COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Alkali Creek
Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Headwaters in the Vicinity of UTM North: 4309953.35	UTM East: 225994.21
LOWER TERMINUS:	Lone Starr Ditch headgate at UTM North: 4303235.60	UTM East: 226093.25
WATER DIVISION:	4	
WATER DISTRICT:	40	
COUNTY:	Delta	
WATERSHED:	Lower Gunnison (HUC#: 14020005)	
CWCB ID:	15/4/A-001	
RECOMMENDER	Bureau of Land Management	
LENGTH:	5.10 miles	
FLOW RECOMMENDATION:	2.0 cfs (5/16 – 7/31) 1.5 cfs (8/1 – 8/31) 0.8 cfs (9/1 – 10/31) 0.3 cfs (11/1 – 5/15)	

ALKALI 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. 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 Bureau of Land Management (BLM) recommended that the CWCB appropriate an ISF water right on a reach of Alkali Creek. Alkali Creek is located within Delta County about 5 miles northwest of the town of Delta (See Vicinity Map). Alkali Creek originates off the Grand Mesa at an elevation of 9,600 feet and flows in a southerly direction as it drops to an elevation of 4,830 feet where it joins the Gunnison River. The proposed reach extends from the headwaters downstream to the Lone Starr Ditch headgate. One-hundred percent of the land on the 5.10 mile proposed reach is publicly owned and managed by the U.S. Forest Service and the BLM (See Land Ownership Map). The BLM recommended this reach of Alkali 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/2015ProposedISFAppropriations.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.

Alkali Creek is a cold-water, high gradient stream in a narrow canyon. The stream is confined by bedrock in many locations. The stream generally has small to moderate sized substrate, consisting of sands, gravels, and cobbles. Pool habitat is abundant because of the step-pool nature of the stream morphology, but riffle habitat is limited.

Fisheries surveys have revealed a self-sustaining population of native cutthroat trout, possibly of high genetic quality. The BLM has taken fin samples from the fish population and is awaiting genetic analysis results. Table 1 shows a list of species identified in this stream. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, caddisfly, and stonefly.

The riparian community along Alkali Creek at higher elevations is comprised of red osier dogwood, equisetum, currant, and sedges/rushes. At lower elevations, the riparian community is comprised of willow, alder, and narrowleaf cottonwood. The riparian community along the creek is narrow in width because of the steep gradient and canyon walls, and limited alluvial soils. Some portions of the lower riparian area are recovering from historic grazing practices. The robust riparian community creates good cover and shading for fish habitat purposes.

Table 1. List of species identified in Alkali Creek.

Species Name	Scientific Name	Status
native cutthroat trout	*Oncorhynchus clarkii**	State Species of Special Concern BLM Sensitive Species

**Identification of subspecies / lineage of native cutthroat trout in Colorado is ongoing through genetic testing and research.*

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 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 summer flow of 1.95 cfs, which meets 3 of 3 criteria and is within the accuracy range of the R2Cross model. The R2Cross model results in a winter flow of 0.79 cfs, which meets 2 of 3 criteria and is within the accuracy range of the R2Cross model.

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

Entity	Date Measured	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	5/16/2013	3.22	1.3 – 8.1	Out of Range	1.30
BLM	5/16/2013	3.68	1.5 – 9.2	Out of Range	2.55
BLM	8/15/2013	0.95	0.4 – 2.4	0.75	Out of Range
BLM	8/15/2013	0.83	0.3 – 2.1	0.82	2.00
			Mean	**0.79**	**1.95**

ISF Recommendation

The BLM recommends flows of 2.0 cfs (5/16 – 7/31), 1.5 cfs (8/1 – 8/31), 0.8 cfs (9/1 – 10/31) and 0.3 cfs (11/1 – 5/15), based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

2.0 cfs is recommended for the snowmelt runoff and early summer period from May 16 through July 31. This recommendation is driven by the average velocity criteria. This creek experiences consistently low flows during late summer and fall, so it is important to protect as much physical habitat as possible during the limited time when snowmelt runoff and growing season flows are available. This flow rate is capable of maintaining pool habitat in the creek and preventing excessively water high temperatures.

1.5 cfs is recommended from August 1 through August 31. This recommendation is driven by more limited water availability during August. This flow rate will meet the average depth and wetted perimeter criteria while providing between 0.8 and 0.9 feet per second average velocity in most of the surveyed stream channel locations.

0.8 cfs is recommended for the late summer and fall period from September 1 to October 31. This recommendation is driven by the average depth and wetted perimeter criteria. This flow rate should provide sufficient flow to prevent pools from freezing and protect overwintering fish.

0.3 cfs is recommended for the low base flow period that extends from November 1 to May 15. This recommendation is driven by naturally limited water availability. This flow comes very close to meeting the 50% wetted perimeter criteria, provides an average depth of 0.15 feet, and should prevent icing in pools where fish are overwintering.

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 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.

Basin Characteristics

The proposed ISF reach of Alkali Creek has a 2.6 square mile drainage basin. The average elevation of the basin is 8,600 ft and the average annual precipitation is 23.9 inches. The drainage basin tributary to the lower terminus does not have any surface water diversions. The majority of the channels that drain the southern side of the Point Peninsula on Grand Mesa have sparse riparian vegetation and appear to be intermittent. Unlike those channels, Alkali Creek has substantially more riparian vegetation and the upper portions of the creek are shown as perennial on USGS topographic maps. A significant amount of streamflow on Alkali Creek appears to come from a spring located fairly high in the basin. This spring was described by an employee of Whiting Farms (located downstream) as "shooting out like a fire hydrant" from beneath the Grand Mesa's basalt dome.

Available Data

There are no known stream gages on or near Alkali Creek. The Alkali Ditch (appropriation date 1882, 1 cfs) appears to be the primary diversion structure in the area with diversion records. The headgate for Alkali Ditch is located approximately 2.3 miles below the proposed lower terminus. This location may receive additional streamflow from a tributary drainage to the north of Alkali Creek. However, the contributions from that tributary are believed to be small compared to Alkali Creek.

Steve Tuck is the Lead Water Commissioner in District 40. Mr Tuck confirmed that several water rights divert through the Alkali Ditch headgate, including the Lone Starr Ditch (appropriation date 1908, 6.5 cfs) and the Lone Starr Ditch No. 2 (appropriation date 1907, 5 cfs). According to Mr. Tuck, the Alkali Ditch diverts the entire stream year round. He estimated that winter streamflow on Alkali Creek is less than 0.5 cfs; however, he noted that he rarely observes the creek during winter months. In fact, the diversion records appear to only be maintained during the irrigation season; therefore, the record is not a perfect measure of streamflow.

BLM and U.S. Forest Service personnel collected two spot measurements in 2014.

Data Analysis

There are fairly consistent diversion records during the irrigation season for Alkali Ditch from 1969 to 2013, based on the data available through Hydrobase on 11/26/2014. The entire diversion record was used to calculate both the median diversion and 95% confidence intervals for the median diversion.

Water Availability Summary

The hydrograph (Figure 1 and Figure 2) shows the median diversion and the 95% confidence interval for the median diversion based on the Alkali Ditch diversion record. Mean-monthly streamflow

estimates from StreamStats are also included to provide information during the non-irrigation season. StreamStats may underestimate streamflow in the winter because it is based on data from primarily snow-melt streams rather than spring-fed streams. However, the spot measurement made in December of 0.32 cfs is very similar to the StreamStats estimate of 0.38 cfs for December. The proposed ISF is less than the median diversion during the irrigation season and less than the StreamStats model results during the remainder of the year. Staff has concluded that water is available for appropriation.

Material Injury

Because the proposed ISF on Alkali 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. (2014), 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.

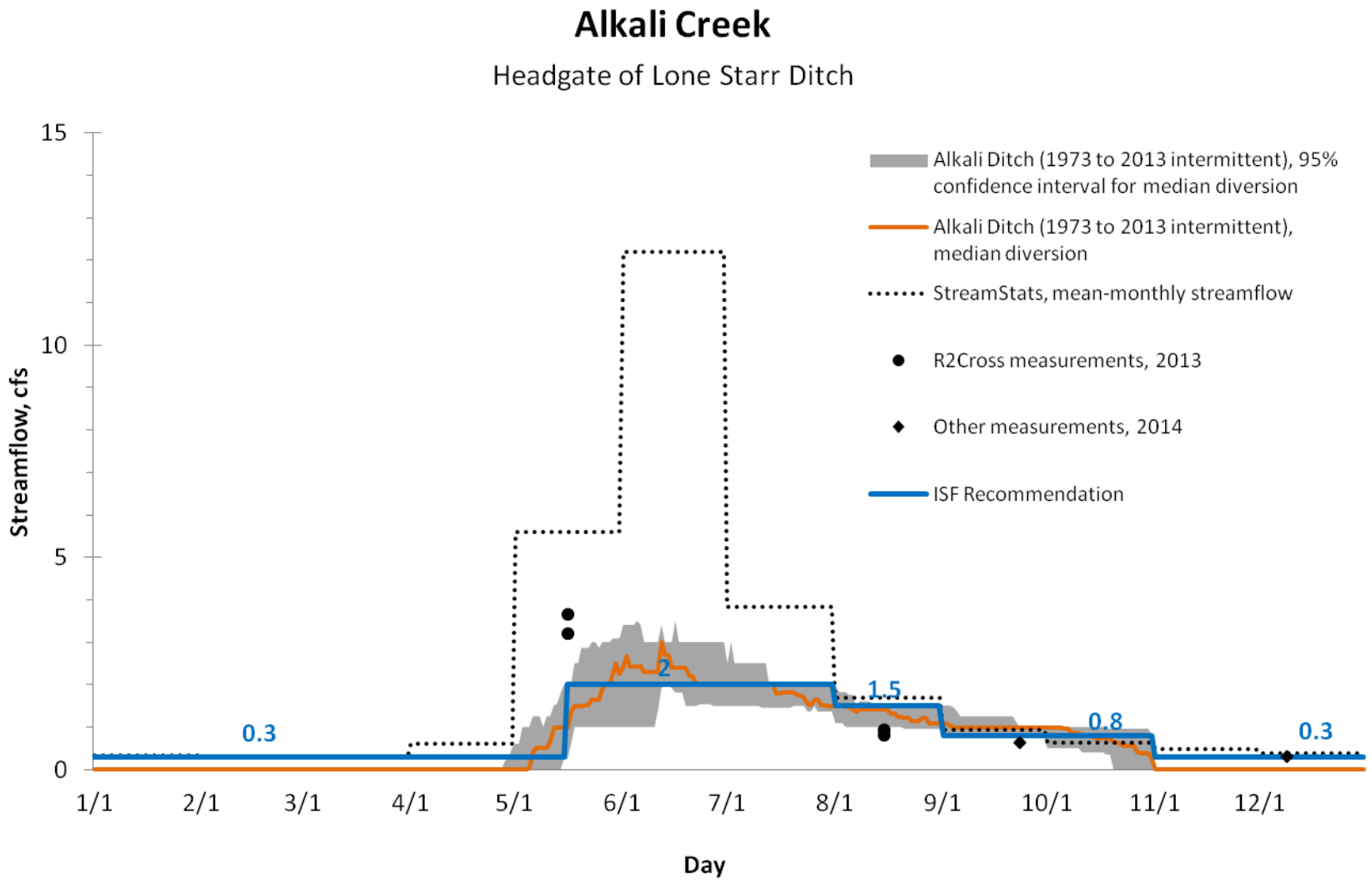


Figure 1. Complete hydrograph showing streamflow data, diversion record data, and the proposed ISF rate on Alkali Creek.

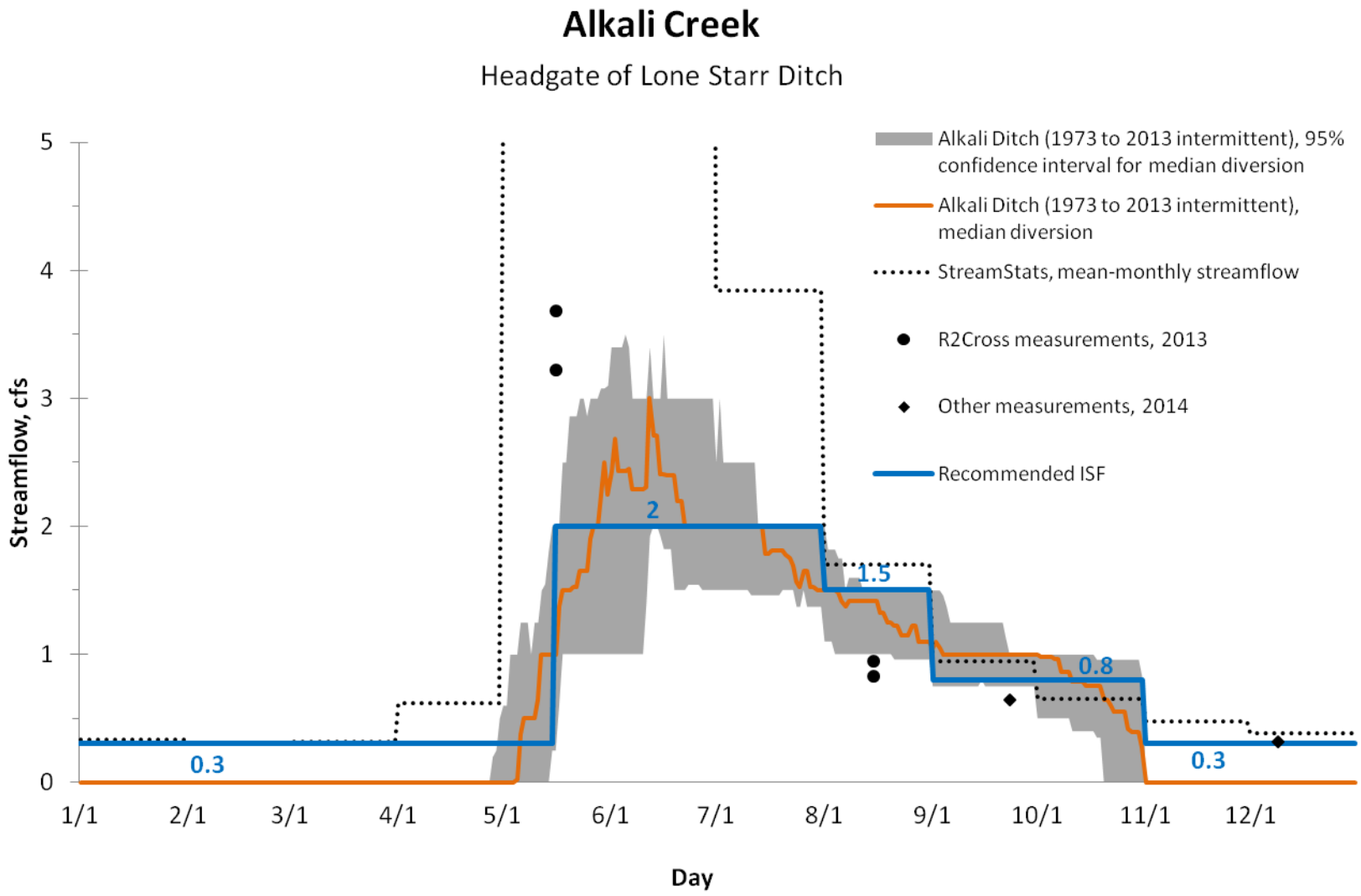
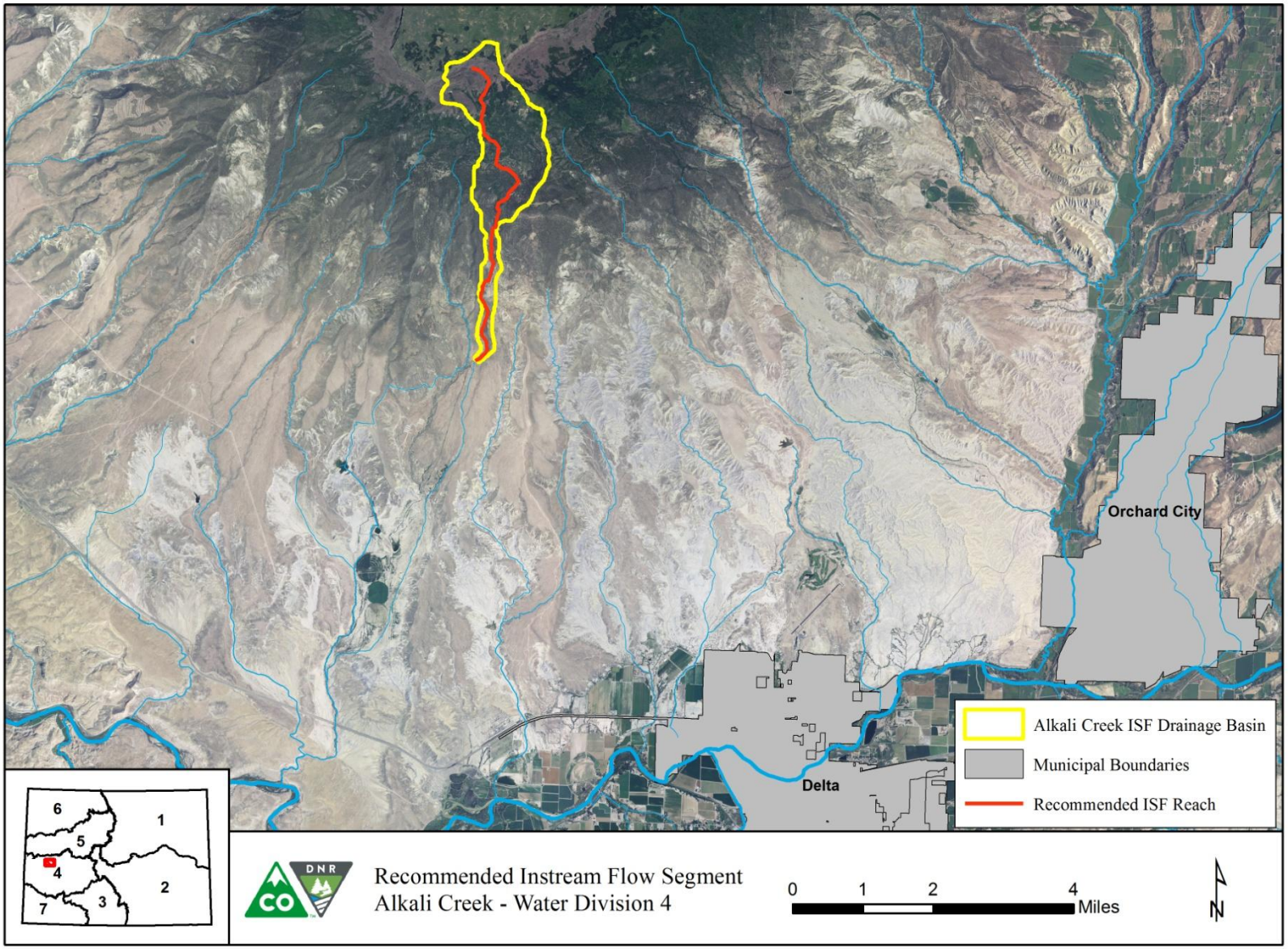
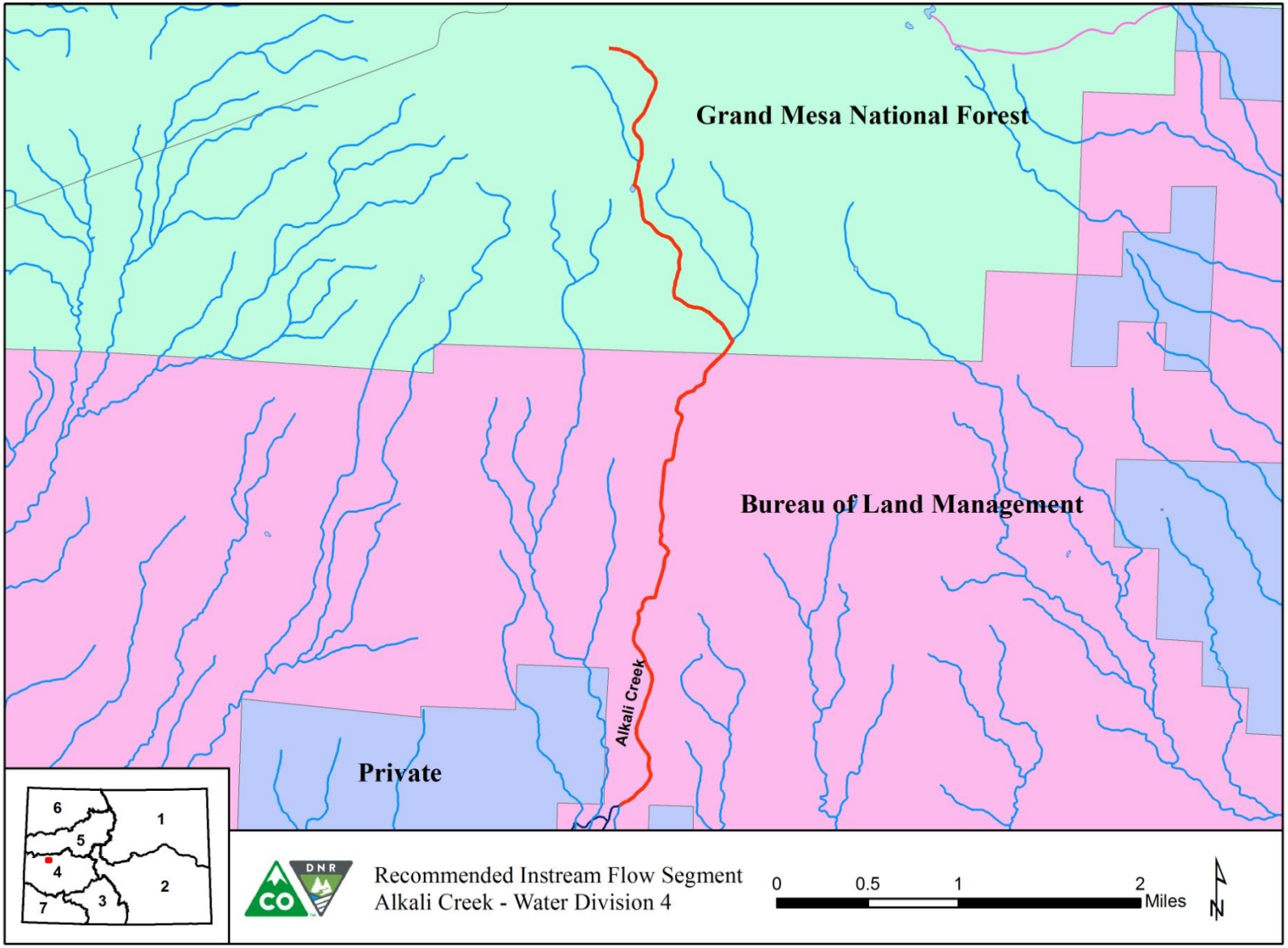


Figure 2. Detailed hydrograph showing streamflow data, diversion record data, and the proposed ISF rate on Alkali Creek.

Vicinity Map



Land Use Map


Grand Mesa National Forest
Bureau of Land Management
Private
Alkali Creek
6
1
5
4
2
7
3
DNR
CO
Recommended Instream Flow Segment
Alkali Creek - Water Division 4
0
0.5
1
2
Miles
N

Water Rights Map