



COLORADO

Colorado Water
Conservation Board

Department of Natural Resources

Square Top Lakes (Upper & Lower)

EXECUTIVE SUMMARY



Square Top Lake (Upper)



Square Top Lake (Lower)

CWCB STAFF NATURAL LAKE LEVEL RECOMMENDATIONS

LOCATION: RECOMMENDATION:	Square Top Lake (Upper)	
	UTM North: 4382782.46 12,322 ft. (elevation)	UTM East: 436057.06 113.14 Acre-Feet
LOCATION: RECOMMENDATION:	Square Top Lake (Lower)	
	UTM North: 4382623.44 12,084 ft. (elevation)	UTM East: 436440.44 26.79 Acre-Feet
WATER DIVISION:	1	
WATER DISTRICT:	80	
COUNTY:	Clear Creek	
WATERSHED:	Upper South Platte	
CWCB ID:	16/1/A-011 & 16/1/A-010	
RECOMMENDER	Colorado Parks and Wildlife (CPW)	



Square Top Lakes (Upper & Lower)

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.

Colorado Parks and Wildlife (CPW) recommended that the CWCB appropriate NLL water rights on Square Top Lakes Upper (STLU) & Lower (STLL). These lakes are located within Clear Creek County about 7.4 miles south of the town of Silver Plume (See Vicinity Map). One hundred percent of the land the subject natural lakes occupy is publicly owned and managed by the U.S. Forest Service (See Land Ownership Map). CPW recommended STLU and STLL because they have natural environments that can be preserved to a reasonable degree with a NLL 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 NLL 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.

STLU and STLL are high-elevation alpine lakes located east of Square Top Mountain in Clear Creek County. These are cirque basin lakes that possess typical cold water aquatic habitat. The main source of water for these natural lakes is snowmelt runoff, and the occasional precipitation event in this area. STLU is truly a headwaters lake since no identifiable creeks flow into the lake. STLU is located just a quarter of a mile west of STLL and water from STLU flows into STLL via a small unnamed creek. A very steep, cascading stream identified as an unnamed tributary to Duck Creek flows out of STLL to the next downstream lake (Duck Lake).

Several years ago, CPW researchers and aquatic biologists discovered whirling disease (WD) in the Square Top Lakes drainage basin. The WD lifecycle is complex and involves genetics of the intermediate host for the parasite, the tubifex worm. *Myxobolus cerebralis* (Mc) is a parasite that causes WD in fish; it has a two-stage life cycle by which it lives in two alternate hosts. The first stage of the Mc's life cycle is in the aquatic worm, *Tubifex tubifex*. The second host is the salmonid, where Mc lives in the cranial cartilage. The Mc life cycle is complicated by the fact that only a specific lineage of the tubifex worm can serve as the intermediate host for Mc (lineage III) (Nehring 2014). The other lineages (I, IV, and IV) are not able to transmit and therefore sustain Mc infection of

a water body. STLL contains lineage III tubifex worms and is therefore WD positive. STLU contains only lineage VI worms and is therefore incapable of sustaining a WD infection. Since Square Top Lakes are high elevation cold water habitats, the water is likely too cold for a WD infection to be severe. The tubifex genetics data makes these lakes good candidates for removal of WD by simply interrupting the Mc life cycle.

Interrupting the life cycle of Mc should result in a situation where the disease is removed from the system over time. The viability of Mc decreases exponentially when one of the hosts is eliminated, which apparently can occur over a time span of about one year (Nehring 2014). In 2010, CPW decided to remove all cutthroat trout from STLL using gill nets, and to keep the lake free of fish for 2-3 years (Nehring 2014). Gill nets were routinely set in STLL each summer for several weeks. Nets were also set at the outlet of STLU, and at the inlet of STLL to further isolate STLL from fish movement into and out of the lake. Even though STLU does not have WD, all fish were also removed from this lake so that greenback cutthroat trout (State and Federal Threatened species under ESA) can be introduced to the lake without the risk of hybridization between species (See Table 1).

Once WD disease and existing salmonid populations are removed, these lakes will become ideal water bodies for conservation activities to aid in the recovery of the greenback cutthroat trout because they: (1) will be completely isolated from any other species; (2) will have little risk of a re-infection by Mc; (3) will not have competition for food resources; and (4) will not be at risk of hybridization with other trout.

Table 1. List of species identified for reintroduction in Square Top Lakes.

Species Name	Scientific Name	Status
Greenback cutthroat trout	<i>Oncorhynchus clarkii stomias</i>	State - Threatened Federal - Threatened

NLL 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. In natural lake level appropriations, CPW recommends that the entire volume of water in a natural lake be appropriated to preserve the natural environment to a reasonable degree. CPW has determined that appropriating a lesser volume would likely result in diminution of habitat to which species have become accustomed.

Standard survey methods were used to determine each lake's surface water elevation, surface area, and volume. The volume for each lake was calculated by taking several cross-sections of each lake and measuring depth across those sections. The longitudinal location of each of the sections was also measured. CPW's Engineering Section took this field data and calculated the volume using computer-aided design (CAD) software. Water surface elevations were determined by CWCB staff taking multiple GPS elevations at the surface of the water at locations around the lakes and averaging all readings for each lake.

NLL Recommendation

Table 2 shows the survey measurements for the NLL quantification of the Square Top Lakes. CPW and CWCB staff contributed to the collection and calculation of the quantification data.

Table 2. Survey measurements.

Name	Volume, AF	Elevation, ft	Max Depth, ft	Surface Area, ft²
Square Top Lakes (Upper)	113.14	12,322	38.70	328,674
Square Top Lakes (Lower)	26.79	12,084	11.5	304,377

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.

Basin Characteristics

The Square Top Lakes are small cirque lakes with small high-elevation drainage basins. The lakes are connected by a short (approximately 640 ft) unnamed perennial stream. The unnamed stream flows out of the STLL for approximately 1.1 miles before entering Duck Lake. The drainage basin of the proposed NLL on STLU is 0.23 square miles, with an average elevation of 12,700 ft and average annual precipitation of 28.02 inches (Hydrologic Features Map). The drainage basin of the proposed NLL on STLL is 0.42 square miles, with an average elevation of 12,600 ft and average annual precipitation of 27.71 inches. No water rights were identified in the basin tributary to the Square Top Lakes and all lake levels are natural.

Water Availability Summary

The Square Top Lakes are clearly identified on USGS 1:24000 scale maps and in the Geographic Names Information System (GNIS), a database of federally recognized feature names. Based on the persistence of these lakes through time and presence of water in the system, Staff concludes that water is available for appropriation.

Material Injury

Because the proposed NLLs on STLL and STLU are new junior water rights, the NLLs 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 these NLL water rights are appropriated.

Citations:

AFS Blue Book, Characteristics of *Myxobolus cerebralis* and other Myxozoans common to salmonid fish, 2014.

Greenback Cutthroat Trout Recovery Team, and David L. Langlois, 1977, *Greenback cutthroat trout recovery plan*, US Fish and Wildlife Service.

Kowalski, D., 2013, Colorado River Aquatic Resource Investigations- Federal Aid Project F-237-R20, Colorado Parks and Wildlife.

Nehring, B.R., 2014, Fishery management interventions to eliminate *Myxobolus cerebralis* infection in Lower Square Top Lake, Clear Creek County, Colorado (1998-2014), Colorado Parks and Wildlife.

Metadata Descriptions

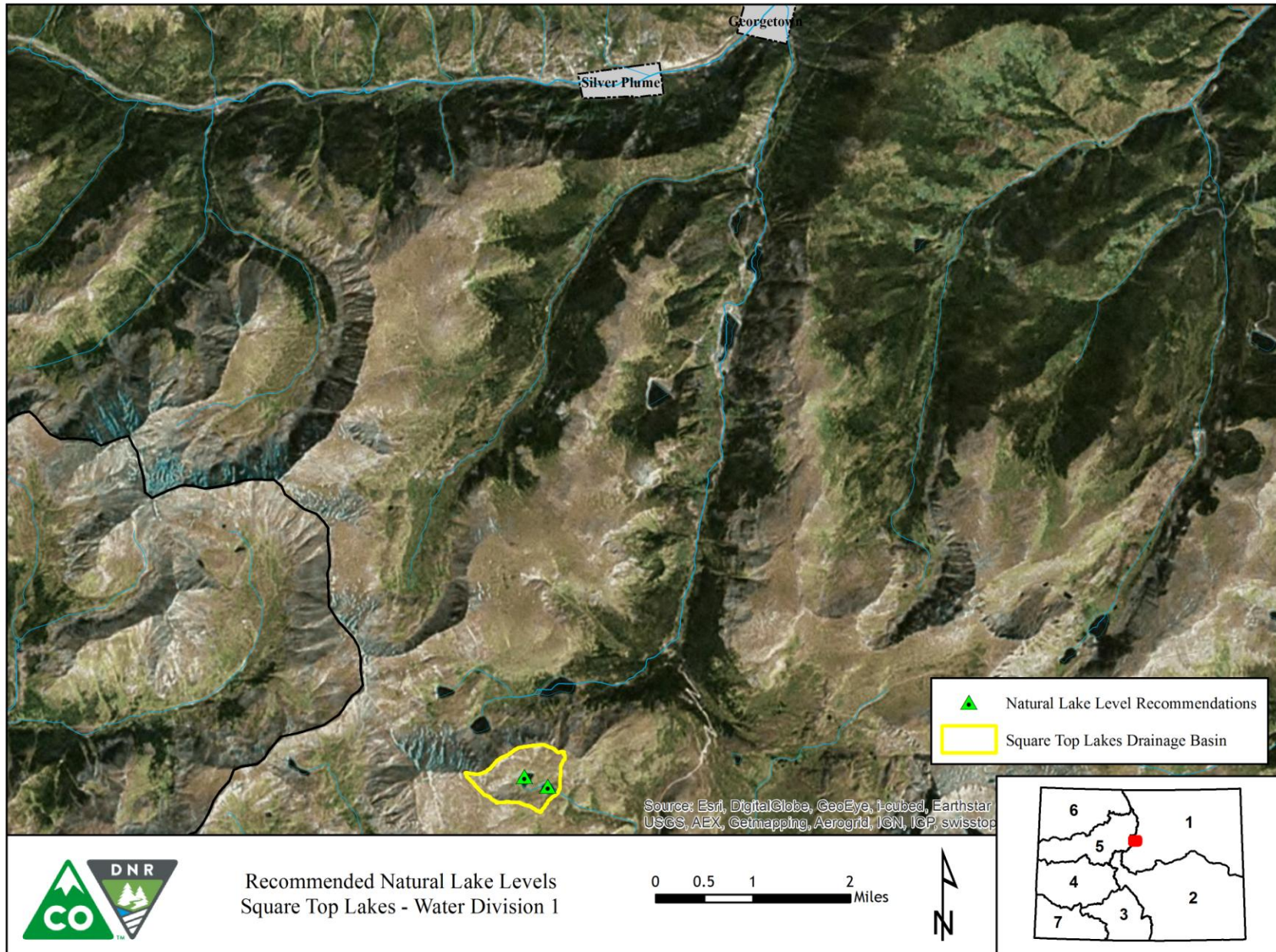
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

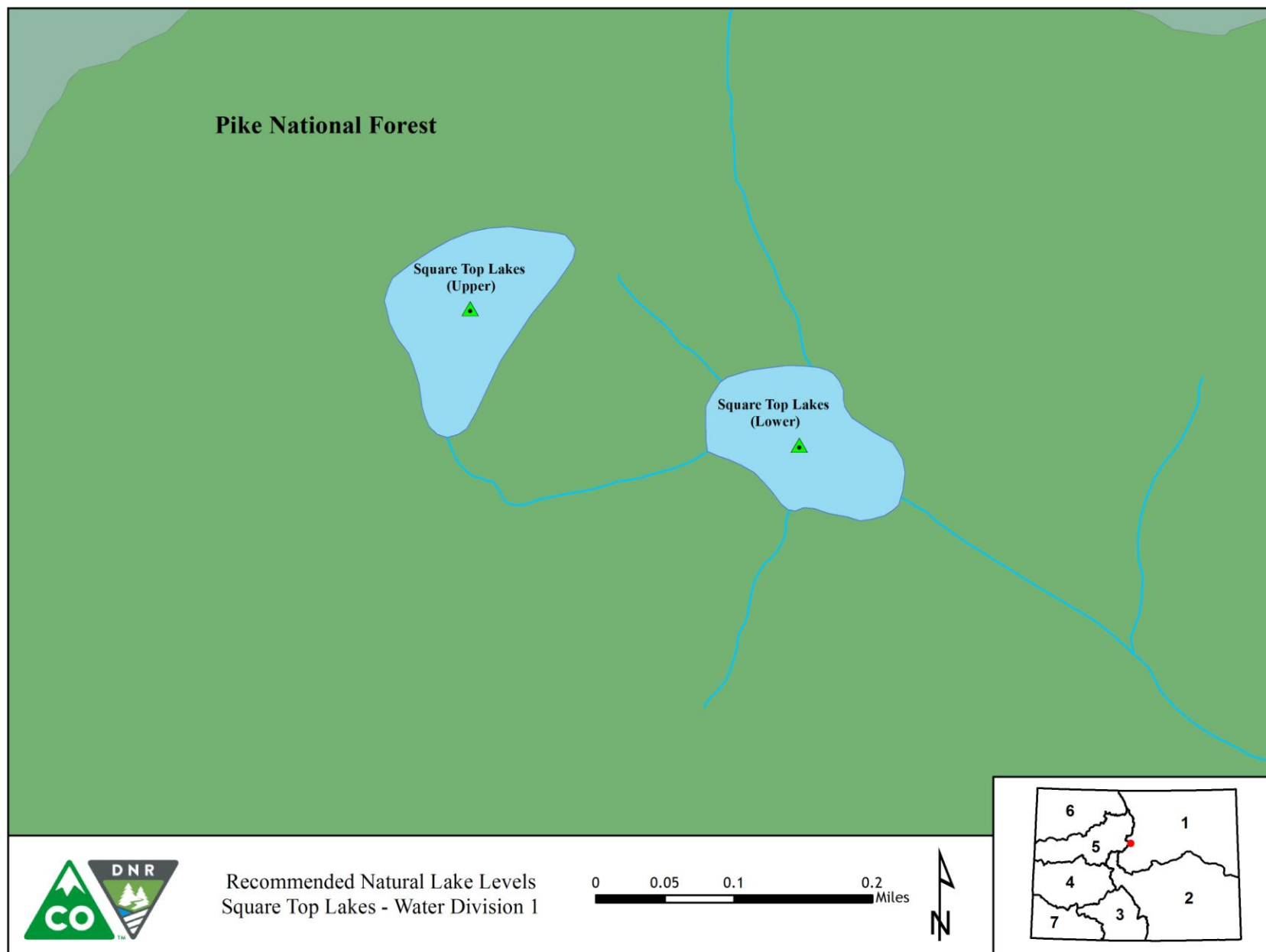
Lake Elevations: North American Vertical Datum of 1988 (NAVD 88).

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VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP

