



COLORADO

**Colorado Water
Conservation Board**

Department of Natural Resources

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Lone Tree Creek EXECUTIVE SUMMARY



CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS: Confluence Spotwood Creek
UTM North: 4536307.01 UTM East: 506761.06

LOWER TERMINUS: Meadow Springs Ranch Property Boundary
UTM North: 4534028.44 UTM East: 506135.59

WATER DIVISION: 1

WATER DISTRICT: 1

COUNTY: Weld County

WATERSHED: Lone Tree - Owl (HUC#: 10190008)

CWCB ID: 13/1/A-005

RECOMMENDER: City of Fort Collins & Colorado Parks and Wildlife

LENGTH: 2.17 miles

FLOW RECOMMENDATION: 0.3 cfs (1/1 - 12/31)



Lone Tree 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 City of Fort Collins and Colorado Parks and Wildlife (CPW) recommended that the CWCB appropriate an ISF water right on a reach of Lone Tree Creek. This reach is located within Weld County about 16.5 miles northeast of the town of Wellington (See Vicinity Map). Lone Tree Creek originates in Wyoming near the Town of Buford at an elevation of 8,400 ft. The creek flows in a southeasterly direction as it drops to an elevation of 4,600 feet where it joins the South Platte River. The proposed reach extends from the confluence with Spotwood Creek downstream to the Meadow Springs Ranch property boundary. One hundred percent of the land on the 2.17 mile proposed reach is privately owned (See Land Ownership Map). The City of Fort Collins and CPW recommended this reach of Lone Tree 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.

In May 2010, Colorado State University (Nate Cathcart, and William Stacy) performed a fish inventory of Lone Tree Creek. Six species of fish were captured in the electrofishing survey, including brook stickleback (*Culaea inconstans*), white sucker (*Catostomus commersonii*), fathead minnow (*Pimephales promelas*), creek chub (*Semotilus atromaculatus*), central stoneroller (*Camptostoma anomalum*), and Iowa darter (*Etheostoma exile*). The respective percentages of each species captured are: fathead minnow (59%), brook stickleback (25%), creek chub (10%), Iowa darter (3%), central stoneroller (2%), and white sucker (1%).

Further, Lone Tree Creek is being studied and investigated as a possible reintroduction site for northern redbelly dace and/or common shiner. Its stable hydrology and temperature regime and its relative isolation make it particularly suitable for active native fishery management activities. Lone Tree Creek also has a diverse community of macro-invertebrates and a productive riparian zone. Due to the relative rarity of water features such as this on the high prairie, it is reasonable to assume that this stream is important to both terrestrial wildlife and avian species.

Table 1. List of fish species identified in Lone Tree Creek.

Species Name	Scientific Name	Status
brook stickleback	<i>Culaea inconstans</i>	None
white sucker	<i>Catostomus commersonii</i>	None
fathead minnow	<i>Pimephales promela</i>	None
creek chub	<i>Semotilus atromaculatus</i>	None
central stoneroller	<i>Campostoma anomalum</i>	None
iowa darter	<i>Etheostoma exile</i>	State Species of Special Concern

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 one transect for this proposed ISF reach (Table 2). The R2Cross model results in a winter flow of 0.30 cfs, which meets 2 of 3 criteria and is within the accuracy range of the R2Cross model. The summer flow was out of the accuracy range of the model.

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

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
CPW	6/11/2014 - 1	0.21	0.1 - 0.5	0.30	Out of range

ISF Recommendation

CPW recommends flows of 0.3 cfs (1/1 - 12/31) based on R2Cross modeling analyses, biological expertise and staff's water availability analysis. This flow rate meets the criteria for wetted perimeter and average depth in the R2Cross model.

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 hydrology estimate 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 Lone Tree Creek is 134 square miles, with an average elevation of 7,040 ft and average annual precipitation of 17.10 inches. There are two known surface water diversions within the proposed ISF reach. These include the Mantey Ditch 1 (appropriation date

1882, 26 cfs) and the Mantey Ditch 2 (appropriation date 1882, 10 cfs). These structures are listed as active, but there are no daily diversion records available. Approximately 127.5 square miles or 95% of the drainage basin for the proposed reach is located in Wyoming. There are approximately 32 reservoirs with a total of 5,866 AF in storage capacity and approximately 124 surface water rights with diversion rates between zero and 100 cfs (many of these water rights do not state a diversion rate in the Wyoming e-permit database) in the Wyoming portion of the drainage. Based on discussions with DWR and the Wyoming State Engineer's office, there are no known transbasin imports or exports. Hydrology in this drainage basin represents altered flow conditions. See the Hydrologic Features Map for more information.

Available Data

There are no current or historic streamflow gages in the proposed ISF reach. There was a historic gage operated downstream (USGS 06753400 Lone Tree Creek at Carr, CO, 4/1/1993 to 9/30/1995), located approximately 5.1 miles southeast from the proposed lower terminus. The Lone Tree gage is located in a 169 square mile drainage basin, with an average basin elevation of 6,830 ft and average annual precipitation of 16.8 inches. In addition to the diversions located within the proposed reach, the gage may have been affected by intervening decreed diversions. These include two absolute rights that total 0.0138 cfs and two conditional water rights that total 115.77 cfs (the conditional rights have some diversion records that show limited use). None of the intervening diversion structures identified appear to have daily diversion records.

In some cases, diversion records can be used to provide an indication of water availability in a stream reach. The Mantley Ditch 1 has records of annual diversion totals in 1956, 1976, 1987, 1997, 2001, 2005, and 2010. Many years in the record contain the water commissioner comment, "No information available;" however, some years contain the comment, "Water taken, but no data available" (1996, 2001, and 2003). In addition, several years in the record contain the comment, "No water available" (2000, 2002, 2004, 2006, 2008, and 2011). This ditch is located approximately mid-way through the reach, upstream from measurements made by CWCB staff. The lack of daily diversion records limits the use of these diversions to estimate streamflow.

CWCB staff made substantial efforts to measure streamflow on Lone Tree Creek. Initially, staff installed a temporary gage consisting of a modified 3 inch Parshall flume and pressure transducer near the bottom third of the reach. This gage was active from 5/30/2012 to 6/8/2012, when a high flow event dislodged the flume. The temporary gage was reinstalled on 6/18/2012 and collected flow data until 7/7/2012, when another high flow event occurred. Unfortunately, a period of high flows in spring and early summer of 2015 precluded installation of a temporary gage that would accurately capture normal base flow conditions. Staff installed a staff plate and time-lapse camera that was used to estimate streamflow from 7/14/2015 to 8/17/2015. When flows receded, a temporary gage consisting of a 90 degree sharp crested v-notch weir and pressure transducer was installed 8/17/2015 and operated until 9/20/2015, when cows damaged the site. The weir was reset on 9/28/2015 and is still in place to date.

CWCB staff made 7 streamflow measurements on the proposed reach of Lone Tree Creek between 6/1/2014 and 10/26/2015. These measurements are included in the water availability analysis.

In addition, staff obtained anecdotal information from Daylan Figgs, the Natural Areas Senior Environmental Planner for the City of Fort Collins Natural Areas Department. According to Mr. Figgs, "Lone Tree Creek appears to have a consistent flow and recent measurements of streamflow verify this observation. Site visits to the Lone Tree over the last 5-7 years have revealed an active stream flow in each occasion and what appears to be a fairly consistent flow. Higher flows do occur during

the spring and in response to storm events. Further, I have not observed periods of no or extremely low flows.”

Data Analysis

Due to the short period of record available for the Lone Tree gage, Staff examined nearby climate stations to evaluate how representative the gage data may be. The nearest climate station with a long period of record is located in Cheyenne, Wyoming, roughly 14.5 miles north of the lower terminus (Cheyenne, USW00024018; accessed 12/7/2015). This station has nearly 100 years of precipitation records (1915 to 2015). The average annual precipitation at the Cheyenne station for years with complete records (1915 to 2014) is 15.24 inches. The climate station shows above average precipitation in 1993 and 1995 (18.96 and 20.11 inches respectively), but below average precipitation in 1994 (13.53 inches). Therefore, the Lone Tree gage represents a combination of above and below average precipitation conditions.

The Lone Tree Creek gage was analyzed using the period of record (1993 to 1995). The gage record was scaled by 0.80706 to the lower terminus using the area-precipitation method. Due to the short period of record, median streamflow and 95% confidence intervals for median streamflow were not calculated.

All CWCB staff-installed weir, staff plate, and flume data is shown on the hydrograph. In addition, spot measurements between 5/13/2015 and 7/14/2015 were interpolated to estimate streamflow during the spring and early summer.

Water Availability Summary

The hydrographs (See Complete and Detailed Hydrographs) show scaled streamflow data from the Lone Tree Creek gage and streamflow measured by CWCB staff. The majority of streamflow measurements are above or near the proposed ISF of 0.3 cfs. However, there is substantial variability in the measurements.

The available streamflow measurements occurred during a relatively unusual period of precipitation conditions. The Cheyenne climate station shows that 2012 had one of the lowest annual precipitation totals on record, with just 5 out of 101 years lower. Conversely, 2015 tied 1995 for the highest monthly precipitation ever recorded in the month of May. Despite this range of precipitation conditions, the measured data on Lone Tree Creek is generally between 0.1 and 1.25 cfs. This data and the observations made by Daylan Figgs form a basis for staff to conclude that 0.3 cfs is typically available year-round.

Material Injury

Because the proposed ISF on Lone Tree 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.

Cathcart, N.C. and Stacy, W.L., 2010, Lone Tree Creek Fish Inventory. Colorado State University Student Subunit of the American Fisheries Society.

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

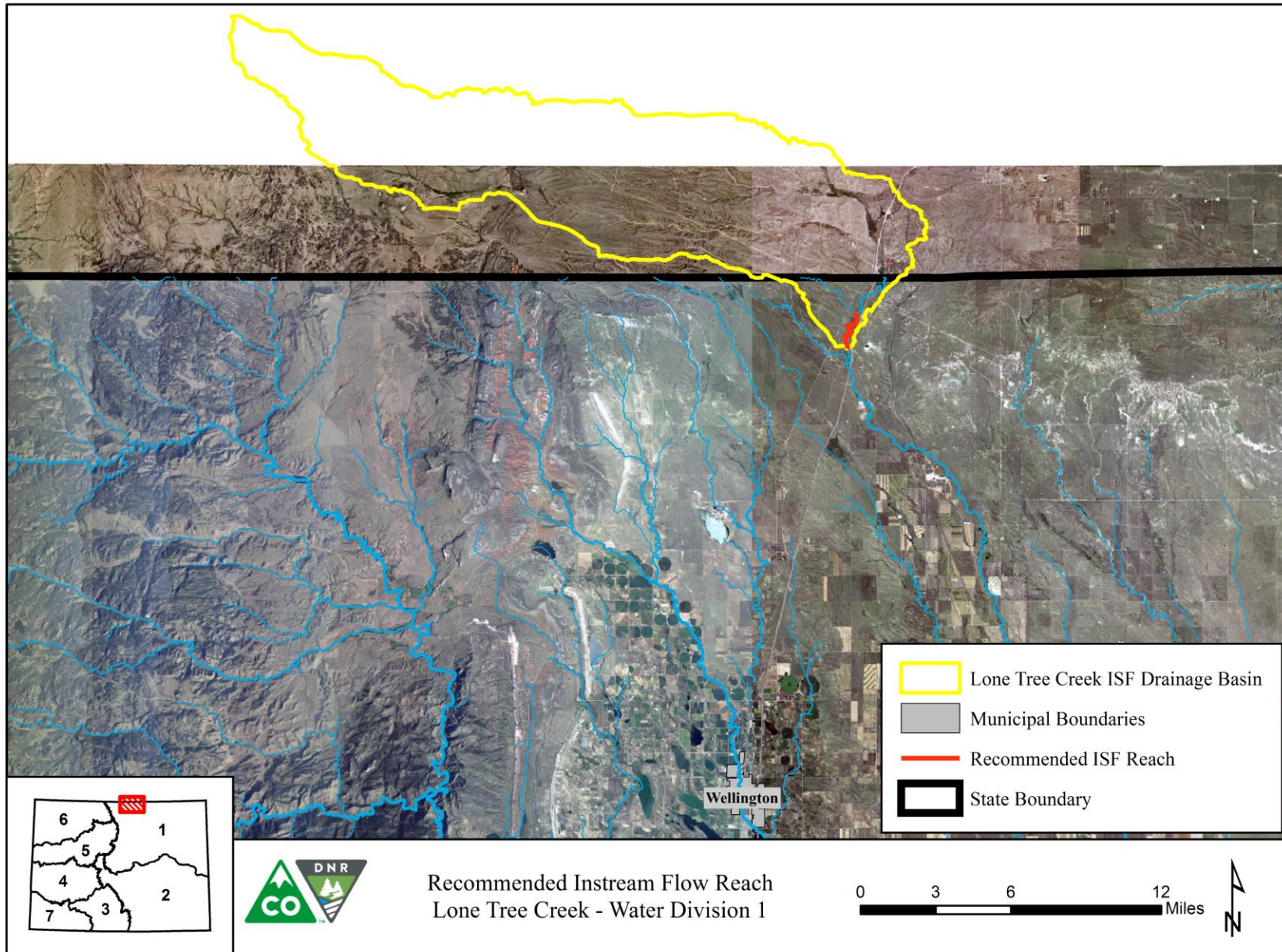
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

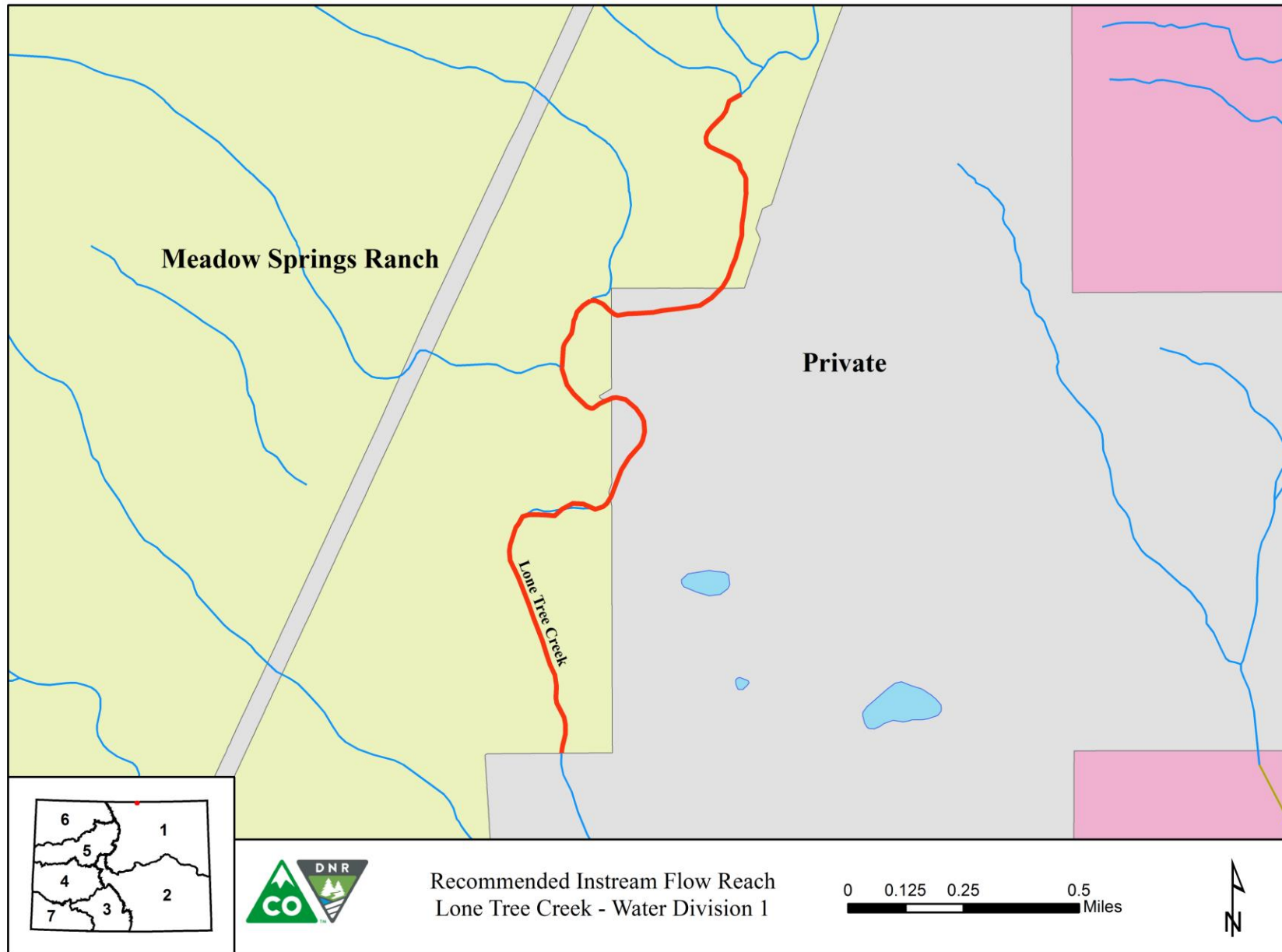
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

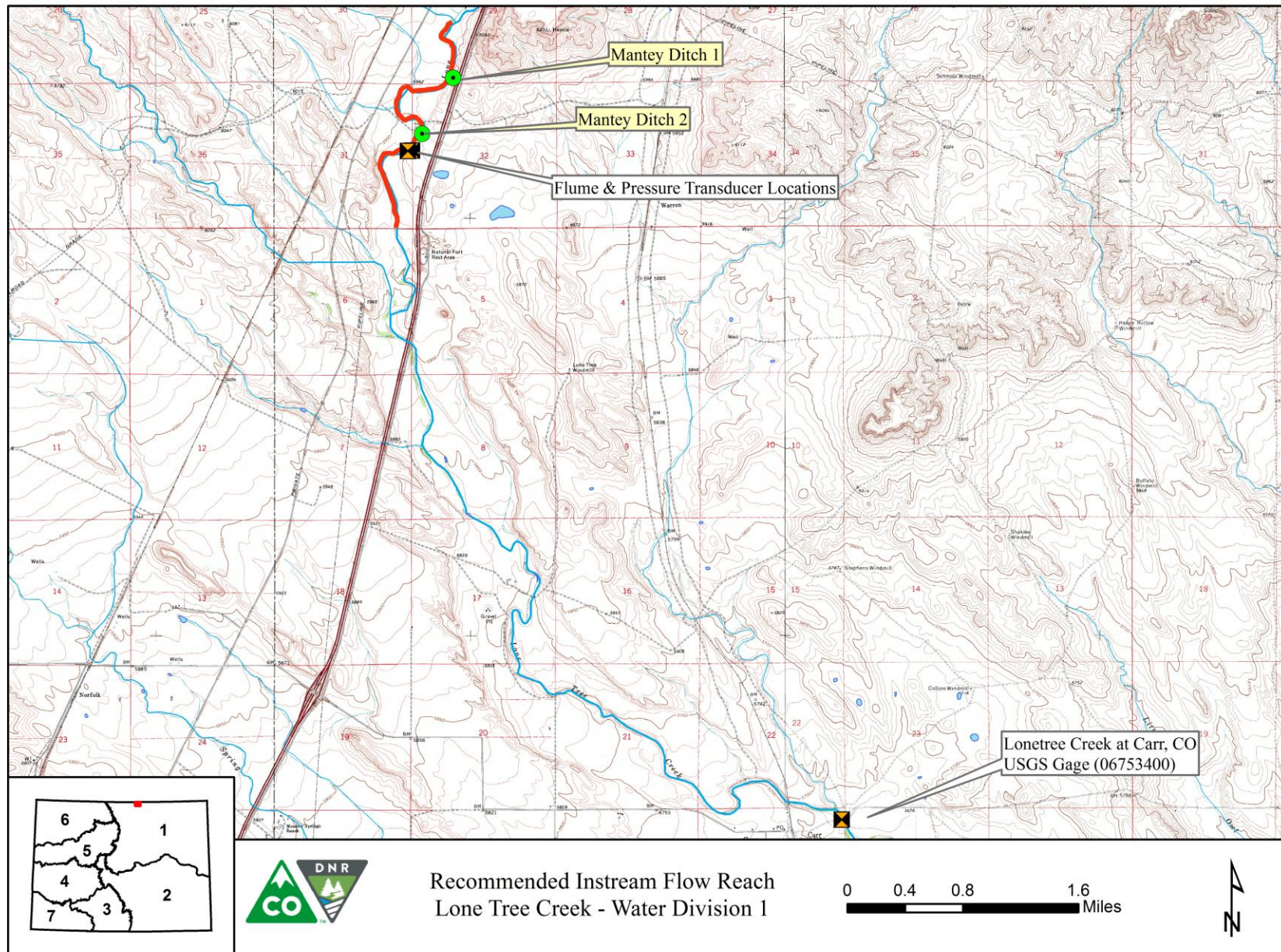
VICINITY MAP



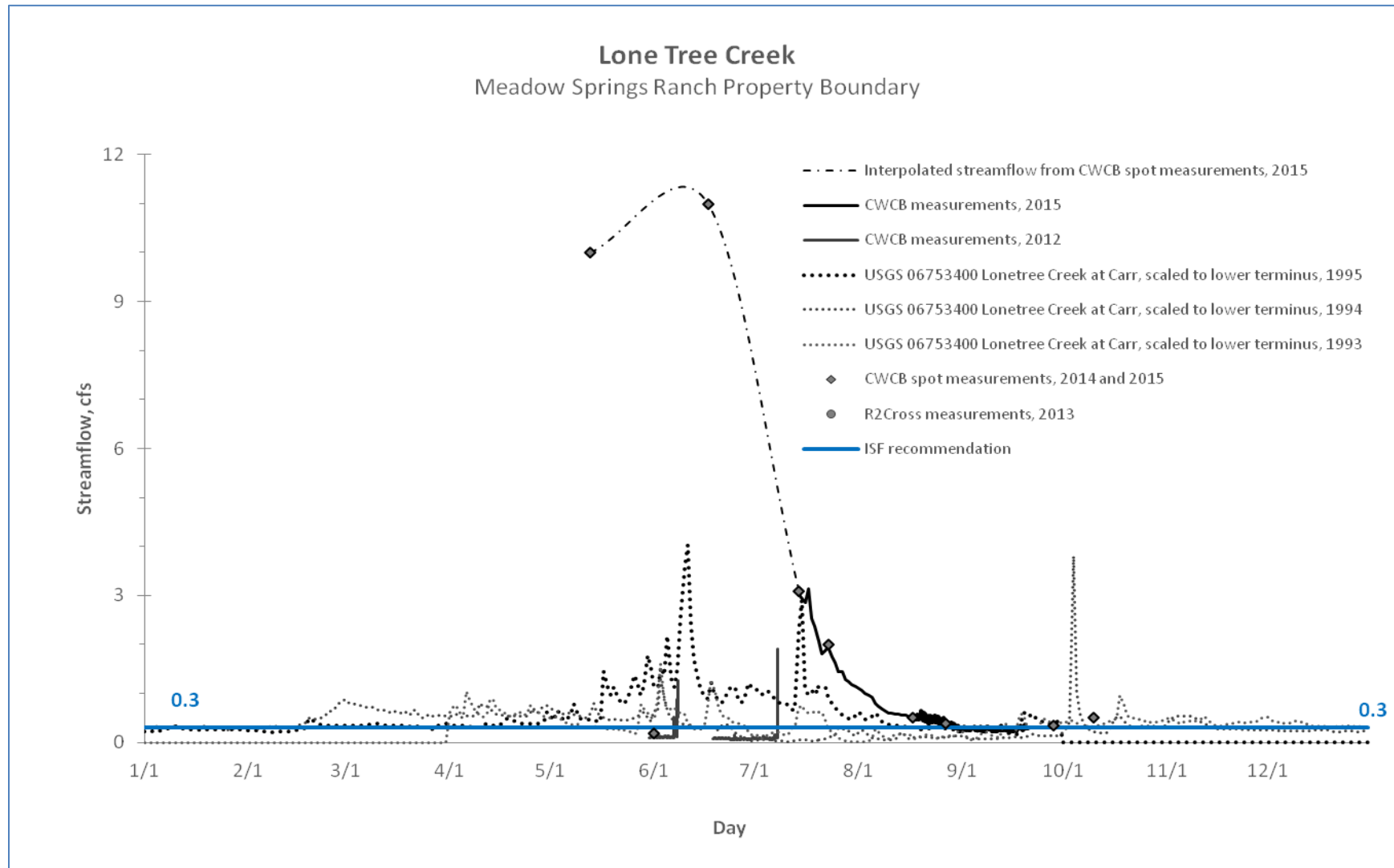
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH

