COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Apishapa River
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Headwaters in the vicinity of UTM North: 4134067.69	UTM East: 498440.80
LOWER TERMINUS:	Confluence with Herlick Canyon UTM North: 4131036.76	UTM East: 504368.80
WATER DIVISION:	2	
WATER DISTRICT:	18	
COUNTY:	Las Animas	
WATERSHED:	Apishapa	
CWCB ID:	12/2/A-001	
RECOMMENDER:	Colorado Division of Wildlife (CPW)	
LENGTH:	4.52 miles	
FLOW RECOMMENDATION:	2.9 (05/1 - 06/30) 1.1 (7/01 - 8/31) 0.5 (09/01 - 04/30)	

Apishapa River

Introduction

Colorado's General Assembly created the Instream Flow and Natural Lake Level Program in 1973, recognizing "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 Colorado Water Conservation Board (CWCB or Board) with the exclusive authority to appropriate and acquire instream flow (ISF) and natural lake level water rights (NLL). Before initiating a water right filing, the Board must determine that: 1) there is a natural environment that can be preserved to a reasonable degree with the Board's water right if granted, 2) the natural environment will be preserved to a reasonable degree by the water available for the appropriation to be made, and 3) such environment can exist without material injury to water rights.

The CPW recommended that the CWCB appropriate an ISF water right on a reach of the Apishapa River. The Apishapa River originates at an elevation of approximately 10,880 ft in the Spanish Peaks Wilderness and flows in a northeasterly direction for one hundred thirty miles dropping to an elevation of approximately 4,280 ft where it joins the Arkansas River. The proposed reach is located within Las Animas County (See Vicinity Map) and extends from its headwaters downstream to the confluence with Herlick Canyon. Forty-seven percent of the land on the 4.52 mile proposed reach is publicly owned and managed by the U.S. Forest Service (USFS); the remaining land is privately owned (See Land Ownership Map). The CPW recommended this reach of the Apishapa River because it has a natural environment that can be preserved to a reasonable degree with an ISF water right.

The information contained in this report and the associated supporting data and analyses (located at: http://cwcb.state.co.us/environment/instream-flow-program/Pages/2017ProposedISFRecommendations.aspx) form the basis for staff's ISF recommendation to be considered by the Board. This report provides sufficient information to support the CWCB findings required by ISF Rule 5i on the natural environment, water availability, and material injury.

Natural Environment

CWCB staff relies on the recommending entity to provide information about the natural environment. In addition, staff reviews information and conducts site visits for each recommended ISF appropriation. This information is used to provide the Board with a basis for determining that a natural environment exists.

In August of 2010, CPW personnel collected stream cross-section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of Apishapa River. The Apishapa River is classified as a small stream (between 10 to 19 ft wide). The Apishapa River basin supports a very diverse fishery - the lower reaches of the stream (downstream of this ISF segment) supports populations of native fish including black Bullhead (*Ameiurus melas*), flathead chub (*Platygobio gracilis*, Species of Concern), plains killifish (*Fundulus zebrinus*), sand shiner (*Notropis stramineus*), green sunfish (*Lepomis cyanellus*), central stoneroller (*Campostoma anomalum*), and white sucker (*Catostomus comersonii*). The lower reaches of the Apishapa River also support populations of nonnative fish including common carp (*Cyprinus carpio*), fathead minnow (*Pimephales promelas*), longnose dace (*Rhinichthys cataractae*), and red shiner (*Cyprinella lutrensis*). While CPW does not currently have fisheries data within the ISF segment, based on samples of similar nearby streams, it is our professional opinion that this stream segment likely has populations of brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*), see Table 1. In

addition, Mark Uppendahl (formerly the CPW ISF coordinator when this recommendation was initially made), observed brook trout in the proposed ISF segment on August 4, 2010.

Table 1. List of species identified in Apishapa River.

Species Name	Scientific Name	Status
brook trout	*Salvelinus fontinalis*	None
brown trout	*Salmo trutta*	None

ISF Quantification

CWCB staff relies upon the biological expertise of the recommending entity to quantify the amount of water required to preserve the natural environment to a reasonable degree. CWCB staff performs a thorough review of the quantification analyses completed by the recommending entity to ensure consistency with accepted standards.

Methodology

CPW staff used the R2Cross methodology to develop the initial ISF recommendation. The R2Cross method is based on a hydraulic model and uses field data collected in a stream riffle (Espegren, 1996). Riffles are most easily visualized as the stream habitat types that would dry up first should streamflow cease. The field data collected consists of streamflow measurements and surveys of channel geometry at a transect and of the longitudinal slope of the water surface.

The field data is used to model three hydraulic parameters: average depth, average velocity, and percent wetted perimeter. Maintaining these hydraulic parameters at adequate levels across riffle habitat types also will maintain aquatic habitat in pools and runs for most life stages of fish and aquatic macro-invertebrates (Nehring, 1979). CPW staff interprets the model results to develop an initial recommendation for summer and winter flows. The summer flow recommendation is based on meeting 3 of 3 hydraulic criteria. The winter flow recommendation is based on meeting 2 of 3 hydraulic criteria. The model's suggested accuracy range is 40% to 250% of the streamflow measured in the field. Recommendations that fall outside of the accuracy range may not give an accurate estimate of the hydraulic parameters necessary to determine an ISF rate.

The R2Cross methodology provides the biological quantification of the amount of water needed for summer and winter periods based on empirical studies of fish species preferences. The recommending entity uses the R2Cross results and its biological expertise to develop an initial ISF recommendation. CWCB staff then evaluates water availability for the reach typically based on median hydrology (see the Water Availability section below for more details). The water availability analysis may indicate less water is available than the initial recommendation. In that case, the recommending entity either modifies the magnitude and/or duration of the recommended ISF rates if the available flows will preserve the natural environment to a reasonable degree, or withdraws the recommendation.

Data Analysis

R2Cross data was collected at two transects for this proposed ISF reach (Table 2). Results obtained at more than one transect are averaged to determine the R2Cross flow rate for the reach of stream. The R2Cross model results in a winter flow of 2.00 cfs, which meets 2 of 3 criteria and is within the accuracy range of the R2Cross model. The R2Cross model results in a summer flow of 2.85 cfs, which meets 3 of 3 criteria and is within the accuracy range of the R2Cross model.

Table 2. Summary of R2Cross transect measurements and results for the Apishapa River.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
CPW	08/04/2010 # 1	3.79	1.5 - 9.5	Out of range	2.90
CPW	08/04/2010 # 2	4.89	2.0 - 12.2	2.00	2.80
			Mean	2.00	2.85

ISF Recommendation

CPW recommended flow rates of 2.85 cfs (4/15 – 6/30), 2.0 cfs (7/1 – 7/31), 1.1 cfs (8/1 – 10/31), and 0.75 cfs (11/1 – 4/14) based on R2Cross modeling analyses, biological expertise, and a preliminary water availability analysis.

The CPW recommendation was modified by staff as a result of water availability and to conform to a standard number of significant digits in ISF water court applications. The final recommended flow rates are as follows:

2.9 cfs is recommended from May 1 through June 30.

1.1 cfs is recommended from July 1 through August 31. This recommendation is limited by water availability.

0.50 cfs is recommended from September 1 through April 30.This recommendation is limited by water availability.

However, if additional water is determined to be available in the future, CPW would recommend appropriating the additional water up to the recommended flow amounts to preserve the natural environment to a reasonable degree. Otherwise, the above modified flow regime should be adequate to preserve the natural environment in the Apishapa River to a reasonable degree.

Water Availability

CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for making the determination that water is available.

Methodology

Each recommended ISF reach has a unique flow regime that depends on variables such as the timing, magnitude, and location of water inputs (such as rain, snow, and snowmelt) and water losses (such as diversions, reservoirs, evaporation and transpiration, groundwater recharge, etc). Although extensive and time-consuming investigations of all variables may be possible, staff takes a pragmatic and cost-effective approach to analyzing water availability. This approach focuses on streamflows and the influence of flow alterations, such as diversions, to understand how much water is physically available in the recommended reach.

Staff's hydrologic analysis is data-driven, meaning that staff gathers and evaluates the best available data and uses the best available analysis method for that data. Whenever possible, long-term stream gage data (period of record 20 or more years) will be used to evaluate streamflow. Other streamflow

information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and StreamStats will be used when long-term gage data is not available. StreamStats, a statistical hydrologic program, uses regression equations developed by the USGS (Capesius and Stephens, 2009) to estimate mean flows for each month based on drainage basin area and average drainage basin precipitation. Diversion records will also be used to evaluate the effect of surface water diversions when necessary. Interviews with water commissioners, landowners, and ditch or reservoir operators can provide additional information. A range of analytical techniques may be employed to extend gage records, estimate streamflow in ungaged locations, and estimate the effects of diversions. The goal is to obtain the most detailed and reliable estimate of hydrology using the most efficient analysis technique.

The final product of the hydrologic analysis used to determine water availability is a hydrograph, which shows streamflow and the proposed ISF rate over the course of one year. The hydrograph will show median daily values when daily data is available; otherwise, it will present mean-monthly streamflow values. Staff will calculate 95% confidence intervals for the median streamflow if there is sufficient data. Statistically, there is 95% confidence that the true value of the median streamflow is located within the confidence interval.

Basin Characteristics

The drainage basin of the proposed ISF on the Apishapa River is 6.03 square miles, with an average elevation of 10,100 ft and average annual precipitation of 31.37 inches. There are a number of small ponds and springs in the drainage basin and two surface water diversions from the proposed reach on the Apishapa River. The surface water diversions include the Spanish Peaks P/L No 1 (0.5 cfs appropriation date 1932), which is used to fill a pond, and the Apishapa Picnic Pipeline (0.011 cfs, appropriation date 1962). Based on available information, these diversions do not appear to significantly impact the stream. See the Hydrologic Features Map.

Available Data

There is not a current streamflow gage on the proposed reach of the Apishapa River. There are two historic gages located downstream on the Apishapa River near the town of Aguilar. The nearest gage is the Apishapa River near Aguilar, CO (USGS 07118000, 1939 to 1950). This gage was located roughly 5 miles east of the proposed lower terminus and has a drainage basin area of approximately 141.7 square miles. The Apishapa River at Aguilar, CO (USGS 07118500) was located roughly 6.8 miles downstream. This gage has a short period of record starting in 1938 to 1939 and again from 1978 to 1981. This gage is below the Borrego Ditch that diverts up to 20.53 cfs of flow from the Apishapa River. Both gages have significantly larger drainage basins than the proposed reach of the Apishapa River, and both gages include significant diversions. These factors make the gages unsuitable to estimate streamflow on the proposed reach of the Apishapa River.

In some cases, diversion records can be used to provide an indication of water availability in a stream reach. The Spanish Peaks P/L No 1 has diversion records; however, the median diversion for the period of record is 0 cfs due to a large number of years without reported use. The diversion records contain the water commissioner comment “no water available,” particularly in recent years (2005-2007, 2008-2009, 2012-2015). One comment in 2000 says “Never in priority.” Water commissioner Doug Brgoch indicated that this pipeline is a junior water right and must bypass streamflow (personal communication, 8/2/2013). Based on this information, this diversion likely does not significantly impact the stream.

Due to the lack of available data, CWCB staff installed a temporary streamflow gage in the spring of 2012. This gage was located approximately 1.3 miles upstream from the lower terminus due to accessibility constraints, rather than at the lower terminus. The gage operated from 4/2/2012 until 9/12/2013 when the gage was destroyed by a high flow event. In addition, CWCB staff made a number of streamflow measurements on the proposed reach of the Apishapa River. Most of these measurements were taken at or above the pressure transducer location. Norwest Corporation also collected spot streamflow measurements periodically between 2010 and the present. These measurements were made at a location 0.7 miles upstream from the lower terminus. All known spot measurements in the proposed reach are summarized in Table 3.

Table 3. Summary of streamflow measurement visits and results for the Apishapa River.

Visit Date	Flow (cfs)	Method	Party
8/4/2010	3.79	Marsh-McBirney	CPW
8/4/2010	4.89	Marsh-McBirney	CPW
9/17/2010	0.24	Marsh-McBirney	Norwest
9/28/2010	0.24	Marsh-McBirney	Norwest
10/22/2010	0.35	Marsh-McBirney	Norwest
4/22/2011	0.60	Marsh-McBirney	Norwest
5/20/2011	1.49	Marsh-McBirney	Norwest
6/30/2011	0.092	Flume	Norwest
7/30/2011	0.52	Marsh-McBirney	Norwest
8/26/2011	0.13	Marsh-McBirney	Norwest
9/1/2011	0.21	FlowTracker	CWCB
9/8/2011	0.23	FlowTracker	CWCB
9/22/2011	0.092	Flume	Norwest
10/28/2011	0.31	Marsh-McBirney	Norwest
11/21/2011	0.15	Marsh-McBirney	Norwest
1/26/2012	0.23	Flume	Norwest
4/10/2012	5.18	FlowTracker	CWCB
5/3/2012	4.31	Marsh-McBirney	Norwest
5/22/2012	2.48	FlowTracker	CWCB
6/1/2012	0.93	Marsh-McBirney	Norwest
6/28/2012	0.20	FlowTracker	CWCB
7/11/2012	1.3	Marsh-McBirney	Norwest
8/1/2012	0.41	FlowTracker	CWCB
8/10/2012	0.064	Flume	Norwest
9/7/2012	0.059	Flume	Norwest
10/5/2012	0.17	Flume	Norwest
11/1/2012	0.23	FlowTracker	CWCB
4/29/2013	0.79	FlowTracker	CWCB
5/9/2013	0.19	Marsh-McBirney	Norwest
5/30/2013	0.63	FlowTracker	CWCB

6/13/2013	0.038	Marsh-McBirney	Norwest
7/8/2013	0.14	FlowTracker	CWCB
7/9/2013	0.018	Marsh-McBirney	Norwest
8/13/2013	0.85	Pygmy	Norwest
10/8/2013	0.75	Marsh-McBirney	Norwest
10/30/2013	0.59	FlowTracker	CWCB
11/12/2013	0.58	Marsh-McBirney	Norwest
4/15/2014	3.40	Marsh-McBirney	Norwest
5/14/2014	4.88	Marsh-McBirney	Norwest
6/13/2014	2.08	Marsh-McBirney	Norwest
7/10/2014	0.47	2" Baski Flume	Norwest
8/12/2014	1.66	Marsh-McBirney	Norwest
9/9/2014	0.30	Marsh-McBirney	Norwest
10/13/2014	0.49	Marsh-McBirney	Norwest
5/13/2015	4.47	Marsh-McBirney	CWCB-JB
6/8/2015	3.81	Marsh-McBirney	Norwest
8/12/2015	0.91	Marsh-McBirney	Norwest
10/14/2015	0.27	2" Baski Flume	Norwest
3/10/2016	1.42	8" Baski Flume	Norwest
5/12/2016	8.37	Marsh-McBirney	Norwest
8/9/2016	0.55	8" Baski Flume	Norwest

The only other available information about streamflow on the Apishapa River comes from discussions with the Water Commissioner for District 18, Doug Brgoch (personal communication 8/2/2013). According to Mr. Brgoch, spring runoff starts around mid-April and ends around mid-June with peak flow typically between 8-10 cfs. Baseflows on the Apishapa River above the confluence with Herlick Creek are about 1 cfs.

Data Analysis

The period for which temporary gage data and streamflow measurements exist on the proposed reach of the Apishapa River was evaluated by looking at longer term precipitation data. The Trinidad climate station was the closest climate station identified with a relatively long period of record (USC00058429). This gage is located roughly 27 miles southeast from the proposed lower terminus on the Apishapa River. The Trinidad climate station records precipitation data from 1898 - 2016, with a number of gaps. The average annual precipitation for years with largely complete data (86 years had data for more than 95% of the year) between 1900 and 2015 is 15.6 inches. The average annual precipitation between 2010 and 2015 is 14.3 inches. 2010 and 2015 had above average precipitation while 2011, 2013, 2014 had below average precipitation. 2012 had missing data, but was a low runoff year in most of the state. Therefore, the available streamflow data from 2012-2013 was collected during below average precipitation conditions. The spot measurements were taken over a range of precipitation conditions.

All CWCB temporary gage data is shown on the hydrograph. Due to the short period of record, median streamflow and 95% confidence intervals for median streamflow were not calculated.

StreamStats provides an estimate of mean-monthly streamflow. It should be noted that 6% of the drainage basin of the proposed reach of the Apishapa River is located in area that does not have defined flow equations. Therefore, the flow estimates are based entirely on the Rio Grande Region.

Water Availability Summary
The hydrograph (See Complete Hydrograph) shows StreamStats results for mean-monthly streamflow, all spot streamflow measurements, and the data collected by the temporary streamflow gage installed by CWCB staff. The proposed ISF is below the StreamStats mean-monthly streamflow for all months. The proposed ISF is less than the available measured streamflow information at some times and higher than it during others. The available temporary gage measurements occurred during dry to exceptionally dry precipitation conditions. In addition, all streamflow measurements occurred upstream from the proposed lower terminus and likely underestimate streamflow at the proposed lower terminus. Based on the combination of gage data, Streamstats, and water commissioner opinion, staff concludes that water is available for appropriation on the Apishapa River.

Material Injury
Because the proposed ISF on Apishapa River is a new junior water right, the ISF can exist without material injury to other water rights. Under the provisions of section 37-92-102(3)(b), C.R.S. (2016), the CWCB will recognize any uses or exchanges of water in existence on the date this ISF water right is appropriated.

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

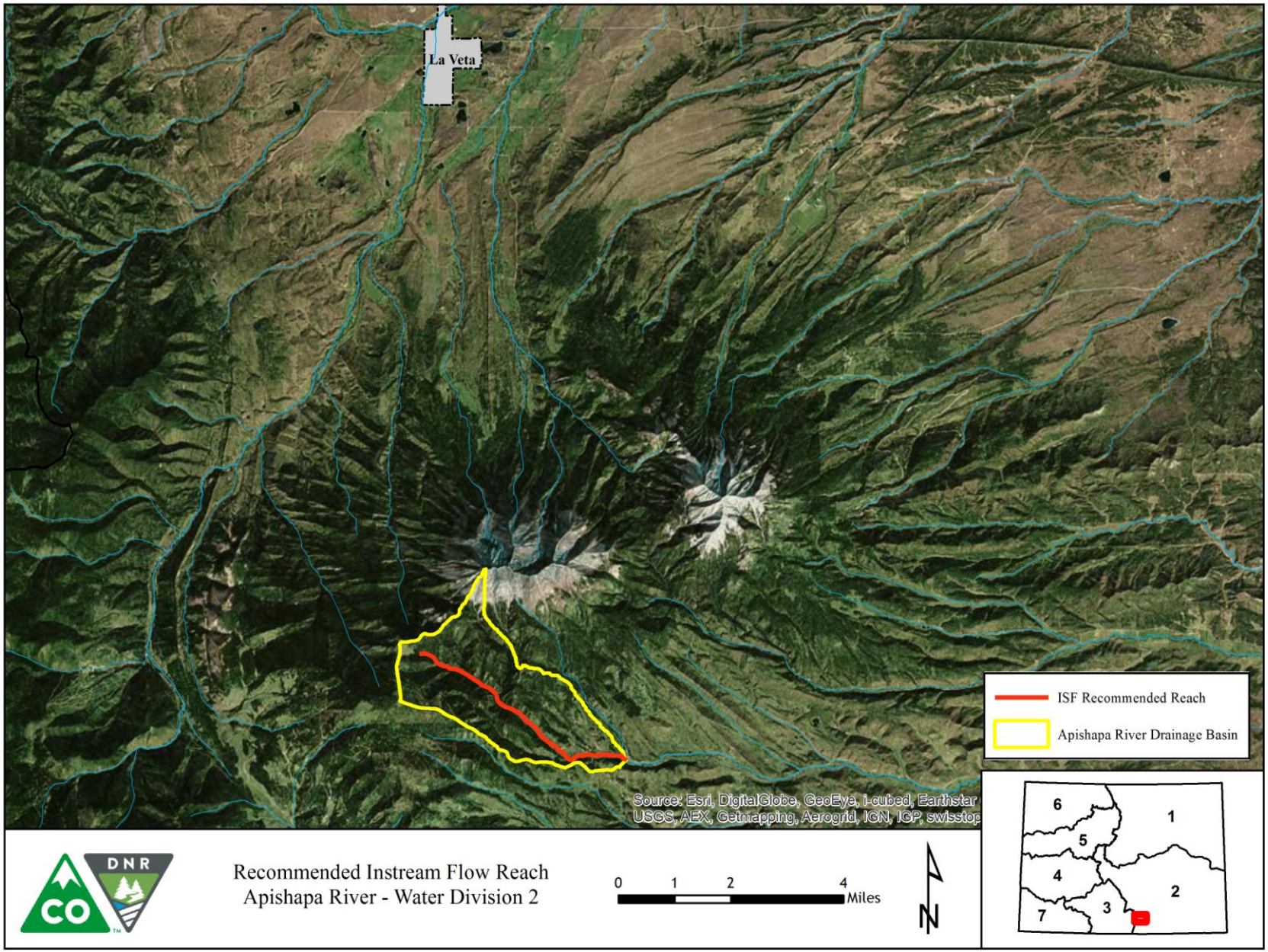
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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

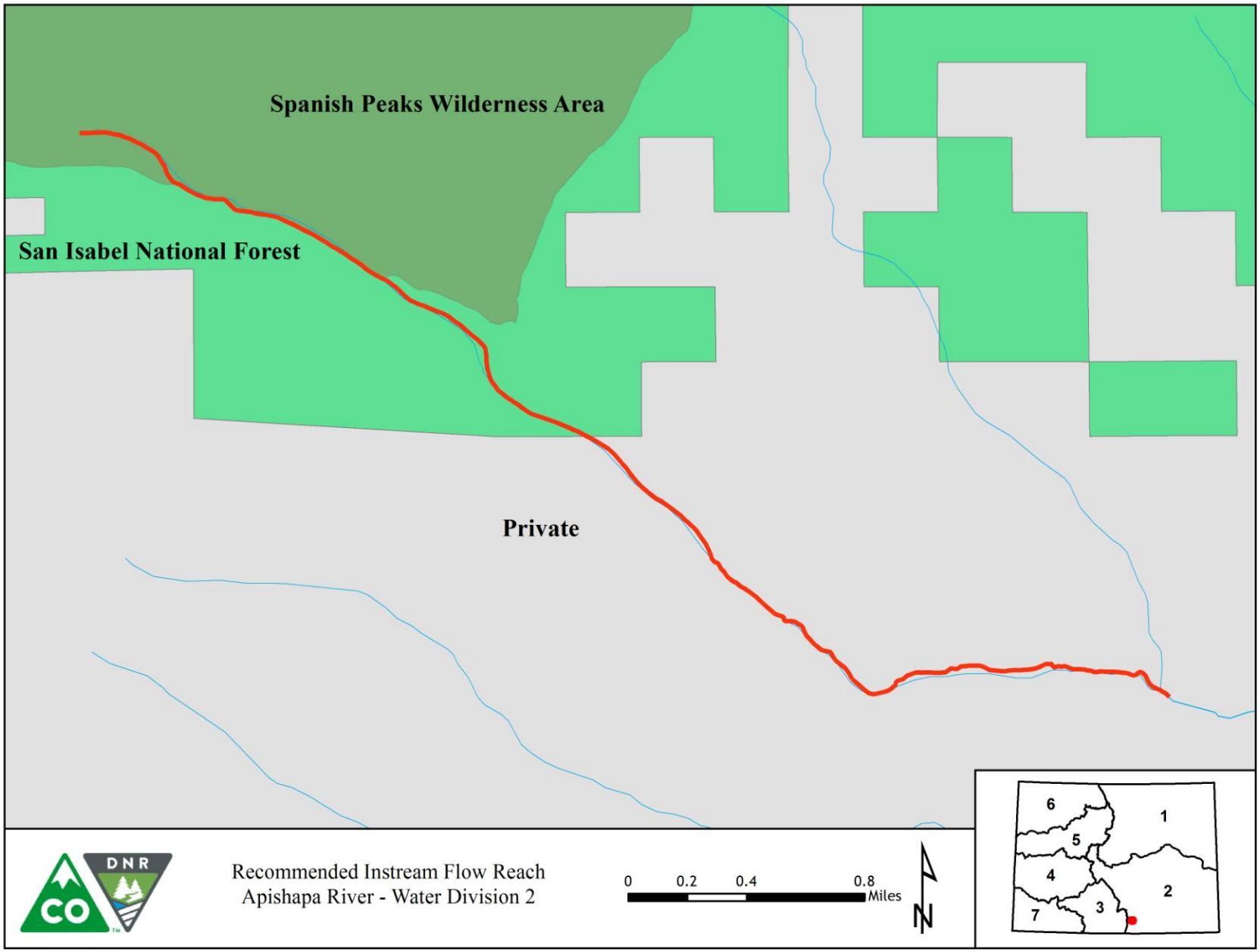
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

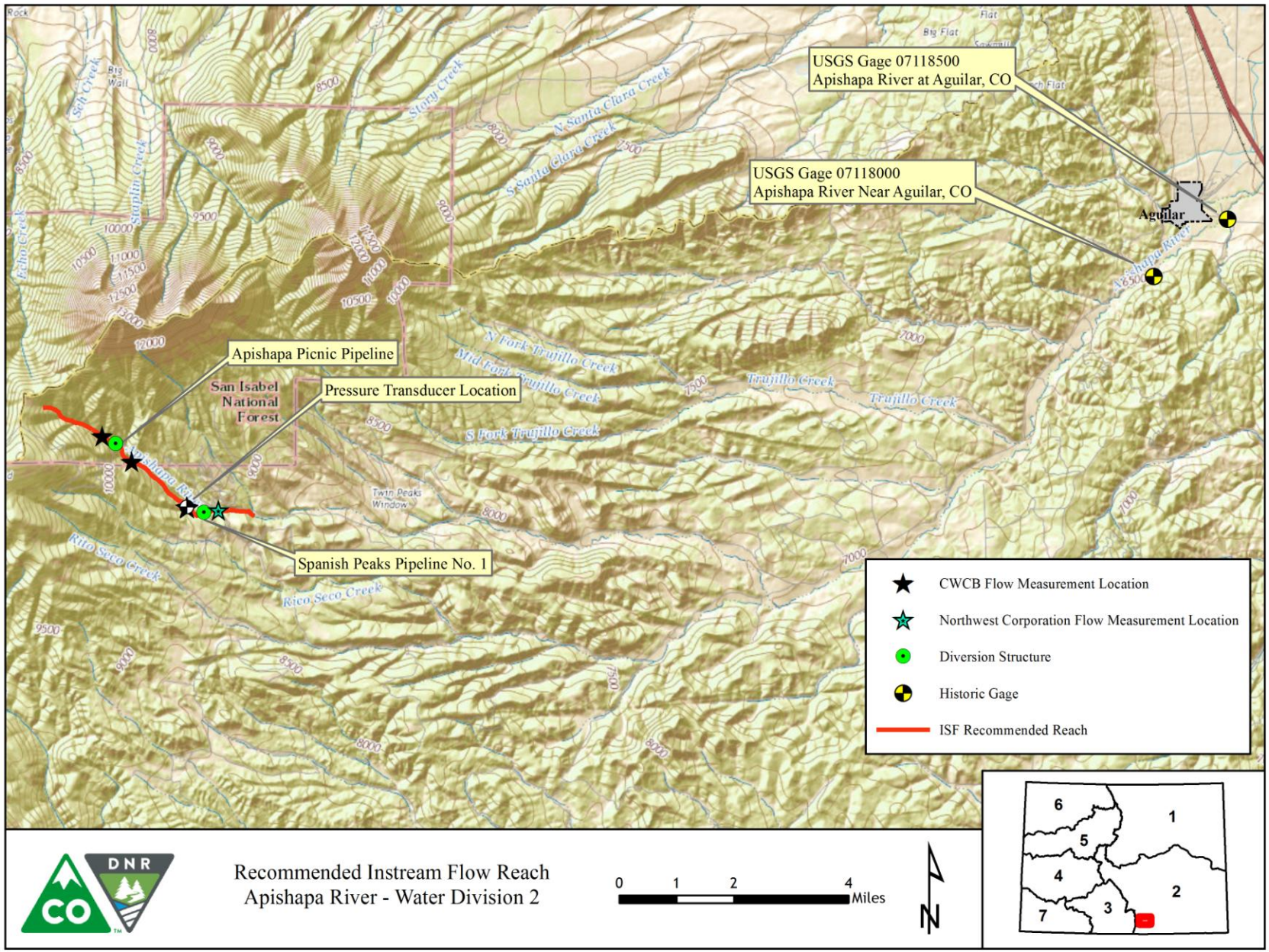
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH