COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Piney River
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Confluence Grape Creek UTM North: 4405229.97	UTM East: 366932.04
LOWER TERMINUS:	Confluence Colorado River UTM North: 4412971.89	UTM East: 359556.85
WATER DIVISION:	5	
WATER DISTRICT:	52	
COUNTY:	Eagle	
WATERSHED:	Colorado Headwaters	
CWCB ID:	17/5/A-001	
RECOMMENDER:	Bureau of Land Management (BLM)	
LENGTH:	7.83 miles	
Existing ISF:	86CW0229; 9 cfs (1/1-12/31)	
FLOW RECOMMENDATION:	55 (5/1 - 7/15) 16 (7/16 - 8/15) 8 (8/16 - 11/30) 4 (12/1 - 3/31) 16 (4/1 - 4/30)	

Piney 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 BLM recommended that the CWCB appropriate an increase to the existing ISF water right on a reach of the Piney River. The CWCB currently holds an instream flow water right on the Piney River for 9.0 cfs (1/1-12/31), decreed in Case No. 86CW0229. The BLM does not consider the current ISF water right to be sufficiently protective of the natural environment in the Piney River, in light of CWCB's current application of R2Cross. The current instream flow water right does not meet all three instream flow criteria during the spring and summer, which is a critical growth and spawning period for the fish population.

The Piney River originates in the Eagles Nest Wilderness Area, approximately six miles northeast of Vail at an elevation of approximately 11,280 feet. The river flows in a northwesterly direction as it drops to an elevation of approximately 6,790 feet where it joins the Colorado River. The proposed reach is located within Eagle County (See Vicinity Map) and extends from the confluence with Grape Creek downstream to the confluence with the Colorado River. Thirty-three percent of the land on the 7.83 mile proposed reach is publicly owned and managed by the BLM; the remaining land is privately held. (See Land Ownership Map).

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.

The Piney River is a cold-water, high gradient stream. It flows through a canyon with a valley floor approximately one-fourth mile in width. The stream cuts through alluvial deposits in the narrow valley and is confined by bedrock in many locations. The stream generally has large substrate, consisting of mostly of small cobbles and boulders of up to two feet in diameter. The stream has a good mix of swift runs and riffles. Slow deep pools and sinuosity are very limited in this reach due to the channel type, but there are some pocket water pools associated with the large rock substrate.

Fisheries surveys have revealed a self-sustaining population of brown trout, rainbow trout, mountain whitefish, sculpin, and longnose sucker (See Table 1). The number of fish is likely to vary seasonally as fish move in and out of this reach from the Colorado River. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, caddisfly, and stonefly – including the giant salmonfly (*Pteronarcys californica)*.

The riparian community is generally comprised of willow, alder, cottonwood, Douglas fir, and red osier dogwood. The riparian community is in very good condition. Given the channel width, the riparian community provides some, but not extensive, shading and cover for fish.

Table 1. List of species identified in Piney River.

Species Name	Scientific Name	Status
brown trout	*Salmo trutta*	None
rainbow trout	*Oncorhynchus mykiss*	None
mountain whitefish	*Prosopium williamsoni*	None
longnose sucker	*Catostomus catostomus*	None
mottled sculpin	*Cottus bairdii*	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

BLM 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). BLM 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 four 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 30.99 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 64.23 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 Piney River.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	07/23/2015 # 1	76.01	30.40 - 190.03	out of range	out of range
BLM	07/23/2015 # 2	75.64	30.26 - 189.1	35.85	73.80
BLM	09/16/2015 # 1	31.56	12.62 - 78.9	25.30	59.36
BLM	09/16/2015 # 2	32.22	12.89 - 80.55	31.83	59.53
			Mean	30.99	64.23

ISF Recommendation

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

64.0 cubic feet per second is recommended during the snow melt runoff period from May 1 to July 15. Protecting this flow rate would require an increase of 55.0 cfs to the existing instream flow water right. This recommendation is driven by the average depth criteria. This portion of the river is within a dark canyon, so it experiences significant icing during the winter months. It is important to protect a flow rate that makes most of this habitat available to the fish population while they are completing critical life history functions during the warm weather months. It is also important to make as much physical habitat as possible available to fish that enter the Piney River from the Colorado River. Finally, this flow should help recharge alluvial aquifers along the Piney River that are important for sustaining the riparian community during low flow periods.

25.0 cubic feet per second is recommended from July 16 through August 15. Protecting this flow rate would require an increase of 16 cfs to the existing instream flow water right. This is the highest water temperature period of the year, so it is important to protect sufficient flow rates to keep water temperatures stable and within the tolerance range for salmonid species. This recommendation is driven by water availability, but comes close to meeting two of the three instream flow criteria.

17.0 cubic feet per second is recommended from August 16 through November 30. This recommendation is driven by water availability. Protecting this flow rate would require an increase of 8.0 over the current instream flow water right. Even though this flow rate does not meet two instream flow criteria, it does protect substantially more habitat than the current instream flow water right during a critical period of the year for the fish population.

13.0 cubic feet per second is recommended during the period from December 1 to March 31. Protecting this flow rate would require an increase of 4.0 cfs to the existing instream flow water right. This recommendation is driven by limited water availability. This flow rate should prevent pools from freezing, allowing the fish population to successfully overwinter.

25.0 cubic feet per second is recommended from during the beginning of the snowmelt runoff period from April 1 to April 30. Protecting this flow rate would require an increase of 16 cfs to the existing instream flow water right. It is important to protect a higher flow rate when the fish population is starting to actively feed during the early portion of the growing season.

Rationale for Instream Flow Increase

The BLM believes an instream flow increase for the Piney River is warranted because of physical habitat characteristics. The R2Cross data summarized above clearly indicates that the current instream flow water right does not provide sufficient physical habitat during the warm weather portions of the year when the fish populations are feeding, growing, and spawning. When the existing instream flow rights are applied to the cross sections that were collected, the stream would exhibit between 52% to 65% wetted perimeter. However, this habitat is not highly usable by the fish population, because 9.0 cfs constrains the habitat to an average depth of 0.27 feet and average velocities ranging from 0.65 to 0.80 feet per second. An average habitat depth of 0.27 feet is not sufficient in a stream that averages 70 feet in width. During the warm weather season, the fish population needs to have access to as much of the stream channel as possible for feeding, resting, and spawning if it is to survive the pronounced cold winters in this canyon.

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 Piney River is 118.00 square miles, with an average elevation of 9,490 ft and average annual precipitation of 24.42 inches (See the Vicinity Map). The Piney River basin supports agriculture, among other uses. Hydrology is altered by water use within the basin.

Available Data

The Piney River has a USGS gage located one mile downstream from the upper terminus (USGS 0959500 Piney River near State Bridge, CO). The drainage basin of the Piney Creek gage is 93 square miles, with an average elevation of 9,720 ft and average annual precipitation of 25.74 inches. Five on-channel diversions between the gage and the lower terminus were identified at the time of analysis. These diversions include; Ashlock No 2 Ditch HDG1 (3.76 cfs, appropriation date 1923), Ashlock Ditch (4.75 cfs, appropriation dates 1888, 1889, 1923, and 1938), Ashlock Ditch HDG2 (1.1 cfs appropriation date 1923), Wiltsey Ditch (2.08 cfs, appropriation date 1938), and Wiltsey Ditch HDG2 (2.08 AP, appropriation date 1938). The record for these diversions varies, but most of the diversions have records starting in 1973 or 1974. Some of the diversion records end in 1999, with others ending in 2011 and 2013. According to the water commissioner, the owner of these diversions recently upgraded to sprinkling irrigation systems (Rick Bumgardner, personal communication 5/16/2016).

CWCB staff made two streamflow measurements on the proposed reach of Piney River as summarized in Table 3.

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

Visit Date	Flow (cfs)	Method
09/21/2016	18.41	Wading ADV
08/10/2016	39.72	Wading ADV

Data Analysis
The Piney River gage and available diversion records from the five diversions located below the gage were used to estimate streamflow in the ISF reach. The effects of the diversions below the gage were accounted for by subtracting the diversion records from the gage record. This analysis was completed from 11/1/1974 to 10/31/2013 based on the availability of diversion records. The adjusted gage data was not scaled to the lower terminus due to uncertainty in the amount of flow that may accrue in the additional 24.6 square miles of contributing drainage basin below the gage. This decision not to scale the gage data likely results in underestimating streamflow at the lower terminus. Median streamflow and 95% confidence intervals for median streamflow were calculated for the adjusted Piney River gage record.

Water Availability Summary
The hydrographs (See Complete Hydrograph and Detailed Hydrograph) show median streamflow and 95% confidence intervals for the median streamflow based on the adjusted Piney River gage record. The proposed ISF rate is below the median streamflow the majority of the time. The proposed ISF rate is below the 95% confidence interval of the median at all times. Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on Piney 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.

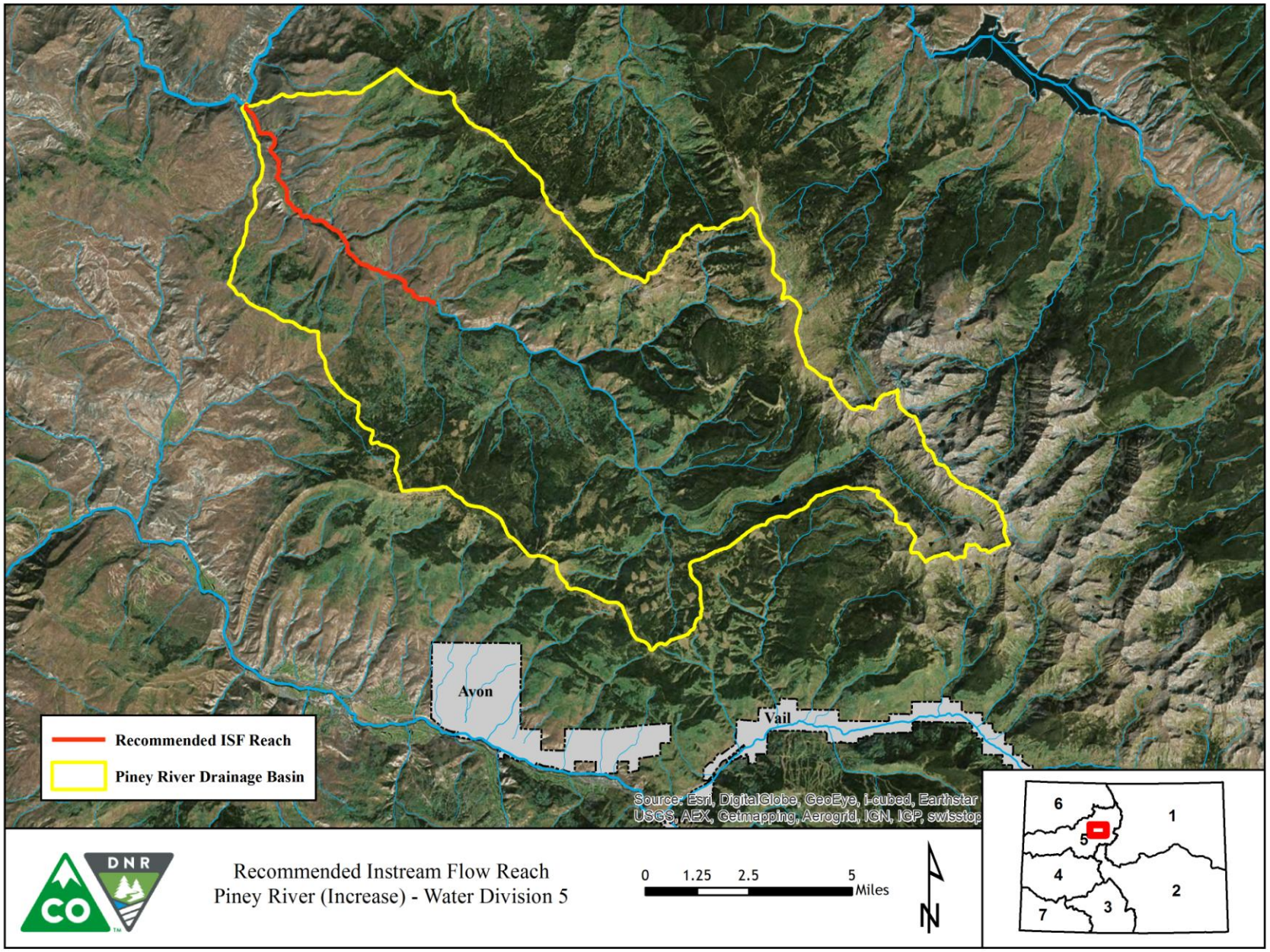
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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.

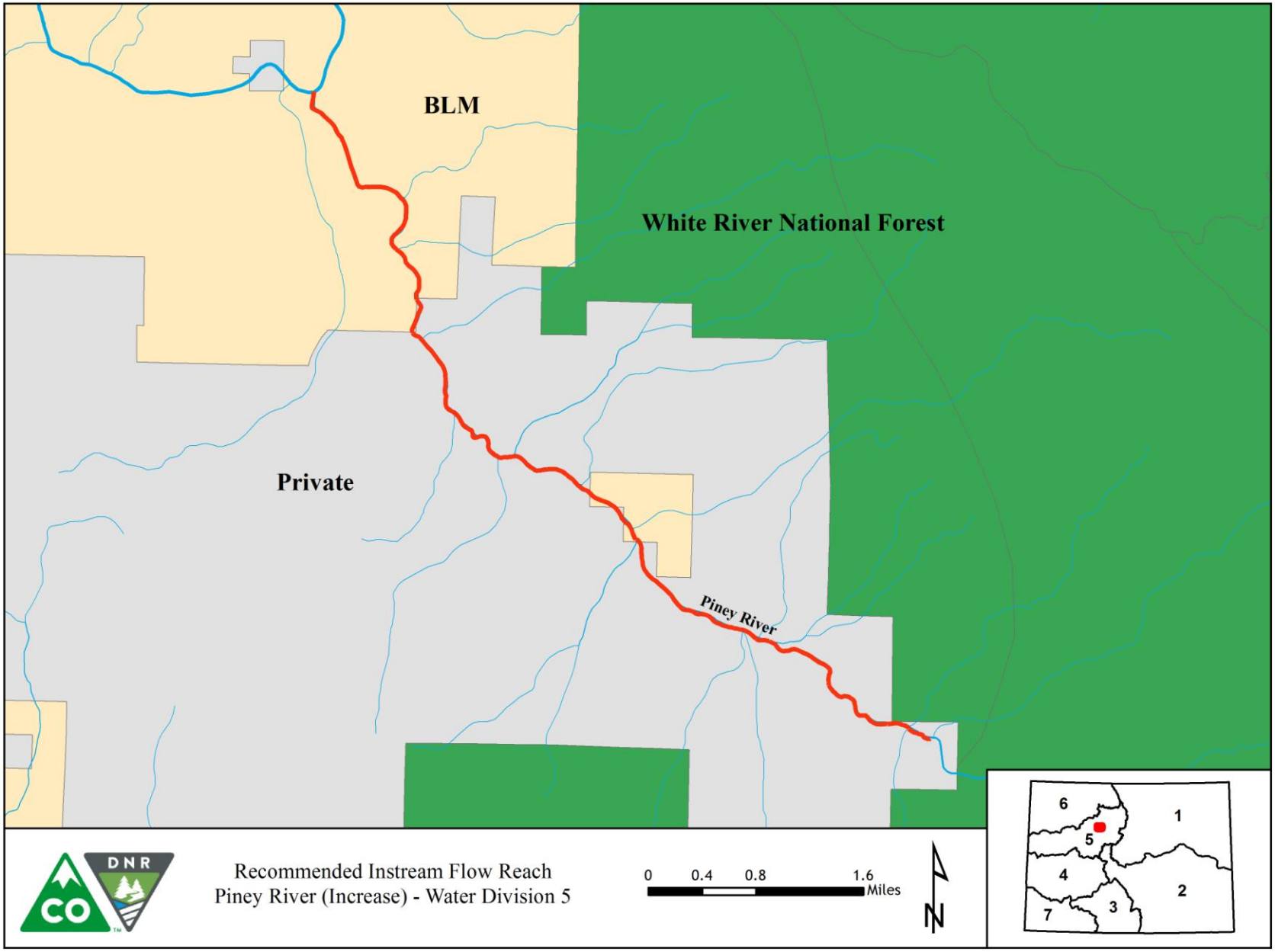
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

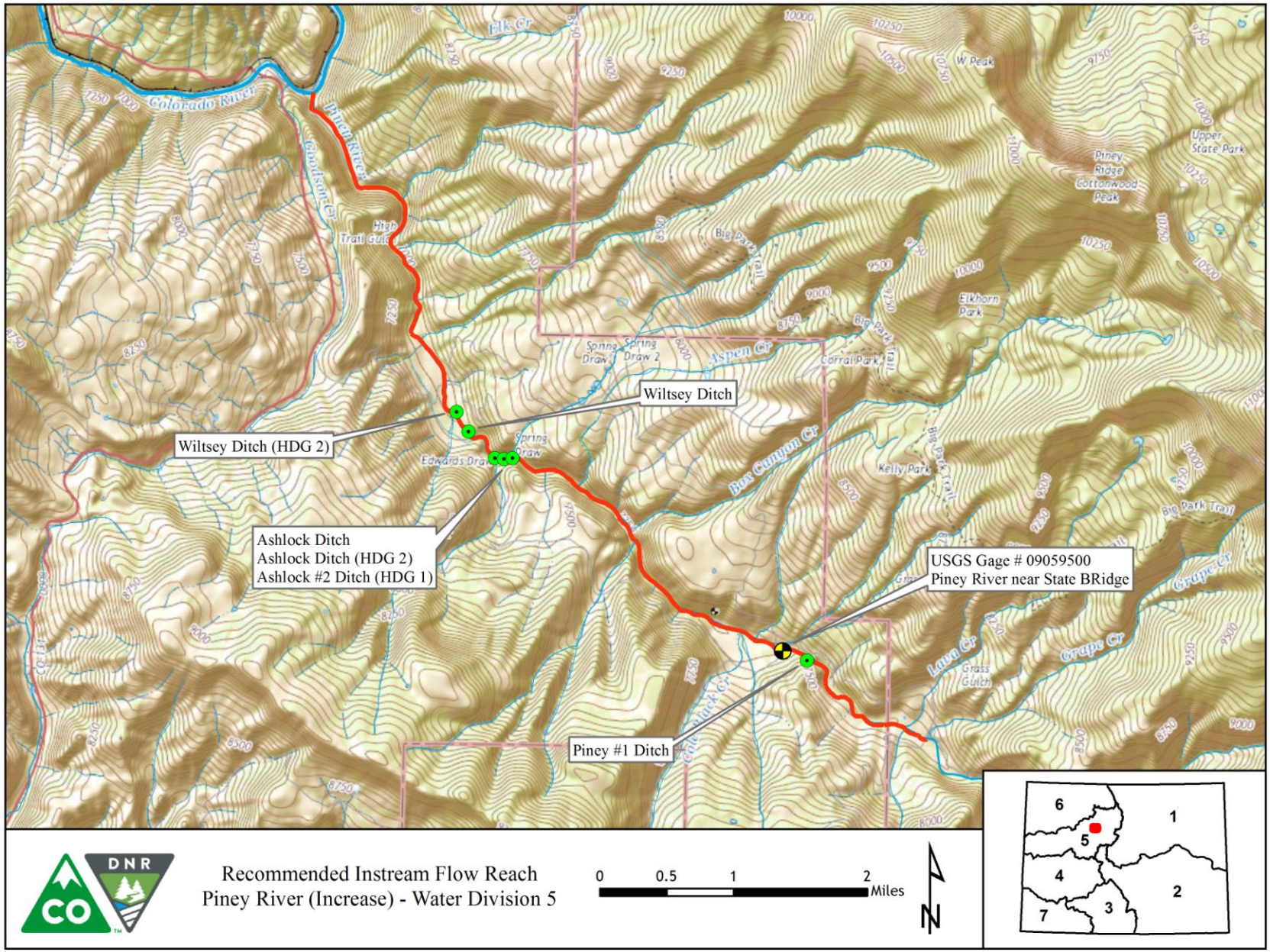
VICINITY MAP



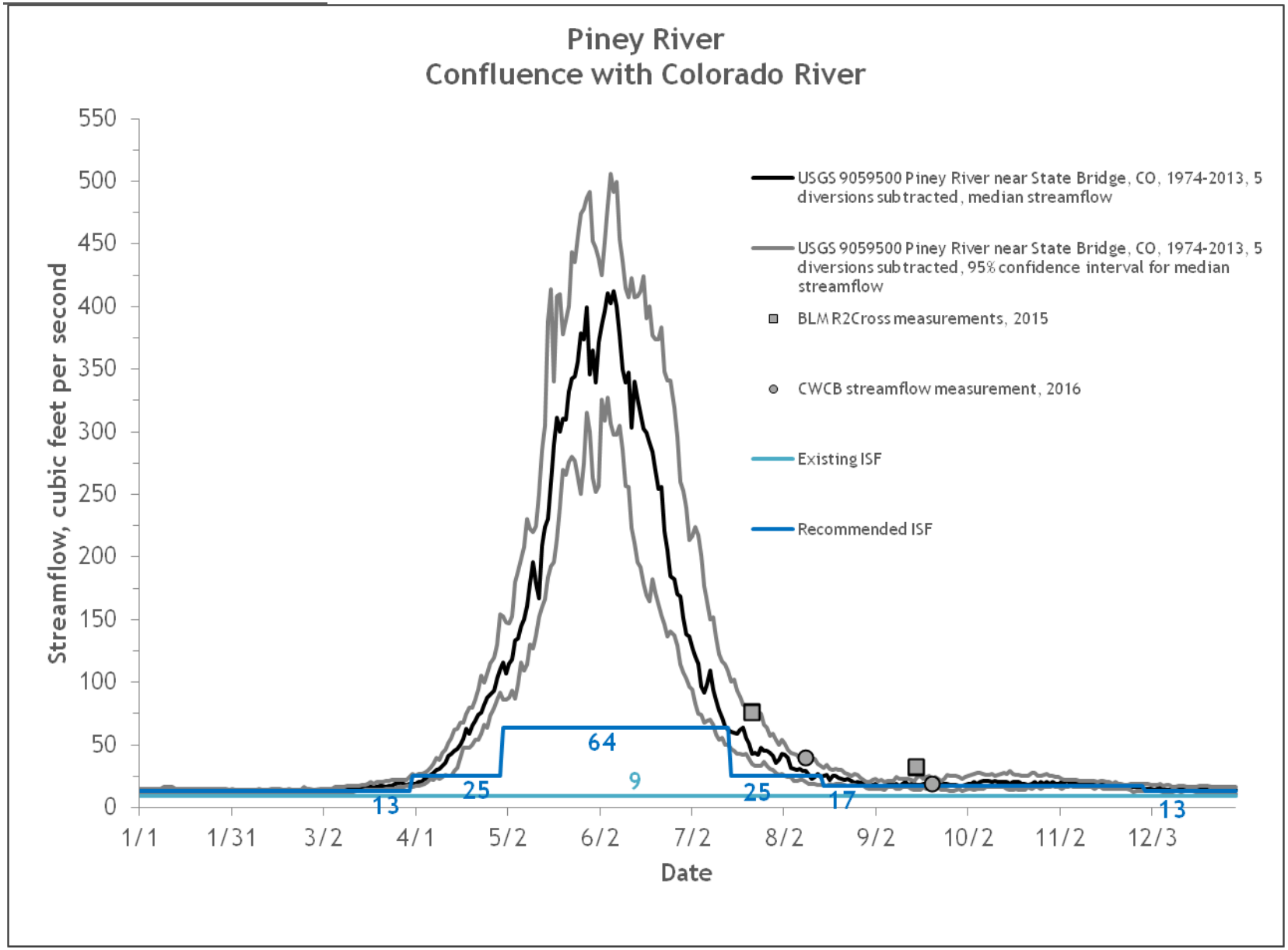
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH