		0.50	10.59
29-Nov		0.50	10.72
30-Nov		0.50	10.71
1-Dec		0.50	10.57
2-Dec		0.50	10.44
3-Dec		0.50	10.40
4-Dec		0.50	10.54
5-Dec		0.50	10.47
6-Dec		0.50	10.40
7-Dec		0.50	10.72
8-Dec		0.50	10.56
9-Dec		0.50	10.58
10-Dec		0.50	10.49
11-Dec		0.50	10.53
12-Dec		0.50	10.55
13-Dec		0.50	10.51
14-Dec		0.50	10.48
15-Dec		0.50	10.47
16-Dec		0.50	10.50
17-Dec		0.50	10.50
18-Dec		0.50	10.51
19-Dec		0.50	10.58
20-Dec		0.50	10.62
21-Dec		0.50	10.51
22-Dec		0.50	10.31
23-Dec		0.50	10.36
24-Dec		0.50	10.39
25-Dec		0.50	10.51
26-Dec		0.50	10.52
27-Dec		0.50	10.49
28-Dec		0.50	10.40
29-Dec		0.50	10.36
30-Dec		0.50	10.34
31-Dec		0.50	10.47

Existing Water Right Information

Staff has analyzed the water rights tabulation and contacted the Division Engineer Office (DEO) to identify any potential water availability problems. There are no decreed surface diversions within this reach of stream. Staff has determined that water is available for appropriation on Willow Creek, between the confluence with Sugar Creek and the confluence with Blue Mesa Reservoir, to preserve the natural environment to a reasonable degree without limiting or foreclosing the exercise of valid existing water rights.

CWCB Staff's Instream Flow Recommendation

Staff recommends the Board form its intent to appropriate on the following stream reach:

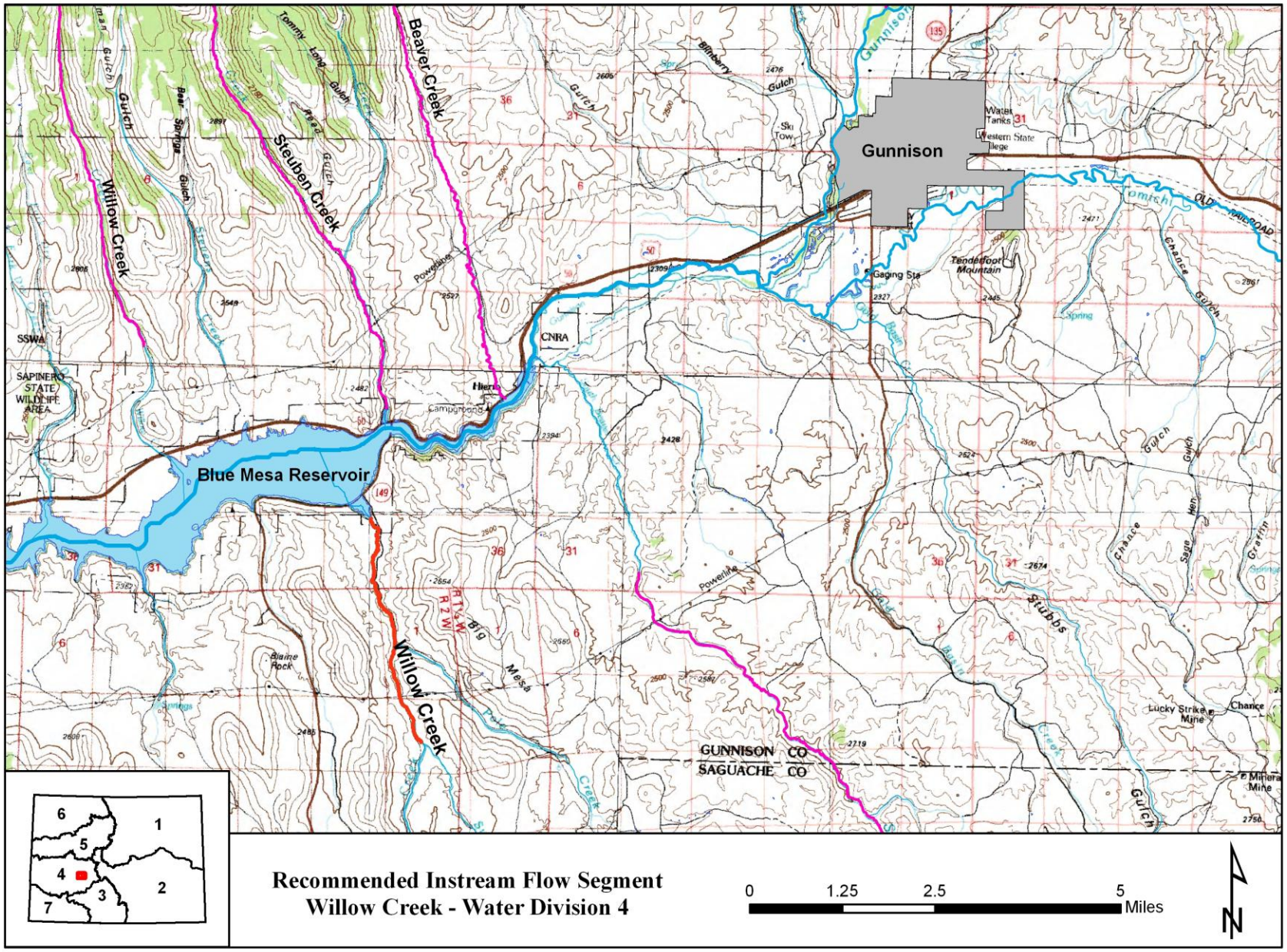
Segment: Confluence with Sugar Creek to Confluence with Blue Mesa Reservoir

Upper Terminus: CONFLUENCE WITH SUGAR CREEK
(Latitude 38° 25' 37.03"N) (Longitude 107° 02' 58.24"W)
UTM North: 4255177.25 UTM East: 321097.92
NE SW S12 T48N R2W NMPM
2420' East of the West Section Line; 1390' South of the North Section Line

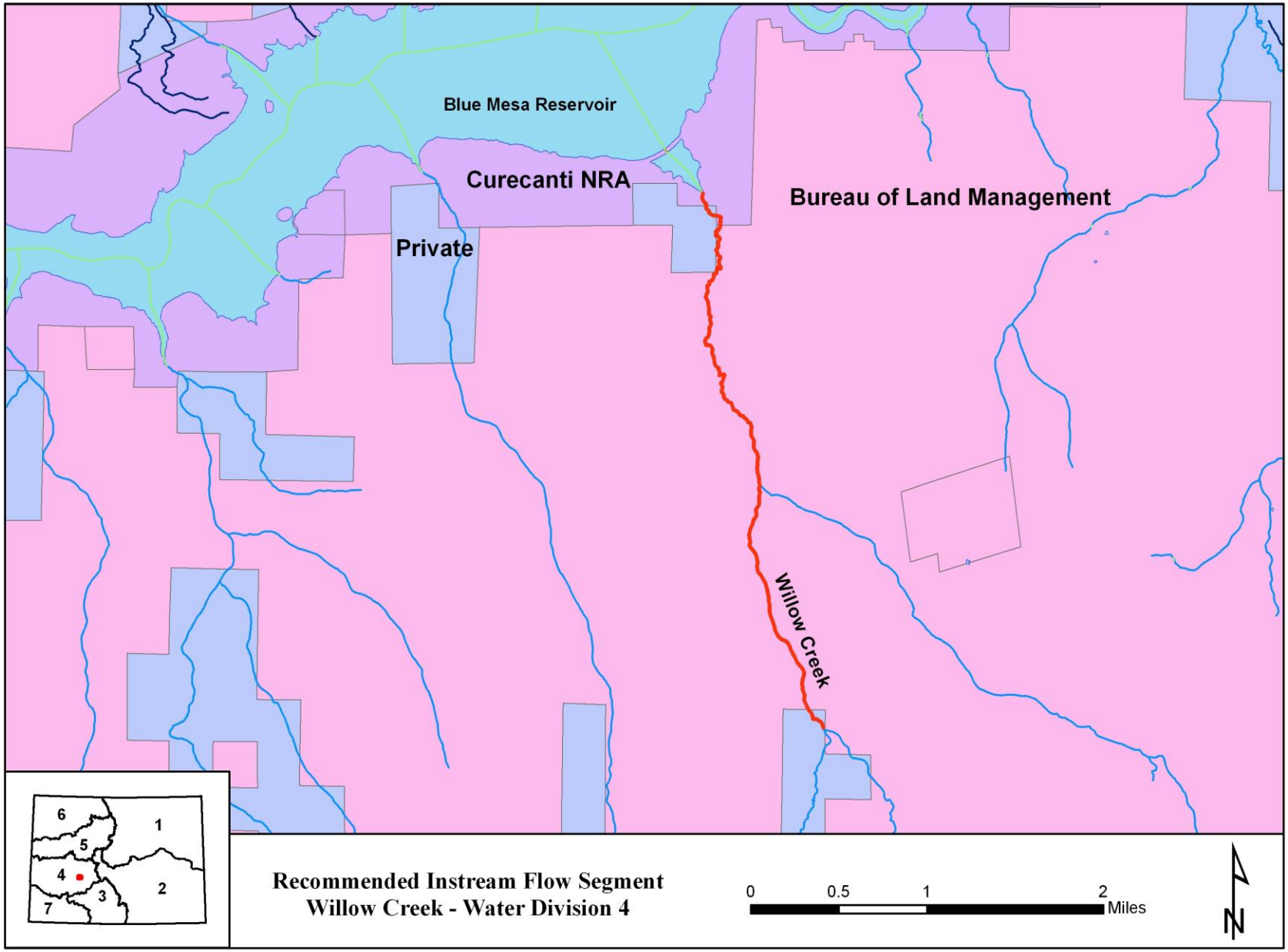
Lower Terminus: CONFLUENCE WITH BLUE MESA RESERVOIR
(Latitude 38° 28' 14.74"N) (Longitude 107° 03' 48.66"W)
UTM North: 4260066.22 UTM East: 319984.09
NW NE S34 T49N R2W NMPM
2450' East of the West Section Line; 200' South of the North Section Line

Watershed: Upper Gunnison (HUC#: 14020002**)**
Counties: Gunnison
Length: 3.59 miles
USGS Quad: Big Mesa
Flow Recommendation: 2.3 cfs (April 1 – June 30)
0.5 cfs (July 1 – March 31)

Vicinity Map



Land Use Map


Blue Mesa Reservoir
Curecanti NRA
Bureau of Land Management
Private
Willow Creek
6
1
5
4
2
3
7
Recommended Instream Flow Segment
Willow Creek - Water Division 4
0
0.5
1
2
Miles
N

Topographic and Water Rights Map