Stream: Baldy Creek

Executive Summary

Water Division: 5
Water District: 45
CDOW#: 19253
CWCB ID: 08/5/A-005

Segment: Headwaters to Headgate Murray & Yule Ditch

Upper Terminus: HEADWATERS IN THE VICINITY OF
(Latitude 39° 24' 28.06"N) (Longitude 107° 24' 29.01"W)

Lower Terminus: HDGT MURRAY & YULE DITCH AT
(Latitude 39° 29' 28.73"N) (Longitude 107° 30' 9.11"W)

Watershed: Colorado headwaters-Plateau (HUC#: 14010005)
Counties: Garfield
Length: 9.7 miles
USGS Quad(s): Center Mountain, Gibson Gulch
Flow Recommendation: 6.5 cfs (April 1 - June 30)
0.6 cfs (July 1 - March 31)

Staff Analysis and Recommendation

Summary

The information contained in this report and the associated instream flow appendices (see CD entitled 2008 Instream Flow Recommendations) 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 and the Colorado Division of Wildlife recommended this segment of Baldy Creek to the CWCB for inclusion into the Instream Flow Program. Baldy 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.

Baldy Creek is approximately 11 miles long. It begins on the north flank of Bald Mountain on BLM Lands at an elevation of approximately 9400 feet and terminates at the confluence Garfield Creek at an elevation of approximately 6400 feet. Approximately 77% of the land on the 9.7 mile segment addressed by this report is publicly owned. Baldy Creek is located within Garfield County. The total drainage area of the creek is approximately 15.3 square miles. Baldy Creek generally flows in a northwesterly direction.

The subject of this report is a segment of Baldy Creek beginning at the Headwaters and extending downstream to the headgate of the Murray and Yule Ditch. The proposed segment is located approximately 4 miles south of New Castle. The staff has received two recommendations for this segment, from both the BLM and CDOW. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

BLM recommended 6.5 cfs, snowmelt runoff period, and 0.6 cfs, late summer through winter, based on its June 12, 2006 data collection efforts. The modeling results from this survey effort are within the confidence interval produced by the R2Cross model.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Headwaters	Headgate of Murray & Yule Ditch	9.7	23%	77%

20% of the public lands are owned by the BLM and 80% are owned by CDOW.

Biological Data

The BLM has conducted field surveys of the fishery resources on this stream and have found a natural environment that can be preserved. As reported in the letter from BLM to the CWCB "Baldy Creek is a high gradient stream with large substrate size. The creek is often confined by a narrow canyon, and it has cut down to bedrock in numerous locations. The riparian community is very vigorous in the upper portions of the creek. The health of the riparian community is improving on the portions of the creek that are easily accessible for public use and livestock grazing. The creek provides good pool habitat, but low flows in late summer and fall are a limiting factor for the fish population. Fishery surveys indicate that the creek supports self-sustaining population of Colorado River Cutthroat Trout.

Field Survey Data & Biological Flow Quantification

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.

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, two data sets were collected with the results shown in Table 1 below. The final flow recommendation was calculated as the average of the two data sets. 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.

Table 1: Baldy Creek R2Cross Summary

			Confidence Intervals	Recommended Flows (cfs)	
Party	**Date**	**Q (cfs)**	**250%-40%**	**Summer (3/3)**	**Winter (2/3)**
BLM	6/12/2006	5.56	13.9 – 2.2	6.88	5.35
BLM	6/12/2006	7.17	17.9 – 2.9	6.13	4.09

BLM = Bureau of Land Management

The snowmelt runoff period flow recommendation, which meets 3 of 3 criteria and is within the accuracy range of the R2CROSS model is 6.5 cfs. The late summer through winter flow recommendation, which is based on water availability limitations, is 0.6 cfs. It is our belief 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.

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 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 **Baldy Creek** such a gage is available at the LT. The gage station is BALDY CREEK NEAR NEW CASTLE, CO. (USGS 09088000), a gage with a 7 year period of record (POR) collected between 1955 and 1961. The gage is at an elevation of 6,920 ft above mean sea level (amsl) and has a drainage area of 15.3 mi^2. The hydrograph (plot of discharge over time) produced by this gage includes the consumptive uses of a few upstream diversions. The existence of these diversions is not a major limitation upon the use of the data from this gage. However, the short POR is a consequential shortcoming.

To keep the positive values of the Baldy Creek gage while reducing the limitation of its short POR, a statistical procedure called linear regression was employed. The procedure gives us the means to relate characteristics of a limited (short) data set to those of a larger (longer) data set and, if the two data sets are similar enough, to predict the data values "missing" from the short data set. The outcome is a "predicted" (called "Y – Hat" or $\hat{Y}$) set of data that augments the short data set; creating, in effect, a longer POR that is reflective of climate variation (i.e., it includes more wet-dry cycles.) The gage that was selected to provide the longer POR was WEST DIVIDE CREEK NEAR RAVEN, CO (USGS 09089500), a gage with a 50 year POR collected between 1955 and 2005. The West Divide Creek gage is at an elevation of 7050 ft amsl and has a drainage area of 64.6 $mi^{2.}$

Before performing the linear regression described above, the measured hydrographs of both gages must be adjusted to remove the effects of water consumption by upstream irrigation diversion. As mentioned above, the hydrograph of the Baldy Creek gage includes some upstream consumption through a few diversions. West Divide Creek also has a small number of upstream diversions as well as a trans-basin source of increased discharge. Thus, before performing the linear regression, The Baldy Creek and West Divide data records must be increased by the amount of consumptive loss due to upstream diversions. In addition, the West Divide data record must be decreased by the amount of trans-basin additions. When the data sets are adjusted in the manner described, then the two gages can be regressed one against the other to produce a "predicted" hydrograph for Baldy Creek that displays the important attributes of a gage that is located nearby, is un-impacted (by irrigation consumption or "foreign water"), and exhibits a long-term POR.

With the creation of the Baldy Creek "predicted" hydrograph we have represented a distribution of flow over time. The next step, to make the Baldy Creek hydrograph reflective of existing conditions, is to reduce the predicted flow values by the amount of upstream consumptive use.

The following hydrograph depicts the mean monthly discharge of Baldy Creek (regressed on West Divide Creek near Raven). Included in the hydrograph are the recommended ISF values. The data used in the creation of this hydrograph are displayed in Table #1.

Figure 1 - Baldy Cr. Discharge (regressed on W. Divide Cr) & ISFs

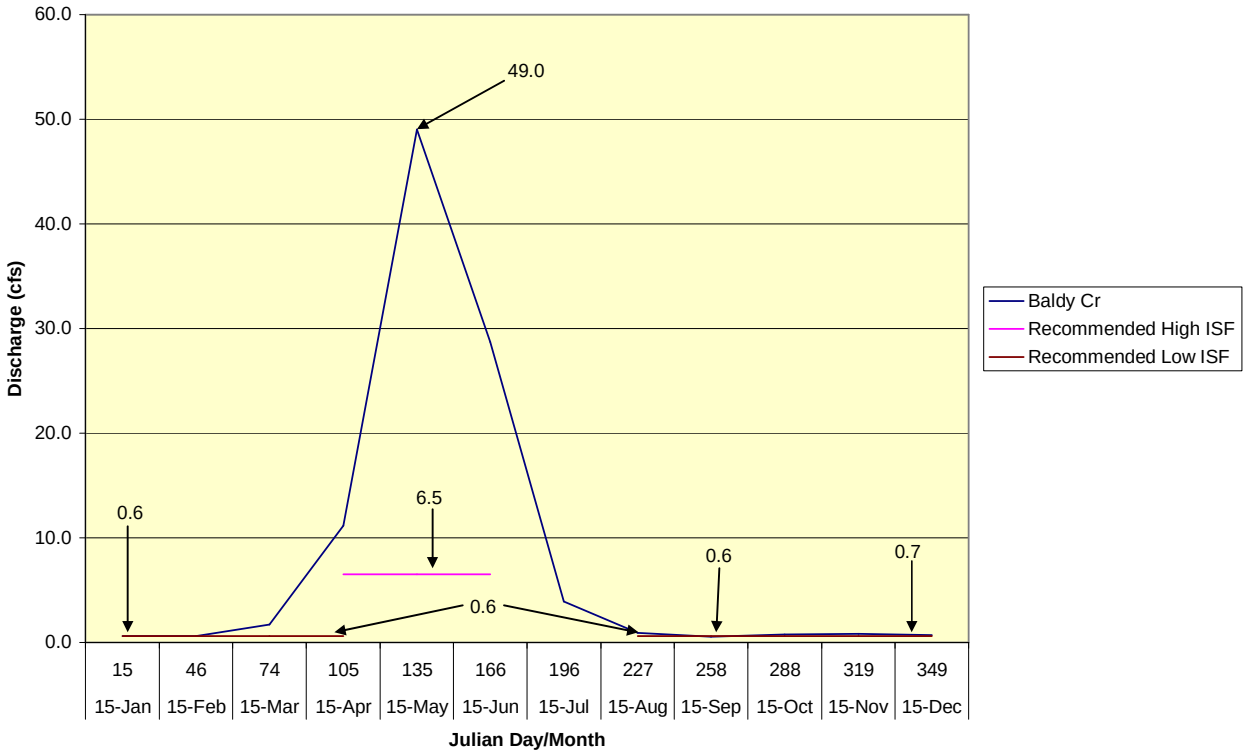


Figure 1 – Baldy Creek Mean Monthly Discharge and Recommended ISFs

Month	Julian Day	Baldy Cr (cfs)	Recommended ISFs (cfs)
15 Jan	15	0.6	0.6
15-Feb	46	0.6	0.6
15-Mar	74	1.7	0.6
31-Mar	105	11.1	0.6
1-Apr	120	11.1	6.5
1-May	121	49.0	6.5
15-May	135	49.0	6.5
15-Jun	166	28.7	6.5
30-Jun	181	28.7	6.5
1-Jul	182	3.9	0.6
15-Jul	196	3.9	0.6
16-Jul	197	3.9	0.6
15-Aug	227	0.9	0.6
15-Sep	258	0.6	0.6
15-Oct	288	0.8	0.6
15-Nov	319	0.8	0.6
15-Dec	349	0.7	0.6

Table 2 – Mean Monthly Discharge and Recommended Instream Flows – Baldy Cr.

Existing Water Right Information

Staff has analyzed the water rights tabulation to identify any potential water availability problems. There is one decreed surface diversion within this reach of stream, the Fairview Mesa Ditch. This water right is owned by CDOW and currently is not being operated. This ditch is decreed for 10 cfs with an appropriation date of 8/11/1955. Based on this analysis staff has determined that water is available for appropriation on Baldy Creek, from the headwaters to the headgate of the Murray & Yule Ditch, 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:

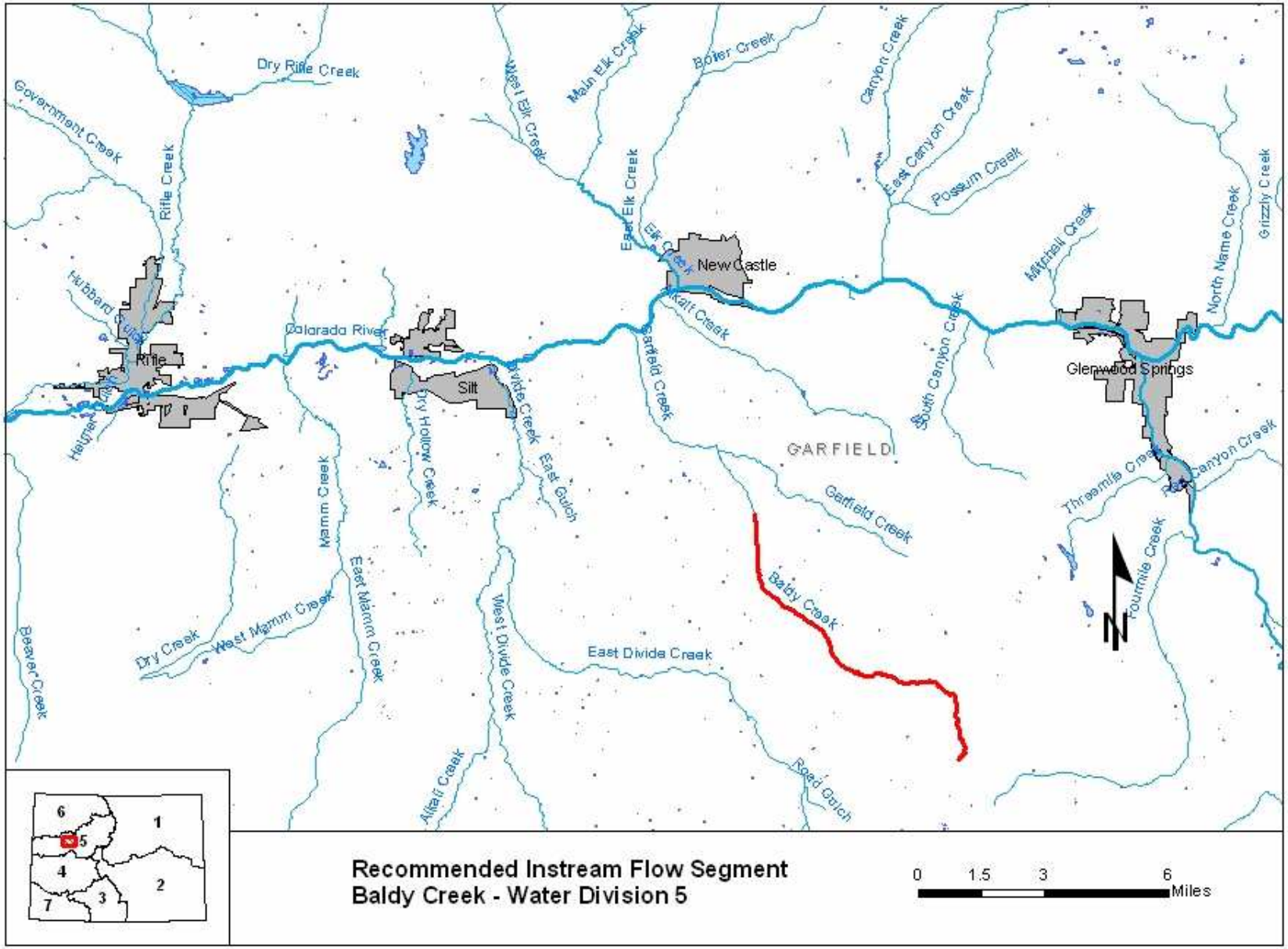
Segment: Headwaters to Headgate Murray & Yule Ditch

Upper Terminus: HEADWATERS IN THE VICINITY OF
(Latitude 39° 24' 28.06"N) (Longitude 107° 24' 29.01"W)
UTM = 4364798.3 N UTM =292672.2 E
NW NE S35 T7S R90W 6PM
2200' West of the East Section Line; 365' South of the North Section Line

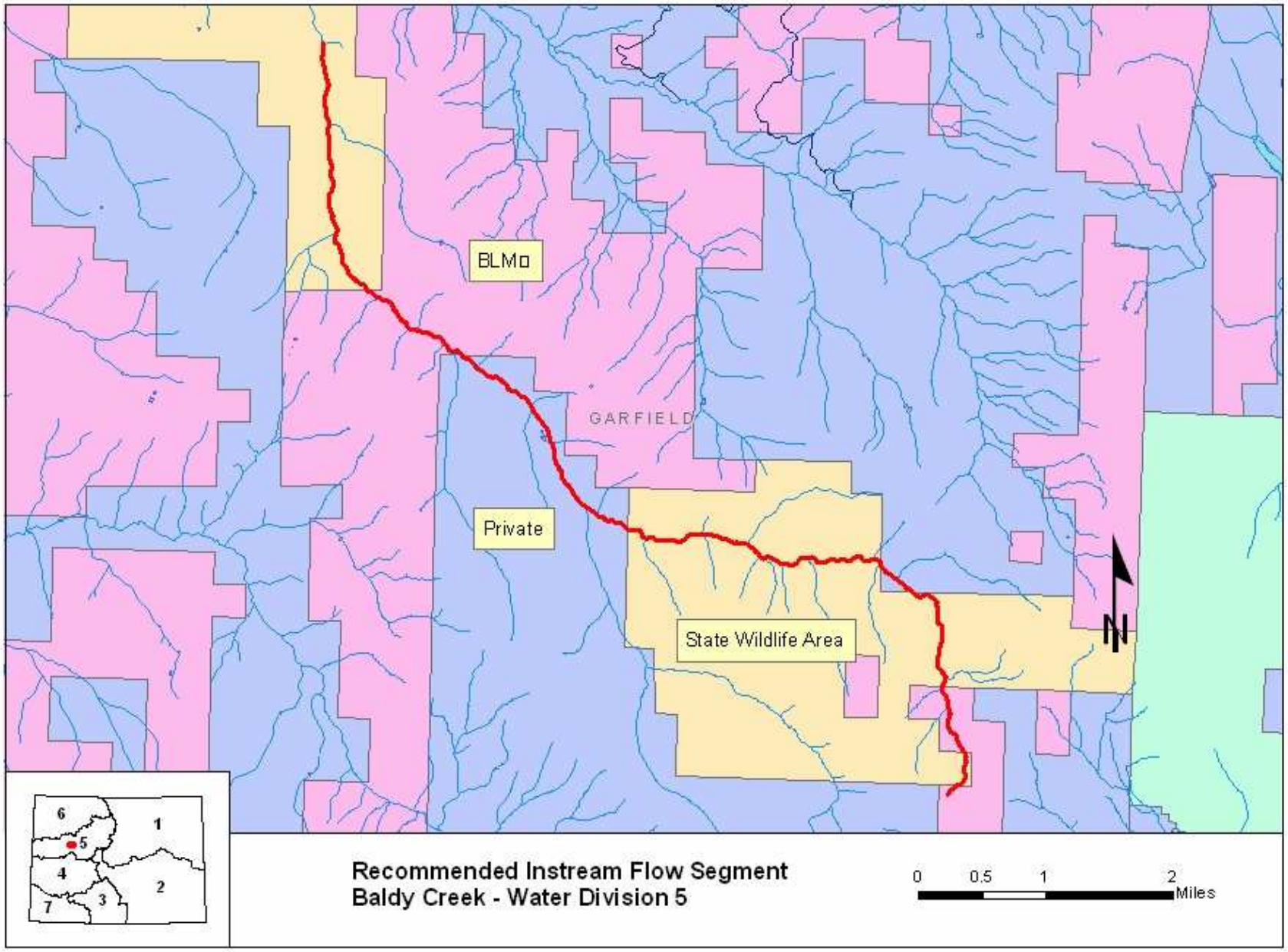
Lower Terminus: HDGT MURRAY & YULE DITCH AT
(Latitude 39° 29' 28.73"N) (Longitude 107° 30' 9.11"W)
UTM = 4374290.4 N UTM =284794.8 E
NW NE S25 T6S R91W 6PM
2600' West of the East Section Line; 385' South of the North Section Line

Watershed: Colorado headwaters-Plateau (HUC#: 14010005)
Counties: Garfield
Length: 9.7 miles
USGS Quad(s): Center Mountain, Gibson Gulch
Flow Recommendation: 6.5 cfs (April 1 to June 30)
0.6 cfs (July 1 to March 31)

Vicinity Map



Land Use Map


BLM
GARFIELD
Private
State Wildlife Area
N
6
1
5
4
2
7
3
Recommended Instream Flow Segment
Baldy Creek - Water Division 5
0
0.5
1
2
Miles

Topographic & Water Rights Map