COLORADO
Colorado Water Conservation Board
Department of Natural Resources

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Turkey Creek
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Confluence with East Fork and West Fork Turkey Creek UTM North: 4277192.32 UTM East: 505655.50
LOWER TERMINUS:	Confluence with unnamed tributary UTM North: 4274992.02 UTM East: 506998.62
WATER DIVISION:	2
WATER DISTRICT:	10
COUNTY:	El Paso
WATERSHED:	Upper Arkansas (HUC: 11020002)
CWCB ID:	16/2/A-001
RECOMMENDER	Bureau of Land Management
LENGTH:	2.38 miles
FLOW RECOMMENDATION:	3.7 cfs (5/1-8/31) 1.8 cfs (9/1-11/30) 1.0 cfs (12/1-3/31) 2.7 cfs (4/1-4/30)

Turkey 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 Bureau of Land Management (BLM) recommended that the CWCB appropriate an ISF water right on a reach of Turkey Creek. This reach is located within El Paso County about 9 miles southwest of the city of Colorado Springs (See Vicinity Map). Turkey Creek is formed at the confluence of East Fork and West Fork Turkey Creeks at an elevation of 7,400 feet. The creek flows in a southeasterly direction as it drops to an elevation of 4,840 feet where it flows into Pueblo Reservoir. The proposed reach extends from the confluence with East Fork and West Fork Turkey Creeks downstream to an unnamed tributary. Eighteen percent of the land on the 3.45 mile proposed reach is publicly owned and managed by the BLM (See Land Ownership Map). The BLM recommended this reach of Turkey 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/2016ProposedISFRecommendations.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.

Turkey Creek is a cold-water, high gradient stream that flows through a narrow canyon. The stream is confined by bedrock in most locations. The stream generally has large-sized substrate, consisting of cobbles and small boulders. The stream has a good mix of pools, small riffles and runs.

Fisheries surveys have revealed a self-sustaining population of brook trout. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, caddisfly and stonefly.

The riparian community is generally comprised of cottonwood, various willow species and alder. The riparian community is in very good condition, and provides abundant shading and cover for fish habitat.

Table 1. List of fish species identified in Turkey Creek.

Species Name	Scientific Name	Status
brook trout	*Salvelinus fontinalis*	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 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 summer flow of 3.7 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 1.0 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 Turkey Creek.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	5/27/2014	2.11	0.84 – 5.28	0.93	3.72
BLM	5/27/2014	2.05	0.82 – 5.13	1.10	out of range
			Mean	**1.0**	**3.7**

ISF Recommendation

The BLM recommends flows of 3.7 cfs (5/1 – 8/31), 1.8 cfs (9/1 - 11/30), 1.0 cfs (12/1 - 3/31), and 3.0 cfs (4/1 – 4/30) based on R2Cross modeling analyses and biological expertise. However, the ISF rate for the month of April was reduced to 2.7 cfs based on staff's water availability analysis

3.7 cubic feet per second is recommended during the warm weather period from May 1 to August 31. This recommendation is driven by the average velocity criteria. This creek is steep and has limited physical habitat, so it is important to protect a flow rate that provides usable habitat in riffles when fish are completing critical life history functions during the warm weather months.

1.8 cubic feet per second is recommended during the fall period, from September 1 to November 30. This recommendation is driven by limited water availability. This flow rates significantly exceeds the average depth and wetted perimeter criteria, and provides an average velocity of approximately 0.8 feet per second.

1.00 cfs is recommended during the winter period from December 1 through March 31. This flow rate should prevent pools from freezing, allowing the fish population to successfully overwinter. Even though the base flow in this creek is small, it is extremely consistent, allowing the fishery to persist.

2.7 cfs is recommended during the early portion of the snowmelt runoff period, from the April 1 to April 30. This flow rate comes close to meeting all three instream flow criteria, but reflects the fact that snowmelt runoff is not yet sufficient during April to meet all three instream flow criteria.

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 Turkey Creek is 10.1 square miles, with an average elevation of 8,530 ft and average annual precipitation of 23.02 inches. No surface water rights with diversion records were identified in the drainage basin tributary to the proposed ISF reach. Due to the lack of surface water diversions, hydrology in this drainage basin represents natural flow conditions. See the Hydrologic Features Map.

Available Data
There was a historic streamflow gage and there currently is a seasonally operated gage on Turkey Creek downstream from the proposed ISF reach. These gages are located downstream from the Turkey Creek canyon on an alluvial fan. Because the gages are believed to be in a losing reach (personal communication with water commissioner Doug Hollister on 3/24/2015), the gage records are not suitable for use in the water availability analysis.

CWCB staff made two streamflow measurements on the proposed reach of Turkey Creek. These measurements are included in this water availability analysis.

Data Analysis
StreamStats provides the best available estimate of streamflow on Turkey Creek.

Water Availability Summary
The hydrographs (See Complete and Detailed Hydrographs) show StreamStats results for mean monthly streamflow for Turkey Creek. The proposed ISF rate is below the mean monthly streamflow at all times. Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on Turkey 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. (2015), 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.

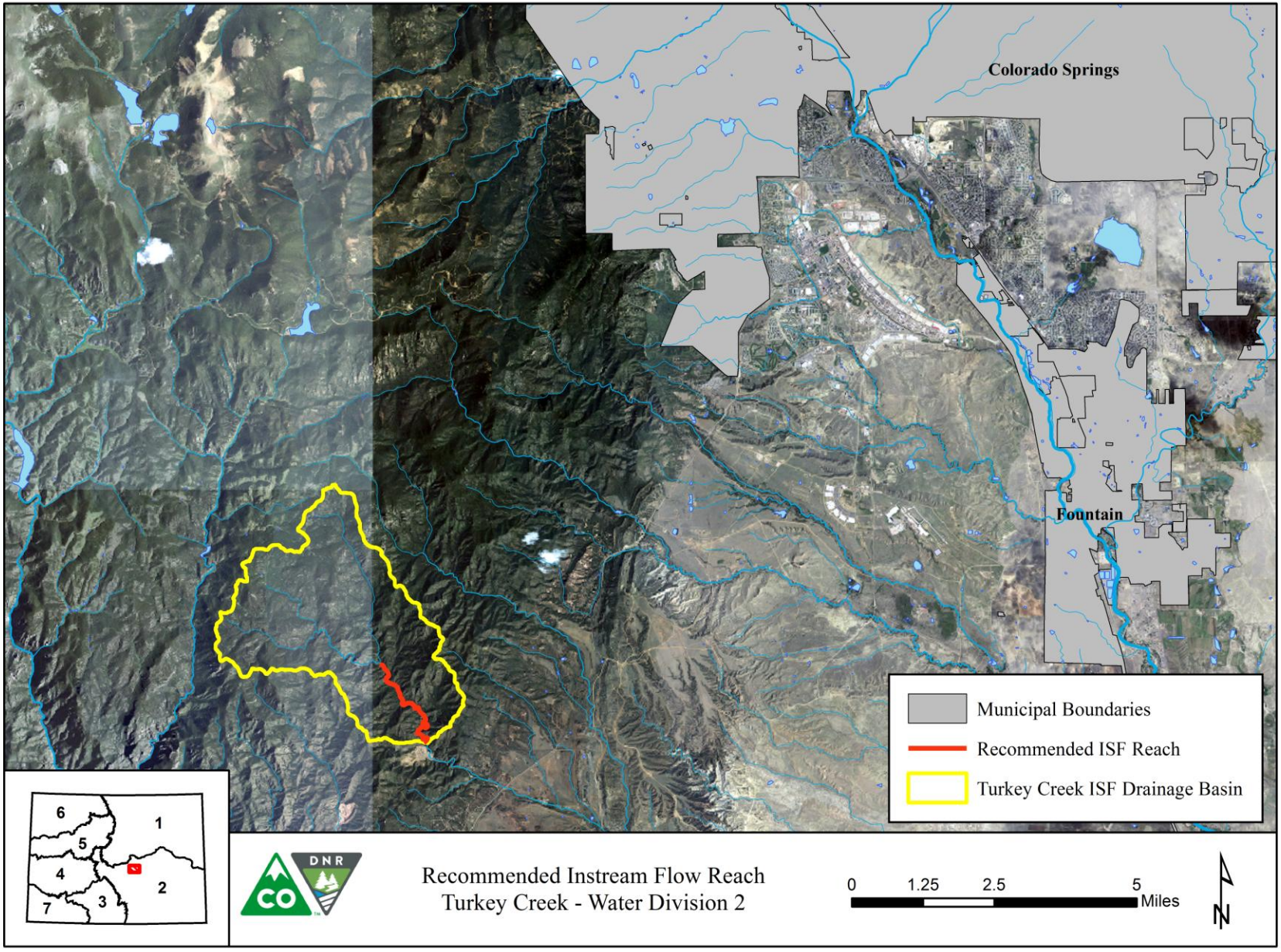
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

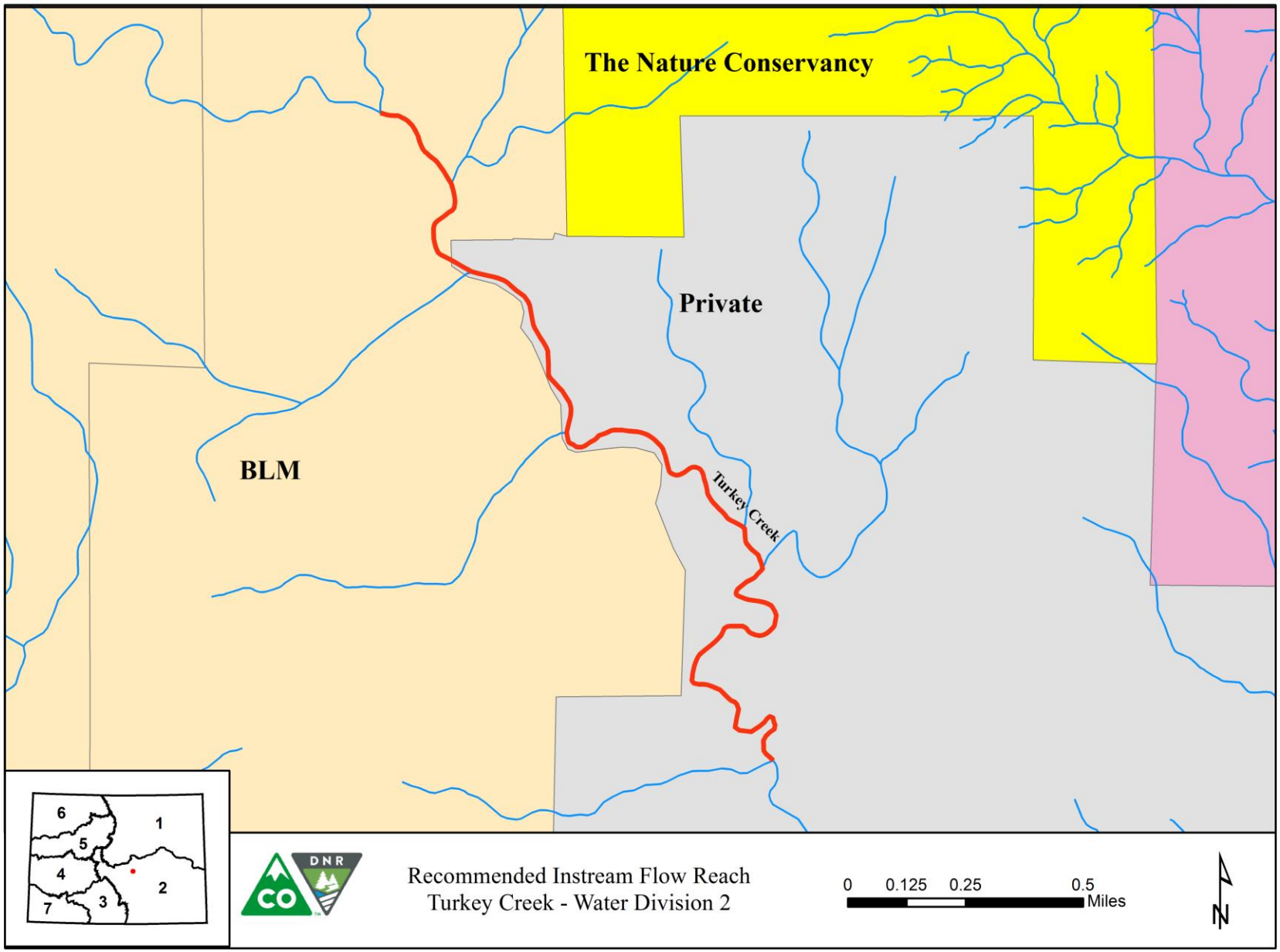
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

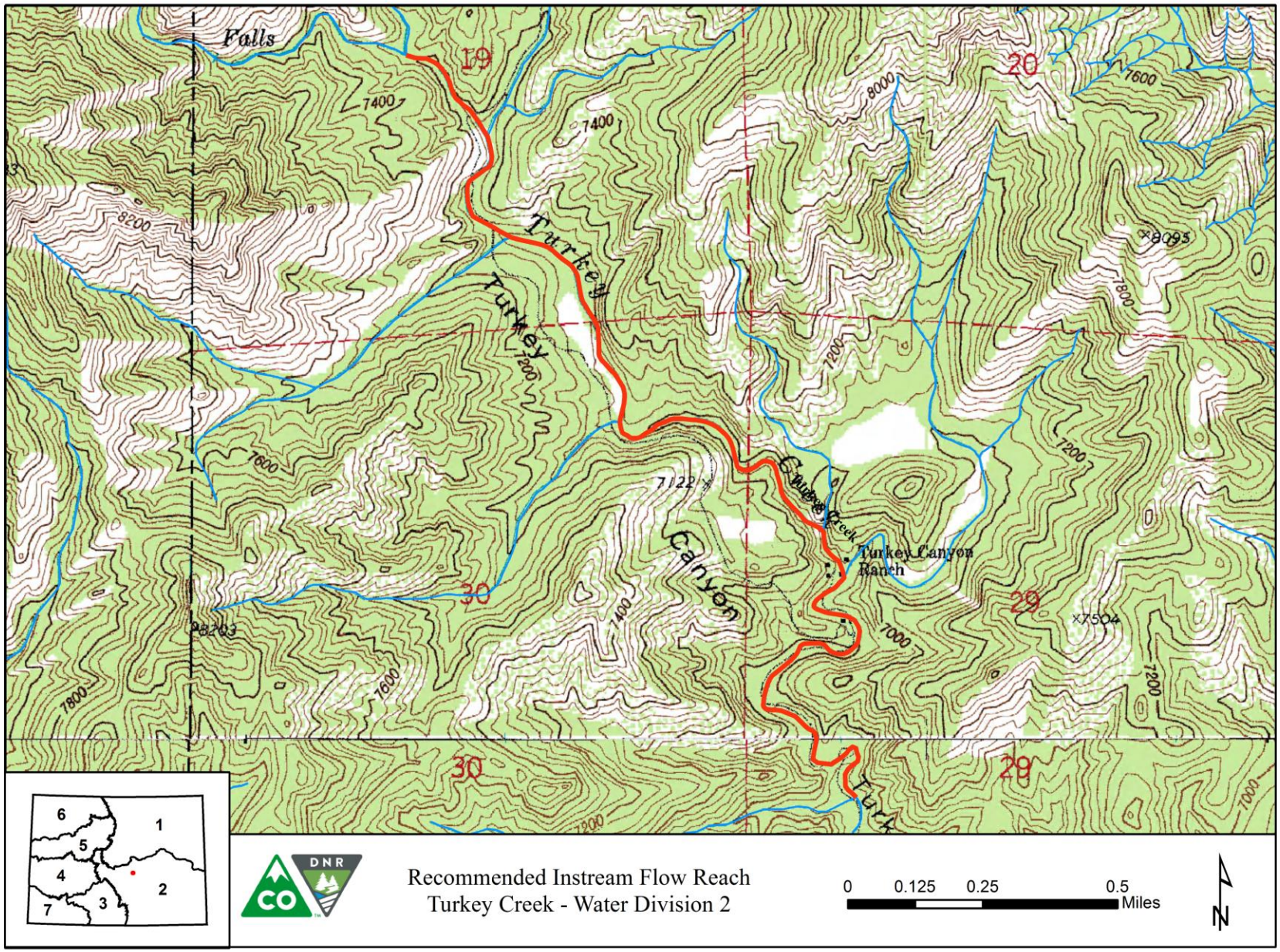
VICINITY MAP



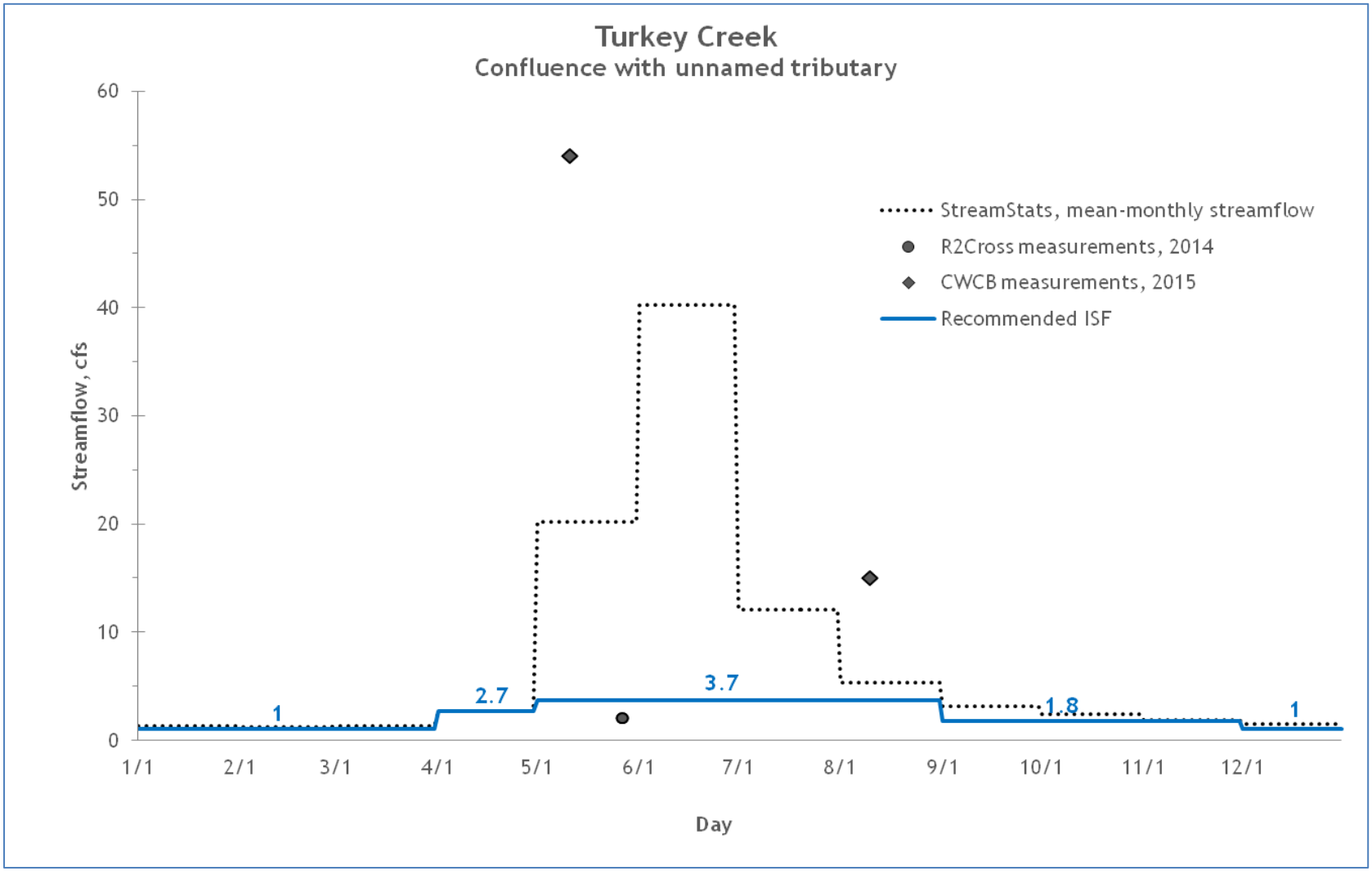
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH