COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Vallecito Creek
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Weminuche Wilderness Area Boundary at UTM North: 4150869.72 UTM East: 275046.50
LOWER TERMINUS:	U.S. Forest Service Property Boundary at UTM North: 4150223.84 UTM East: 274708.66
WATER DIVISION:	7
WATER DISTRICT:	31
COUNTY:	La Plata
WATERSHED:	Upper San Juan
CWCB ID:	17/7/A-005
RECOMMENDER:	U.S. Forest Service (USFS)
LENGTH:	0.51 miles
FLOW RECOMMENDATION:	20 cfs (01/01 - 03/15) 33 cfs (03/16 - 04/15) 92 cfs (04/16 - 08/31) 70 cfs (09/01 - 10/31) 45 cfs (11/01 - 11/15) 31 cfs (11/16 - 12/14) 25 cfs (12/15 - 12/31)

Vallecito Creek

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 USFS recommended that the CWCB appropriate an ISF water right on a reach of Vallecito Creek. Vallecito Creek originates in the Weminuche Wilderness Area at an elevation of approximately 12,640 feet. It flows in a southerly direction as it drops to an elevation of approximately 7,665 feet where it terminates at Vallecito Reservoir. The proposed reach flows through La Plata County from the Weminuche Wilderness Area boundary downstream to the USFS Property boundary. One hundred percent of the land on the 0.51 mile proposed reach is owned and managed by the USFS (See Land Ownership Map). The USFS recommended this reach of Vallecito Creek 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 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 natural environment of lower Vallecito Creek consists of resident self-sustaining populations of rainbow trout, brown trout, brook trout, and hybridized cutthroat trout. The fishery within this reach is an important part of the aquatic ecosystem of Vallecito Creek and is heavily used for recreational fishing. Vallecito Creek is one of several streams that flows into Vallecito Reservoir; all of these streams serve as important spawning habitat for the resident fishery in this reservoir. The natural environment also consists of various aquatic macroinvertebrates, water-dependent wildlife habitat, and healthy riparian vegetation.

Vallecito Creek is a cold-water, moderate-to-high gradient mountain stream. The recommended reach is located in a moderately confined channel with medium to large-sized substrate including many large boulders and some bedrock outcrops. In general, stream condition is good to excellent. Aquatic habitat is comprised of a good mix of riffles, pools, and runs. The riparian corridor has variable width and diversity throughout the reach and is dominated by mixed conifer forest with scattered narrow leaf cottonwood and aspen. The primary understory species are red-osier dogwood and willow.

Fishery surveys were conducted by Colorado Division of Wildlife in 1977, and 1995, respectively. These samples documented self-sustaining populations of rainbow trout *(Oncorhynchus mykiss)*, brown trout *(Salmo truta)*, brook trout *(Salve linus fontinalis)*, and hybridized cutthroat trout *(Oncorhynchus clarki spp.)*.

Table 1. List of species identified in Vallecito Creek.

Species Name	*Scientific Name*	*Status*
brown trout	*Salmo trutta*	*None*
brook trout	*Salvelinus fontinalis*	*None*
rainbow trout	*Oncorhynchus mykiss*	*None*
Colorado River cutthroat trout	*Oncorhynchus clarkii pleuriticus*	*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

USFS 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). USFS 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 using the Manning's n subroutine 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. However, the R2Cross model also contains the Thorne and Zevenbergen subroutine which uses field measured bed material grain size to estimate velocity. This method is not constrained by the accuracy range of the Manning's n subroutine.

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 three 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 39.5 cfs, which meets 2 of 3 criteria, and a summer flow of 91.8 cfs, which meets 3 of 3 criteria.

Table 2. Summary of R2Cross transect measurements and results for Vallecito Creek.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
USFS	08/25/2016 # 1	83.54	33.42 - 208.85	20.9 *	21.6 *
USFS	08/29/2016 # 2	125.83	50.33 - 314.58	76.6 *	225.6
USFS	09/20/2016 # 3	49.49	19.80 - 123.73	21.0 *	28.3 *
			Mean	**39.5**	**91.8**

**Results calculated using the R2Cross Thorne-Zevenbergen subroutine.*

ISF Recommendation
The USFS recommends the following flows based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis: 20 cfs (01/01 - 03/15), 33 cfs (03/16 - 04/15), 92 cfs (04/16 - 08/31), 70 cfs (09/01 - 10/31), 45 cfs (11/01 - 11/15), 31 cfs (11/16 - 12/14), and 25 cfs(12/15 - 12/31).

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 Vallecito Creek is 80.6 square miles, with an average elevation of 11,300 ft and average annual precipitation of 39.23 inches (Hydrologic Features Map). There are 16 existing natural lake level water rights in the drainage basin tributary to the proposed lower terminus. There are also two small water rights in the drainage basin tributary to the lower terminus. These include a surface water diversion, listed as a pump, that operates six months a year for household use (WDID 3100634 Norwood Residence P&PL, appropriation date 1956, 0.033 cfs). The second structure is a small well (WDID 3105114, appropriation date 1980, 0.022 cfs). Due to the small size of these diversions relative to the creek, hydrology in this drainage basin represents natural conditions.

Available Data
There is a current streamflow gage on Vallecito Creek approximately 3 miles upstream from Vallecito Reservoir, the Vallecito Creek near Bayfield, CO gage (USGS 09352900). The approved gage record as of 2/22/2017 was 10/1/1962 to 10/13/2016. The drainage basin of this gage is 72.6 square miles, with an average elevation of 11,400 ft and average annual precipitation of 39.54 inches. There are no diversions in the drainage basin tributary to the gage.

Data Analysis
The USGS Vallecito Creek gage data was analyzed from 1/1/1962 to 10/31/2016 based on approved data available through HydroBase on 2/22/2017. The gage was not scaled up to account for the 10% difference in drainage basin size between the gage and the proposed lower terminus. The small diversions near the lower terminus (0.055 cfs total) are unlikely to affect water availability. Median streamflow and 95% confidence intervals for median streamflow were calculated.

Water Availability Summary
The hydrographs (See Complete and Detailed Hydrographs) show median streamflow estimated at the proposed lower terminus of Vallecito Creek. The proposed ISF is below the median streamflow estimate at most times and below the 95% confidence interval for the median at all times. Staff concludes that water is available for appropriation on Vallecito Creek.

Material Injury
Because the proposed ISF on Vallecito Creek 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.

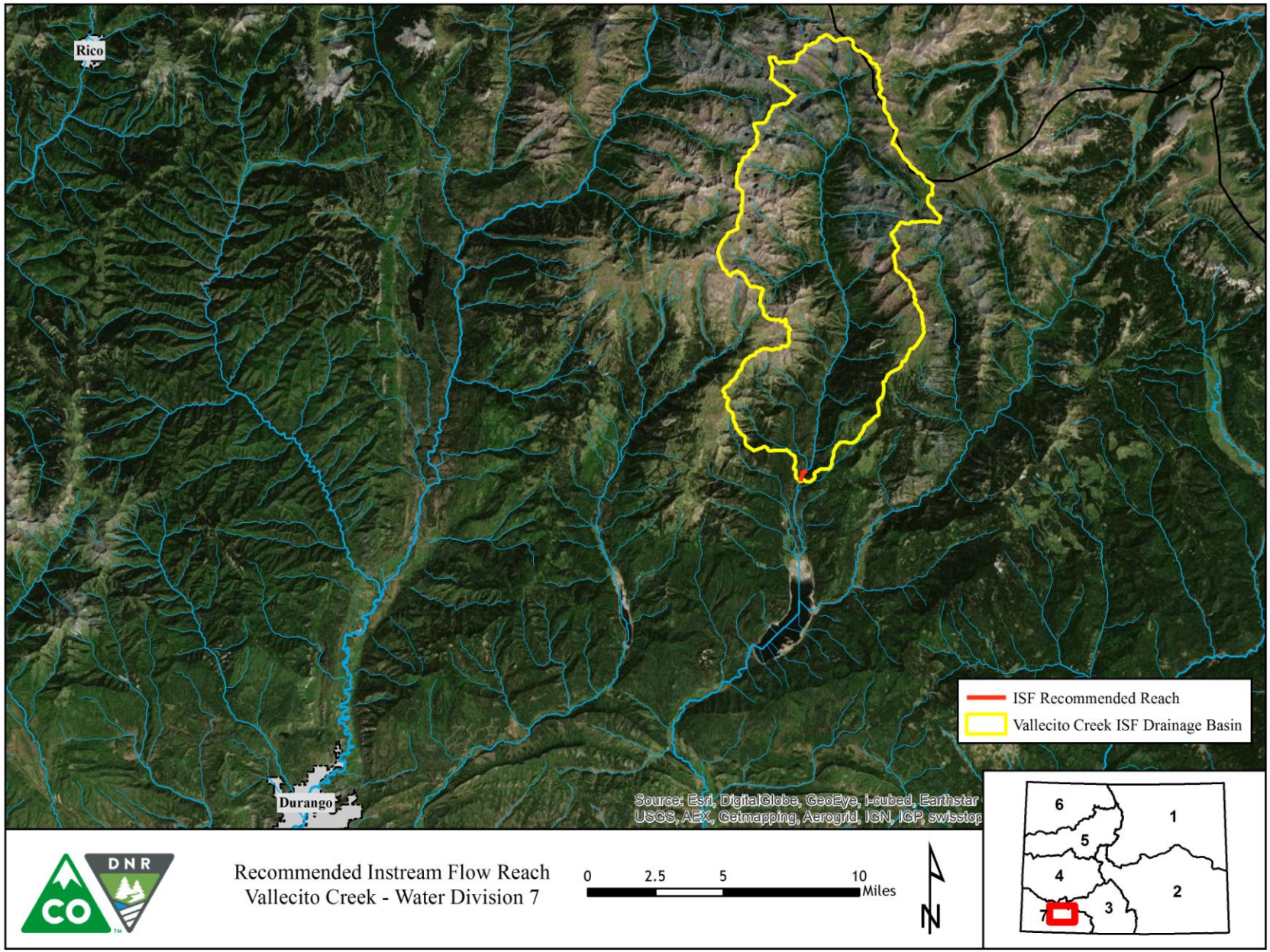
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

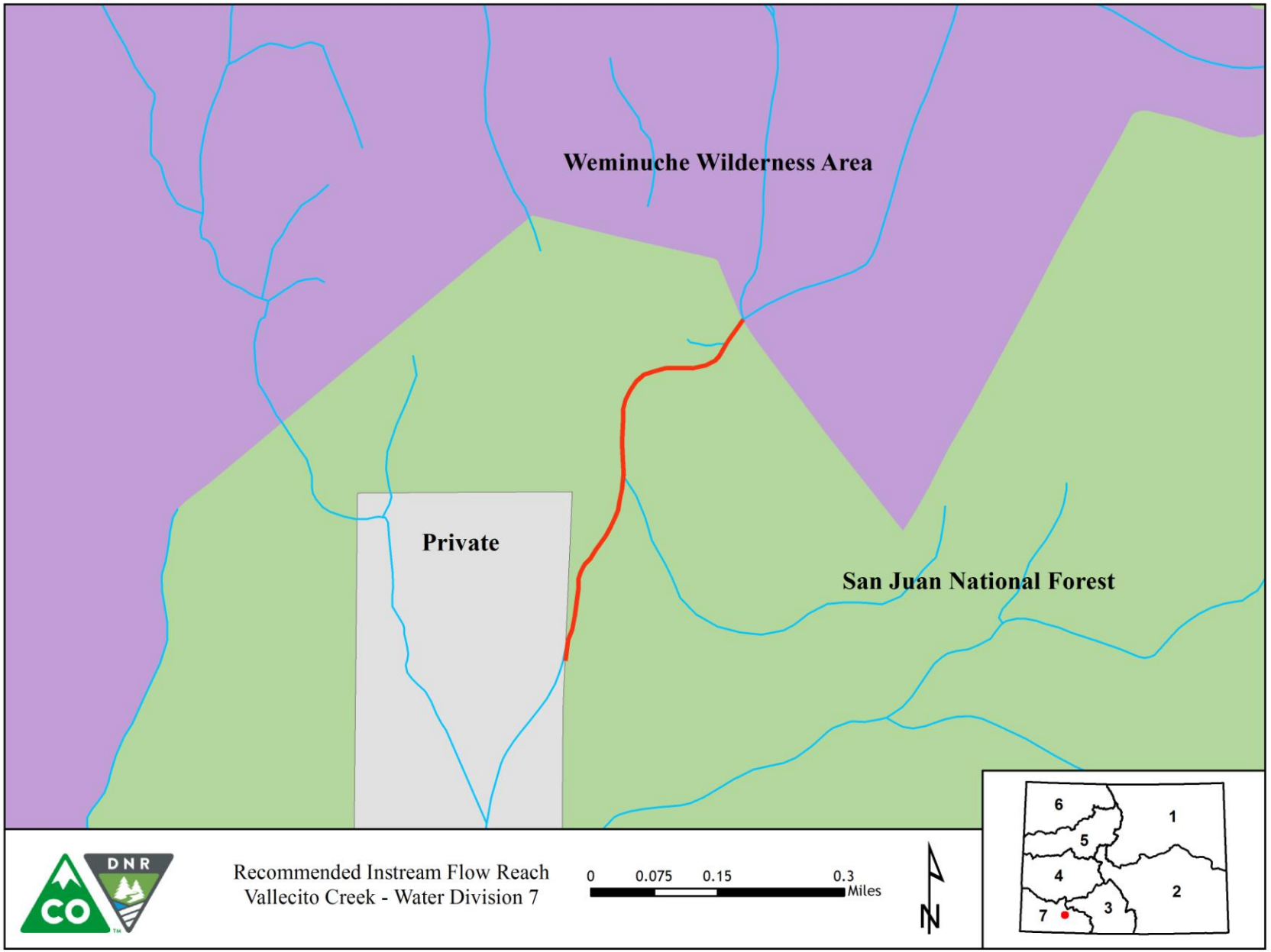
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

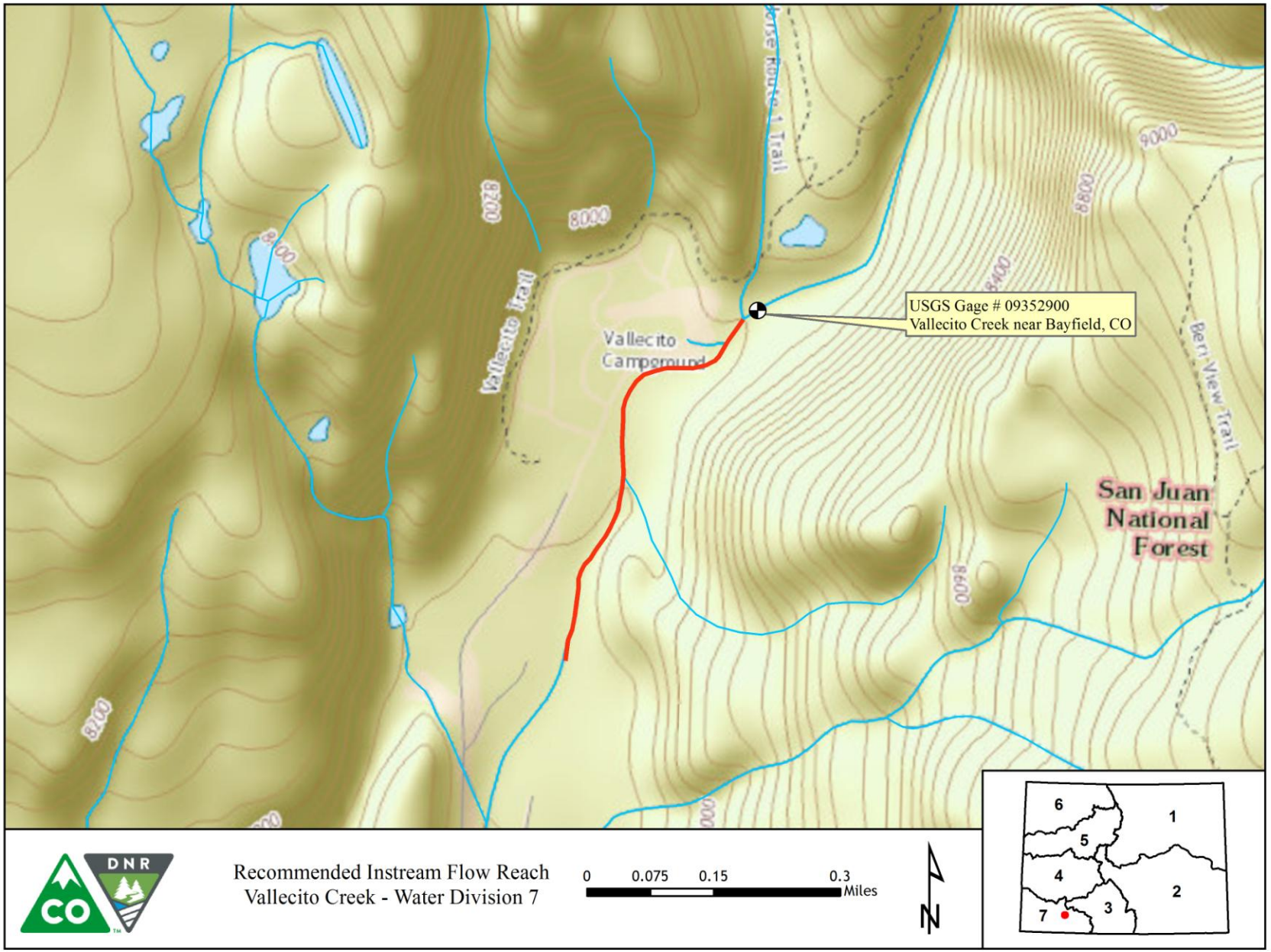
VICINITY MAP



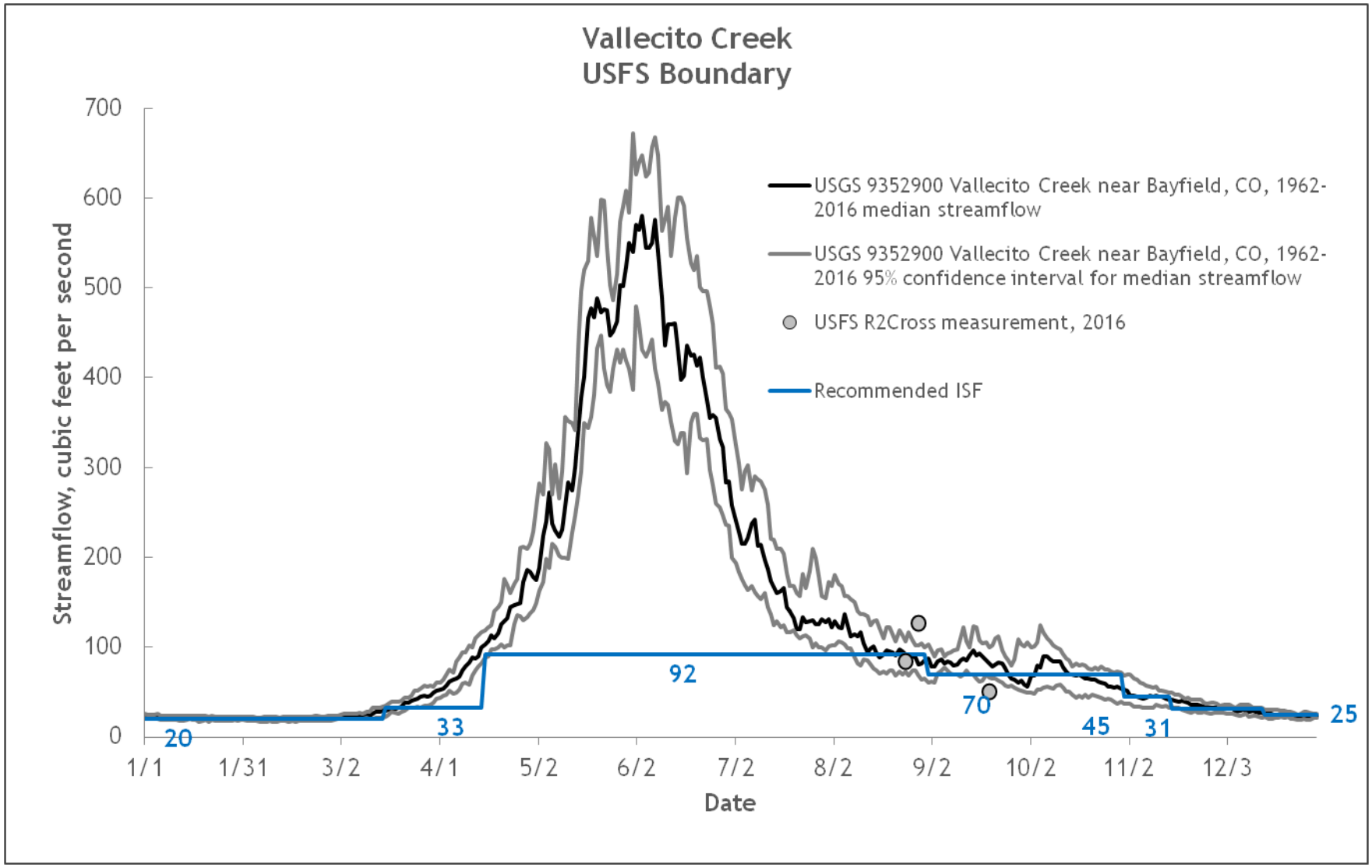
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH