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TO: Colorado Water Conservation Board Members

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Stream and Lake Protection Section

DATE: September 19-20, 2018 Board Meeting

AGENDA ITEM: 21. Lease of Water to Benefit Endangered Fish on the Yampa River

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Background

The Colorado Water Trust ("CWT"), in coordination with the Upper Colorado River Endangered Fish Recovery Program (Recovery Program or Program) and the Upper Yampa Water Conservancy District (UYWCD), has offered to lease water released from Elkhead Reservoir or Stagecoach Reservor to benefit endangered fish, aquatic habitat, and streamflow in the Yampa River. $30,000 of funds for these reservoir releases were secured from the CWCB Fiscal year 2018-2019 Severance Tax Operational Fund and must be used before the end of the fiscal year on June 30, 2019. The CWCB and CWT will coordinate with stakeholders to determine the best location and timing for the release of reservoir water that will provide the most benefit for the Yampa River basin.

The CWT has two options for leasing water:

(1) 548 acre-feet of short-term water supply (at $50.00 per acre-foot) can be leased for releases out of Elkhead Reservoir through the Recovery Program's Agreement with the Colorado River Water Conservation District (CRWCD), which is valid through as least February 2025, for the beneficial use of endangered fish habitat maintenance (Exhibit A); or
(2) 696 acre-feet of contract water (at $40.23 per acre-foot) can be leased for releases out of Stagecoach Reservoir through the CWT's existing 2018 Water Use Agreement (Exhibit B) with the UYWCD for the beneficial use of nonconsumptive municipal use by the City of Steamboat Springs.

The following memorandum summarizes the details of each lease option for Elkhead Reservoir and Stagecoach Reservoir.

Staff recommendation

This item is informational only. No Board action is requested.

Discussion

Elkhead Reservoir Lease

In 2005, the CWCB entered into an Acquisition Agreement for the Elkhead Reservoir Enlargement, under which the CRWCD conveyed interests in the storage capacity and certain water rights in Elkhead Reservoir to the CWCB once the storage capacity was available and the water rights were made absolute. The U.S. Fish and Wildlife Service (USFWS) manages this water supply for protection of endangered fishes critical habitat downstream of Elkhead Reservoir on the Yampa River. The Recovery Program manages 5,000 acre-feet per year of permanent water supply from the fish pool in Elkhead Reservoir for augmenting Yampa River instream flows for piscatorial and recreational use including in-river fish habitat and river flow maintenance and enhancement uses for recovery of the endangered fishes. An additional short-term water supply of 2,000 acre-feet per year can be leased as needed, if water is available. The Recovery Program has released water from the Elkhead Reservoir fish pool for flow augmentation every year beginning in 2007.

So far this year, the Recovery Program has managed 5,500 acre-feet of water and has been releasing water at a rate of approximately 25-70 cubic feet per second (cfs) throughout the summer to meet the USFWS dry-year flow target. The USFWS recommends that daily average base flows in the Yampa River not fall below 93 cfs at the Maybell gage from August through October at any greater frequency magnitude, or duration, than had occurred historically. Flows below this level cause riffle habitat to decline; such habitat is important for the production of macroinvertebrates (the basis for the aquatic food web on which the endangered fishes rely).

Unusually hot and dry weather conditions have persisted this summer. As a result, decreased streamflows and scarce summer precipitation have led to flows at the Maybell gage to drop below the USFWS dry-year target of 93 cfs at the Maybell gage (Figure 1). In addition, the USFWS reported an increase in non-native smallmouth bass populations due to low flows and warm temperatures, further threatening the survival of the native endangered fish. At the current anticipated rate of release from the 5,500 acre-feet fish pool water in Elkhead Reservoir, it is anticipated that this fish pool water will be exhausted by mid-September. Historically, the need to augment Yampa River flows frequently extends well beyond that timeframe.

The Program is considering leasing additional water before mid-September to offset low flow conditions. The CWT, in coordination with the Recovery Program, has offered to lease an additional 548 acre-feet of short-term lease water (at $50.00 per acre-foot) for releases out of Elkhead Reservoir for an increased number of days (e.g., approximately 40 cfs of releases would last for an additional 19 days). The lease of this water would be executed through the existing Recovery Program's agreement with the CRWCD for the beneficial use of endangered fish habitat maintenance (Exhibit A). The lease of this 2018 water can also be carried over and any unused leased water can be released in subsequent years.

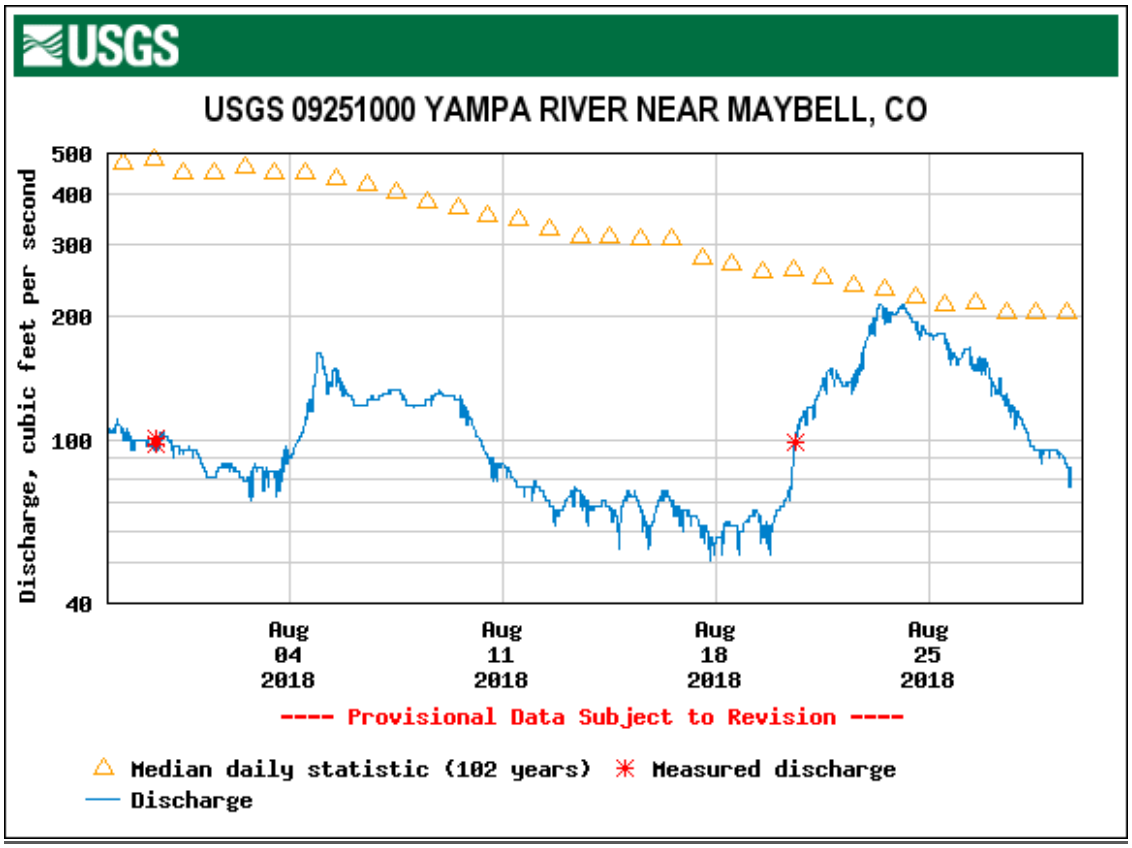

Figure 1: Yampa River flows at USGS Gage: Yampa River near Maybell (#09251000), downstream of Elkhead Reservoir. The USFWS dry-year target flow at this gage is 93 cfs.

Stagecoach Reservoir Lease

The CWT has contracted with the UYWCD for leasing water in Stagecoach Reservoir on the Yampa River in six of the last seven years, starting in 2012. Through 2017, these leases have restored over 9,000 acre-feet of water to the Yampa River. The administrative delivery mechanism for these releases has varied from year-to-year, but has included releases for hydropower production with downstream subcontracted uses including instream flow use, nonconsumptive municipal use by the City of Steamboat Springs, and industrial use by Tri-State Generation and Transmission.

The CWCB has leased water from Stagecoach Reservoir for instream flow use in 2012, 2013, and 2017. Section 37-83-105(2), C.R.S. authorizes temporary loans and leases of water for instream flow use that may be exercised not more than 120 days in a given year, and not more than three years in a ten-year period. 2017 marked the last year the CWCB was able to lease water for instream flow use under the existing approval pursuant to that statute.

To date in 2018, the CWT has contracted for 1,800 acre-feet of water in Stagecoach Reservoir for nonconsumptive municipal uses for the City of Steamboat Springs. The CWT has been

releasing water at a rate of 15-25 cfs since July 14, 2018. This 1,800 acre-feet of leased water will be exhausted soon, and additional water may be needed.

The CWT is considering leasing additional water to offset low flow conditions. The CWT, in coordination with the UYWCD, has offered to lease an additional 696 acre-feet of contract water (at $40.23 per acre-foot) for releases out of Stagecoach Reservoir. The lease of this water would be executed through the existing 2018 Water Use Agreement (Exhibit B) with the UYWCD for the beneficial use of nonconsumptive municipal use by the City of Steamboat Springs.

Water releases from Stagecoach Reservoir in 2018 will not be used for instream flow purposes, but do provide incidental benefits to the CWCB's instream flow water right on the Yampa River between Morrison Creek and Lake Catamount Reservoir (decreed in Case No. 01CW0106). 2018 water releases are used first for hydropower by the UYWCD, and subcontracted downstream by the City of Steamboat Springs for nonconsumptive municipal purposes below its wastewater treatment facility. Additionally, these releases benefit not only an important cold-water fishery below Stagecoach Reservoir that is critical habitat for the native mountain whitefish, but also provide benefits lower on the Yampa River for the Colorado Species of Concern the roundtail chub and other fish species including bluehead suckers and flannelmouth suckers. Releases also benefit recreational users, water quality, and other consumptive users downstream.

Attachments

Exhibit A: Upper Colorado Endangered Fish Recovery Program Procedures for Releasing and Administering Water from Elkhead Reservoir to Augment Yampa River Flows for Endangered Fish

Exhibit B: 2018 Water Use Agreement between the Colorado Water Trust and the Upper Yampa Water Conservancy District

Procedures for Releasing and Administering Water
from Elkhead Reservoir to Augment Yampa River Flows for Endangered Fish
October 3, 2017

Prepared by Jana Mohrman and Don Anderson,
Upper Colorado River Endangered Fish Recovery Program

This document summarizes procedures currently in place to release water from Elkhead Reservoir for purposes of augmenting flows in the Yampa River to benefit endangered fish. It includes:

- a brief history of how the need for water in Elkhead Reservoir for fish purposes was identified and how that pool was quantified and established;
- a review of Yampa River base flow recommendations for endangered fish;
- a description of the process by which the Recovery Program requests releases of Elkhead Reservoir storage to augment Yampa River flows;
- a description of how those releases are administered by the Division Engineer; and
- a summary of the history of flow augmentation in the Yampa River by the Recovery Program since 2007.

1. Historical Background

Development of the Yampa River Management Plan – 2004

Development of a management plan for the Yampa River Basin was a need identified in the *Recovery Implementation Program Recovery Action Plan* (RIPRAP) for the Upper Colorado River Endangered Fish Recovery Implementation Program (Recovery Program) in the 1990's. The resulting document, *Management Plan for Endangered Fishes in the Yampa River Basin* (Yampa Plan), was released in September 2004 (Roehm 2004). The purpose of the Yampa Plan is to promote the recovery of four federally listed endangered fishes[1] as water is depleted to serve human needs in the Yampa River Basin through the year 2045. The Yampa Plan summarizes current and anticipated future depletions, identifies management actions believed necessary to recover the listed fishes in consideration of these depletions and other environmental stressors, and describes criteria by which to measure their success.

As part of the Yampa Plan, the U.S. Fish and Wildlife Service (Service) evaluated the flow augmentation that would be needed to achieve the base flow recommendations developed for the endangered fishes in the Yampa River (see the 'Base Flow Recommendations' discussion below), including the volume of water required. Hydrologic modeling indicated that 7,000 acre-feet (af) of supplemental flow would satisfy base-flow recommendations in all but the driest 10% of years, while allowing minimum flows to be maintained at historical magnitudes and frequencies in the remaining 90% of years. On this basis, thirteen base-flow augmentation alternatives were evaluated. The Yampa Plan determined that enlargement of Elkhead Reservoir would provide the most reliable supply at an acceptable cost, and with minimal impacts to parks and water-related recreation, agriculture and peak

[1] These endangered fish species are the bonytail (*Gila elegans*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), and Colorado pikeminnow (*Ptychocheilus lucius*).

flows. In 2005, the U.S. Fish and Wildlife Service (Service) and the States of Colorado and Wyoming, as partners in the Recovery Program, signed a *Cooperative Agreement to Implement the Management Plan*, collectively committing to implement the Yampa Plan, including the Elkhead Reservoir enlargement. The signing of the Cooperative Agreement by the Service constituted a federal action impacting endangered fish that required an Endangered Species Act (ESA) Section 7 consultation. That consultation resulted in the Final Programmatic Biological Opinion on the Management Plan for Endangered Fishes in the Yampa River Basin (U.S. Fish and Wildlife Service, 2005a).

Programmatic Biological Opinion (PBO) – 2005

The Service's 2005 Programmatic Biological Opinion (2005 PBO) on the impacts of the Yampa Plan identifies the maintenance of elevated spring peak flows and the augmentation of low flows in the Yampa River as important for maintaining suitable habitat conditions and supporting the recovery of endangered fish. The Service recognized that implementation of a base flow augmentation plan involving the release of up to 7,000 acre-feet per year (af/yr) for instream flow purposes could serve as an essential conservation measure to provide ESA compliance for historic depletions in the river basin, and for up to approximately 53,000 af/yr of new basin depletions (30,000 af/yr in Colorado, and 23,000 af/yr in Wyoming).

The Colorado River Water Conservation District had proposed to enlarge Elkhead Reservoir. In light of that, the Recovery Program funded an additional 5,000 af enlargement to the planned enlargement of Elkhead Reservoir to provide water for augmenting summer low flows in the lower Yampa River between Elkhead Creek and the Green River. The Recovery Program contributed $13,276,547 toward the total cost of the reservoir enlargement, as a prorated share for obtaining the 5,000 af storage for Program purposes. This enlargement of Elkhead Reservoir was completed in 2007.

In addition to the pool provided by the enlargement, the Service entered into a 20-year contract with the Colorado River Water Conservation District (CRWCD) to lease up to 2,000 af of water annually from Elkhead Reservoir on an as-needed basis at a rate of $50.00 per acre-foot of water actually leased (USFWS 2005b). This lease rate is less than the actual cost of the water incurred by CRWCD. The difference is credited as a nonfederal contribution to the Recovery Program pursuant to P.L. 106-392 as amended, the Recovery Program's authorizing legislation.

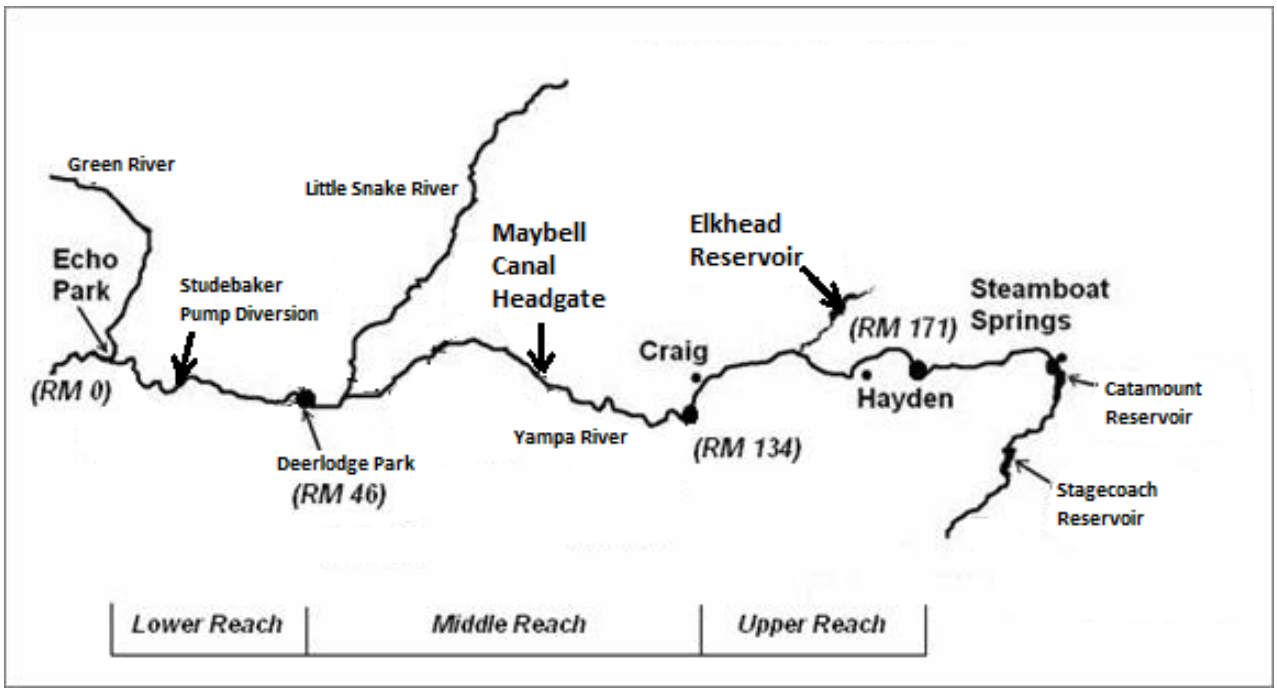

Figure 1. Schematic of the Yampa River system, including several features cited in this paper.

2. Base Flow Recommendations

"Base flows" generally refer to the sustained flow of a stream in the absence of direct runoff, where flow is primarily maintained by groundwater and shallow subsurface discharge to the stream channel and its tributaries, including returns from agricultural uses. The base flow period for the Yampa River – that is, the period during which base flows rather than direct runoff dominate the hydrograph, and during which streamflow tends to be lower – generally begins in August and ends in March. Modeling shows that the undepleted hydrograph of the Yampa River follows a pattern wherein flows during August - October are generally lower than the remainder of the base-flow period, with the lowest flows occurring in September (Modde et al., 1999). Flows during the August – October period have been further reduced by water demands.

From a fisheries standpoint, a threat presented by low flows is reduced habitat of all types (Modde et al., 1999; Bestgen, 2015). In general, low flows reduce overall habitat depth and area and reduce the availability of food. Maintenance of minimum flows is important for fish movement, as large-bodied native fishes must traverse riffles to move throughout the Yampa River and find the best sites for foraging, resting, and spawning. Base flows additionally provide habitat for early life stages of native fishes in nearshore areas, such as backwaters and secondary channels. Higher base flows in the Yampa River may also promote a thermal regime that is more favorable overall for the native fish community as a result of reducing nonnative predator fish growth (Bestgen 2015).

Yampa Plan Recommendations – 2004

Base flow recommendations for the Yampa River that were recognized in the 2004 Yampa Plan as supporting the survival and recovery of the endangered fishes included the following:

- The U.S. Fish & Wildlife Service's (Service) recommendations (Modde et al. 1999) that daily average base flows in the Yampa River not fall below 93 cubic feet per second (cfs) at the Maybell, Colorado gage location from August through October at any greater frequency, magnitude, or duration in the future than had occurred historically[2]. These researchers determined that riffle habitat declined most rapidly at flows below 93 cfs. Of the three river meso-habitats (riffles, runs and pools), riffles are considered the most sensitive to changes in flow and important for the production of macro-invertebrates which are the basis for the aquatic food web on which the endangered fishes rely.

- Additionally the Service recommendations include (Appendix D of Roehm 2004) that the base-flow period be expanded to include July, and that due to uncertainty with respect to the winter flow needs of the fishes, the base-flow period be extended through the winter months (November through March) with a 33% buffer added to the 93-cfs flow target (i.e., 124 cfs)[3]. That is, that flows at the Maybell location should not fall below 124 cfs during the winter with any greater frequency, magnitude, or duration than they had under historic conditions.[4]

The 2005 PBO determined a need for 7,000 af/yr of base flow augmentation capability based on a flow augmentation protocol that would release water from storage (or otherwise deliver water) at a rate of 50 cfs until the augmented flow in the Yampa River at Maybell exceeded 138 cfs in July through October, and 169 cfs in November through February. Collectively, the above recommendations and PBO analysis identify a variety of possible base flow targets ranging from 93 to 169 cfs. The following discussion describes the targets currently applied by the Recovery Program.

Amended Recommendations – 2008

The Service later noted (Muth 2008) that while Modde et al. (1999) recognized that an average of 93 cfs should be sufficient to maintain riffle habitats, it is less than flows identified to avoid a 50% risk of riffles becoming a potential barrier to local movements of Colorado pikeminnow due to shallow depths. Muth (2008) further noted that the standard deviation around the Modde et al. (1999) 93 cfs average was 40.8 cfs, "resulting in an upper flow level to maintain riffle habitats of approximately 134 cfs". On this basis, the Service's recommendation at the Maybell gage was amended by Muth (2008) as follows:

> "Given the above information and depending on the amount of water available in the Elkhead Reservoir endangered fish pool, the Upper Colorado River Endangered Fish Recovery Program **will typically request that releases from the endangered fish pool be managed to ensure minimum flows of at least 93–134 cfs (preferably 120 cfs or greater)**[5] **at the Maybell gage during August–October**. However, the **Recovery Program may request other release**

[2] Modde et al. (1999) determined that flows fell below 93 cfs at Maybell in roughly 38 percent of the years during the 80-year period of record (1916–1995), with an average duration of about 9 days/year (maximum 68 days in 1934), and that endangered fish populations had not declined as a result of these occasional low flows.

[3] Roehm (2004) explains that this 33% buffer was added to compensate for the uncertainties surrounding the magnitude of needed winter flows, and notes this "is consistent with historic hydrologic patterns, wherein average base flows after October 31 rose by 33% or more in half of the years of record with respect to comparable average base flows prior to November 1." (p.33)

[4] For the 2004 Yampa Plan analysis, water years 1909 through 1998 were used for the historic analysis.

[5] The 120 cfs recommendation is based on the analysis of Anderson and Stewart (2003).

scenarios to support management actions deemed appropriate to assist in recovery of the endangered fishes." [Emphasis added]

The "other release scenarios" mentioned by Muth (2008) allow the Recovery Program to seek higher base flow in wet years to better mimic historic flows, and to realize additional habitat benefits provided by higher flows. Recommendations made in several river studies[6], together with the characteristics of late summer flow in Yampa River in wetter years, have led the Recovery Program Director's Office to seek to maintain a minimum flow of at least 200 cfs in August through October of wet years. However, 200 cfs has not been formally adopted by the Program as a wet year target. The Program intends to review the additional hydrologic and biologic data collected since the original base flow recommendations were established to evaluate the suitability of the existing targets, and possibly update its Yampa River flow recommendations.

In summary, the Recovery Program generally operates to make Elkhead Reservoir releases relative to these instream flow targets in the Yampa River at the Maybell gage location from August 1 to October 31 of each year:

Dry Years	93 cfs
Average Years	134 cfs
Wet Years	Under evaluation

Generally speaking, "dry" corresponds to hydrologic conditions of 75% or greater exceedance, "average" to 75% to 25% exceedance, and "wet" to 25% or less exceedance. The Program sets the corresponding flow target in June after considering the conditions on the river, forecasted streamflow, and the volume of storage in Elkhead Reservoir.

3. The Recovery Program's Flow Request Process

Recovery Program Water Supply

Two sources of supply at Elkhead Reservoir are available to augment Yampa River base flows for endangered fish:

- A 'Permanent Water Supply' (5,000 af /yr) which is available annually, with a 2002 storage priority, and
- An additional 'Short-Term Water Supply' (2,000 af/yr) which is available as needed through lease from CRWCD, under an agreement valid through at least February 2025.

Water released from these sources for the Recovery Program is measured at the USGS Yampa River near Maybell gage (#09251000), less transit losses determined by the Division Engineer. Normally, the maximum rate of release from Elkhead Reservoir for Recovery Program purposes is 50 to 75 cfs, but may occasionally be higher. The Division Engineer administers and protects the releases to the farthest downstream diversion structure on the Yampa River in Colorado, currently the Studebaker Pump, which is located approximately 17 river miles upstream of the Green River confluence and 75 river miles below the Maybell Canal diversion.

[6] For example, Stewart et al. (2005) recommended base flows of at least this magnitude. Several other researchers (e.g., Bestgen 2015, Anderson and Stewart, 2003) similarly identified 200 cfs as a desirable base flow target for the lower Yampa River. However, none of these studies have been formally endorsed by the Recovery Program technical committees.

Scheduling Releases from Elkhead Reservoir

In June, the Recovery Program assesses the water supply forecast to determine the minimum flows to attempt to maintain through the late summer months. The Recovery Program implements its August through October base flow augmentation on the Yampa River through weekly flow/release coordination calls that are initiated when the Maybell gage drops to approximately 400 cfs. Historically, this tends to occur sometime between early July (in unusually dry years) and early September (in unusually wet years). The Recovery Program invites the staff of Colorado Basin River Forecast Center, the National Weather Service, CRWCD, Division 6 Engineer's Office, USGS, Tri-State Generation and Transmission, City of Craig, Upper Yampa River Water District, and Maybell Irrigation District to participate in these calls. Participants in the call provide updates on current and forecasted conditions and anticipated river operations. After considering that information, the Recovery Program determines what Elkhead releases, if any, to request. The request is made by the Recovery Program to the CRWCD.

The Recovery Program has never made releases to augment Yampa River base flows in the winter, although such releases are allowed under the 2005 PBO. The Program twice has made four-day "pulse" releases in July or August from the Elkhead Reservoir Permanent Water Supply, as described under 'Program Flow Release History' below.

Leasing the Short-term Water Supply from Elkhead Reservoir

The terms of the Service's agreement with the CRWCD are described on pages 10-11 of the 2005 PBO. The District and the Service entered into a 20-year lease (February 2005 through February 2025) for the Short-term Water Supply of up to 2,000 af/year at a cost to the Recovery Program of $50/af.[7] The District is free to market any unused water from the Short-term Water Supply on an annual basis. However, the Service has first option to lease each year, and agreed to notify the CRWCD of its intent to lease water in accordance with the following three-tiered schedule[8]:

> **Tier I:** On or before **May 1**: The Service will notify the CRWCD of its intent to take a minimum of 500 AF of water from the Short-term Water Supply or relinquish the entire 2,000 AF volume to the CRWCD at that time;
>
> **Tier II:** On or before **June 1**: In any year in which the Service calls for 500 AF of the Short-term Water Supply in accordance with Tier I, the Service will notify the CRWCD of its intent to take an additional 500 AF or relinquish the remaining 1,500 AF to the CRWCD at that time;

[7] This cost is fixed for the duration of the 20-year lease. The Service has a first option to renew this lease at terms agreed to by both parties. http://www.coloradoriverrecovery.org/documents-publications/section-7-consultation/yampaPBO/FinalYPBO.pdf. There are also O&M charges associated with the permanent pool and the leased pool (when utilized).

[8] While the dates specified here are set by the 2005 contract language, in practice CRWCD has often provided additional flexibility on these dates when other demands on the leasable storage have not materialized. This flexibility helps allow the Program to better adjust to unexpected changes in hydrologic conditions that can develop in late April and May.

Tier III: On or before **July 1**: In any year in which the Service calls for 1,000 AF of the Short-term Water Supply in accordance Tiers I and II, the Service will notify the CRWCD of its intent to take the remaining 1,000 AF or relinquish that amount to the CRWCD.

If the Service fails to make an affirmative request in any year for water pursuant to this three-tiered schedule, the Service shall be considered to have relinquished the remaining balance of the Short-Term Water Supply until the supply resets on March 1. The CRWCD has the right to use any relinquished portion for other District purposes, including leasing the water to third parties. However, water from the Short-term Water Supply that is not used in any year is carried over for use in the subsequent year(s) to reduce any potential shortfall in filling the 2,000 af pool. (Nevertheless, that pool may never exceed 2,000 af.)

4. Administration of Elkhead Reservoir Releases and the Maybell Irrigation District Water Right

As mentioned earlier, the Division Engineer ensures that water released from Elkhead Reservoir to enhance flows for endangered fish is protected to the farthest downstream diversion on the Yampa River, while respecting applicable water law and maintaining consistency with Yampa River water administration and accounting practices. The Division Engineer is able to protect the released water because of its decreed use for river fish habitat maintenance.

Protection of the released water includes coordination with the Maybell Irrigation District, which diverts from the Yampa River at the Maybell Canal headgate (River Mile 90.3). Enhancements in flow measurement and the automation of operations at the upper end of the Maybell Canal completed in 2017 allow the District to respond quickly to ensure that Elkhead Reservoir releases for the Program remain in the river, either through adjustments made to diversions at the canal headgate, or by promptly returning any diverted Recovery Program releases to the Yampa River at the canal flume where it crosses the river about one mile downstream. These procedures, agreed to by the District and the Division Engineer, are described in a document dated July 20, 2016, "Procedure for Protection of the Elkhead Creek Reservoir Releases for Endangered Fish and the Administration/Operation of the Maybell Canal" (Pitts, 2016).

As indicated in that document, the Recovery Program is obligated to do the following:

- Provide the Division Engineer with at least 48 hours advanced notice of initiation of releases from Elkhead Reservoir, including the start date and time, magnitude, and expected duration of the release (if known), as well as the expected timing and increase in flow at the Maybell Canal headgate; and

- Notify the Division Engineer of any changes in releases, including termination of releases, and the corresponding expected change in flow at the District's headgate.

When the Division Engineer is notified of these releases and changes to releases by the Recovery Program, she/he will promptly notify the Maybell Irrigation District. These notifications may occur during the coordination calls mentioned above.

5. Program Flow Release History

The Recovery Program has released water from the Elkhead Reservoir fish pool for flow augmentation every year beginning in 2007. Actual releases made from 2007-2016 to augment existing base flows are shown in Table 1 and Appendix A. As summarized in Table 1, the total quantity released has been between 1,579 and 6,583 af annually.

The Recovery Program leased Short-Term water from CRWCD in only two of these years, 2012 (2,000 af) and 2013 (1,000 af), these being years in which snowpack was meager and expectations were for an unusually low late summer flow. However, in both these years not all of the Short-Term water leased was released, because in both years the summer conditions became wetter and a full release of water became unnecessary. The unused balance was carried over and used in the following years.

In the two wettest years (2011 and 2014) the Service released large pulses that supplemented relatively high summer flows. These releases were made from the permanent pool (in both years), and in 2014 also included leased water that was carried-over from unused 2013 supplies. In 2011 this consisted of a four-day Elkhead Reservoir pulse release in August, peaking at 295 cfs, to disadvantage nonnative bass. In 2014 this consisted of a four-day pulse release in July, peaking at 262 cfs, to extend the boating period for the purpose of removing nonnative fish.

Table 1. Yampa River Conditions and Elkhead Reservoir Releases for Instream Flow, 2007-2016

Year	CBRFC Forecast	Mean Flow	Target Minimum Flow	Elkhead Release				Days Below Thresholds in Aug-Oct		
	Apr-Jul Water Supply as % Avg	July-Oct Average (CFS)	CFS	Start Date	Perma-nent Pool Release (AF)	Temp Pool Lease Release (AF)	Total Release (AF)	Below 93 CFS	Below 134 CFS	Below 200 CFS
2007	No forecast	299	93	2-Aug	5,000	0	5,000	0	7	38
2008	122%	702	134	24-Aug	5,005	0	5,005	0	0	6
2009	67%	530	134	10-Aug	5,000	0	5,000	0	8	23
2010	80%	418	134	1-Sep	5,000	0	5,000	0	8	42
2011	280%	2037	200	18-Aug	1,822	0	1,822#	0	0	0
2012	19%	113	93	2-Jul	5,000	1,583	6,583	58	72	87
2013	59%	321	93	11-Aug	4,852	394	5,246	4	19	41
2014	144%	647	200	22-Jul	639	940*	1,579#	0	0	0
2015	78%	387	134(?)	14-Aug	5,000	0	5,000	0	13	45
2016	58% **	338	134	17-Aug	5,000	0	5,000	13	35	52

* This 940 AF of leased water was carried over from that not used in 2013.
** Unanticipated May precipitation substantially boosted the actual water supply relative to this April forecast.
# Released only to briefly augment high flows in 2011 and 2014.

6. Assessment of Recovery Program Releases

As suggested by Table 1 and illustrated by graphs for each year (Appendix B), releases made from Elkhead Reservoir to enhance base flows in the Yampa River during the July-through-October low flow period have substantially improved the frequency with which flows have met or exceeded corresponding base flow targets.

While it has not been unusual for mean daily flows to fall below the corresponding target for multiple days during the low-flow period, it is clear that timely Elkhead Reservoir releases have substantially reduced the frequency, magnitude, and duration of shortfalls to targets. As described in footnote 2, a 1999 analysis indicated that, historically, flows fell below 93 cfs at the Maybell gage location in roughly 38 percent of years, with an average duration of about 9 days/year. Table 1 shows that daily mean flows below 93 cfs have occurred in only three of the ten years Recovery Program releases have been made from Elkhead Reservoir, and in only one of those years (2012, one of the driest on record) for more than 13 days total, or for more than seven consecutive days.

Literature Cited

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Muth, R. 2008. Rationale for Management of Water Releases from the Elkhead Reservoir Endangered Fish Pool to Augment August-October Base Flows in the Yampa River. Memorandum from Program Director of the Upper Colorado River Recovery Program to Erin Light, Division Engineer, Water Division 6, Steamboat Springs, Colorado, April 3, 2008.

Pitts, T. 2016. Memo to Erin Light, Division Engineer and Mike Camblin, President, Maybell Irrigation District, *Final Procedure: Protection of the Elkhead Creek Reservoir Releases for Endangered Fish and Administration/Operation of the Maybell Canal*, via email, July 20, 2016.

Roehm, G.W. 2004. Management plan for endangered fishes in the Yampa River Basin and environmental assessment. U.S. Fish and Wildlife Service, Mountain-Prairie Region. Denver.

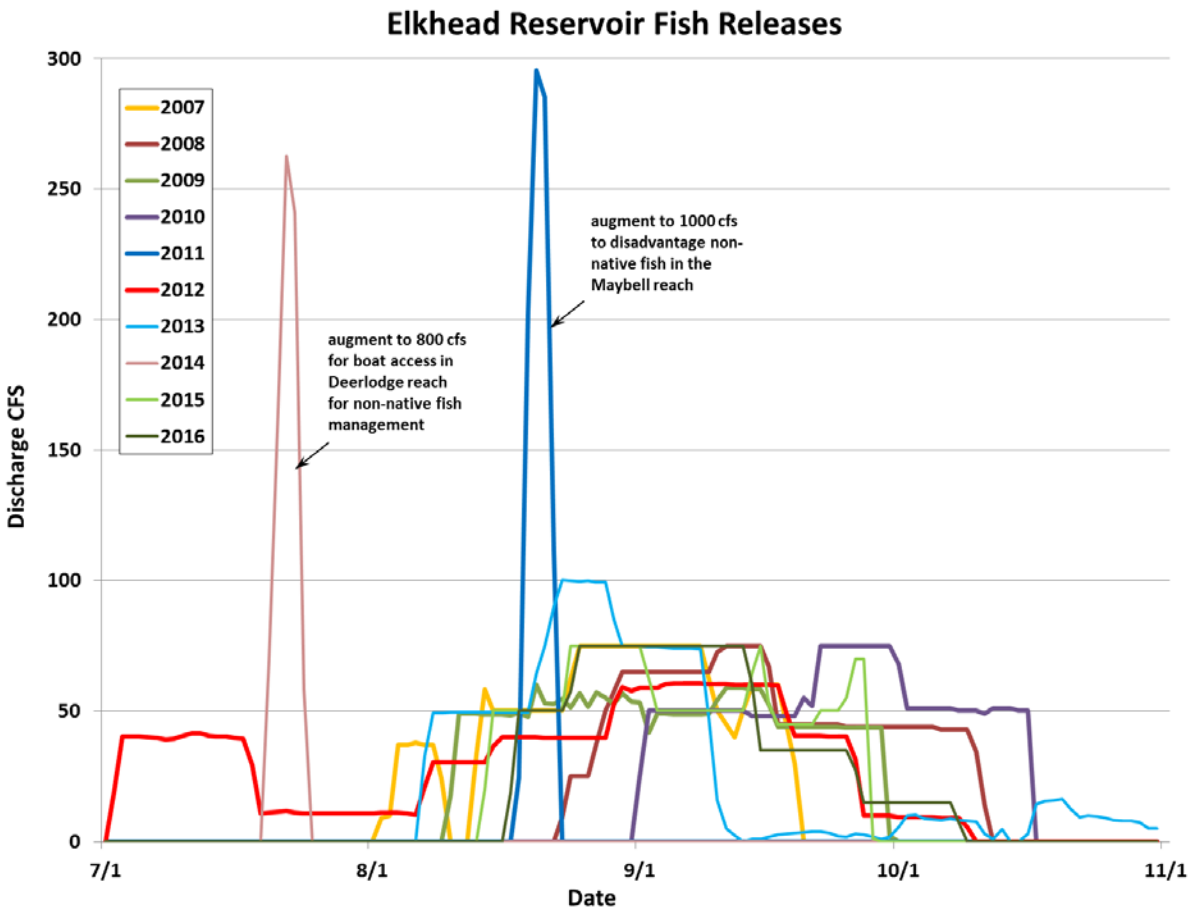
Stewart, G. S., R. A. Anderson, and E. Wohl. 2005. Two-dimensional modeling of habitat suitability as a function of discharge on two Colorado rivers. *River Research and Applications*, 21:1061–1074.

U.S Fish and Wildlife Service. 2005a. Final Programmatic Biological Opinion on the Management Plan for Endangered Fishes in the Yampa River Basin. 93 pp.

U.S. Fish and Wildlife Service. 2005b. Lease, Elkhead Reservoir Englargement Short-Term Water Supply. 10 pp.

Appendix A

Fish Pool Releases from Elkhead Reservoir 2007 – 2016



Flow Release Estimated Travel Times:

Ashley Nielson from Colorado basin River Forecast Center ashley.nielson@noaa.gov:
The model is set for these travel times for high flow (1000 cfs):

Elkhead Reservoir to Yampa-Craig = ~6-8 hours
Yampa-Craig to Maybell = ~15-17 hours
Maybell to Deer Lodge = ~18-20 hours

Don Meyer from the River District don@crwcd.org @ low flows ~150 cfs:

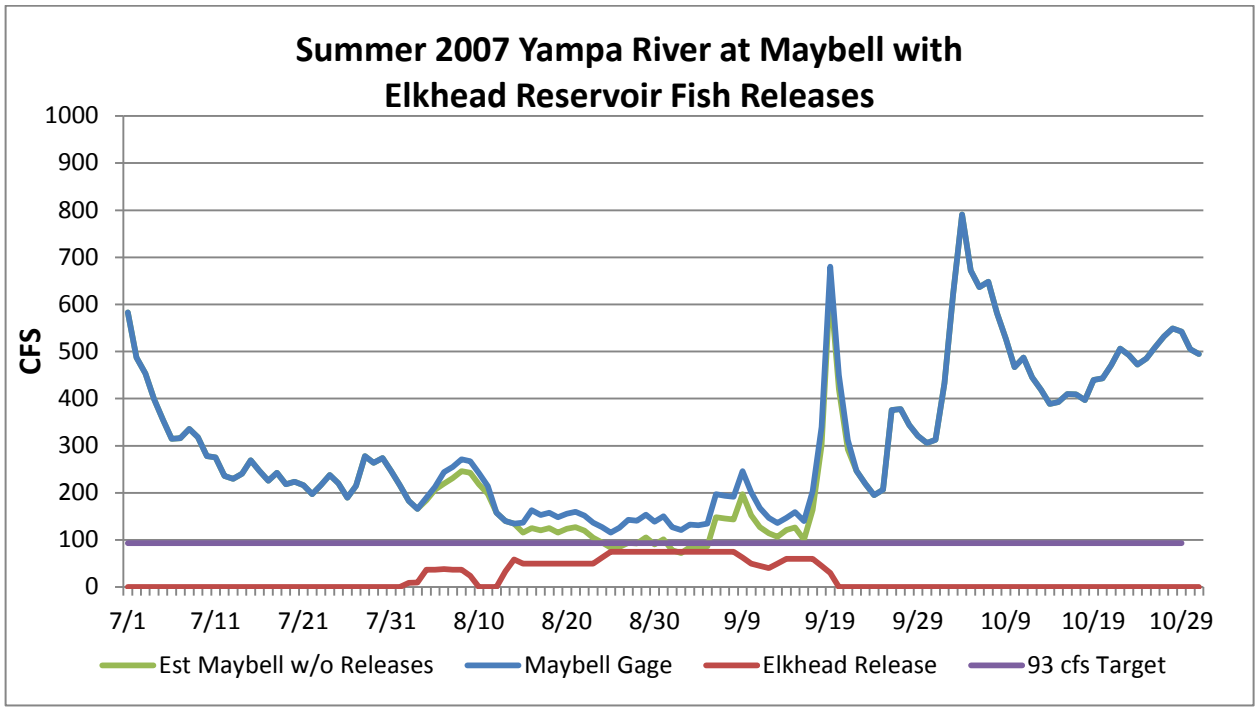
Elkhead Reservoir to Maybell about 2 to 3 days

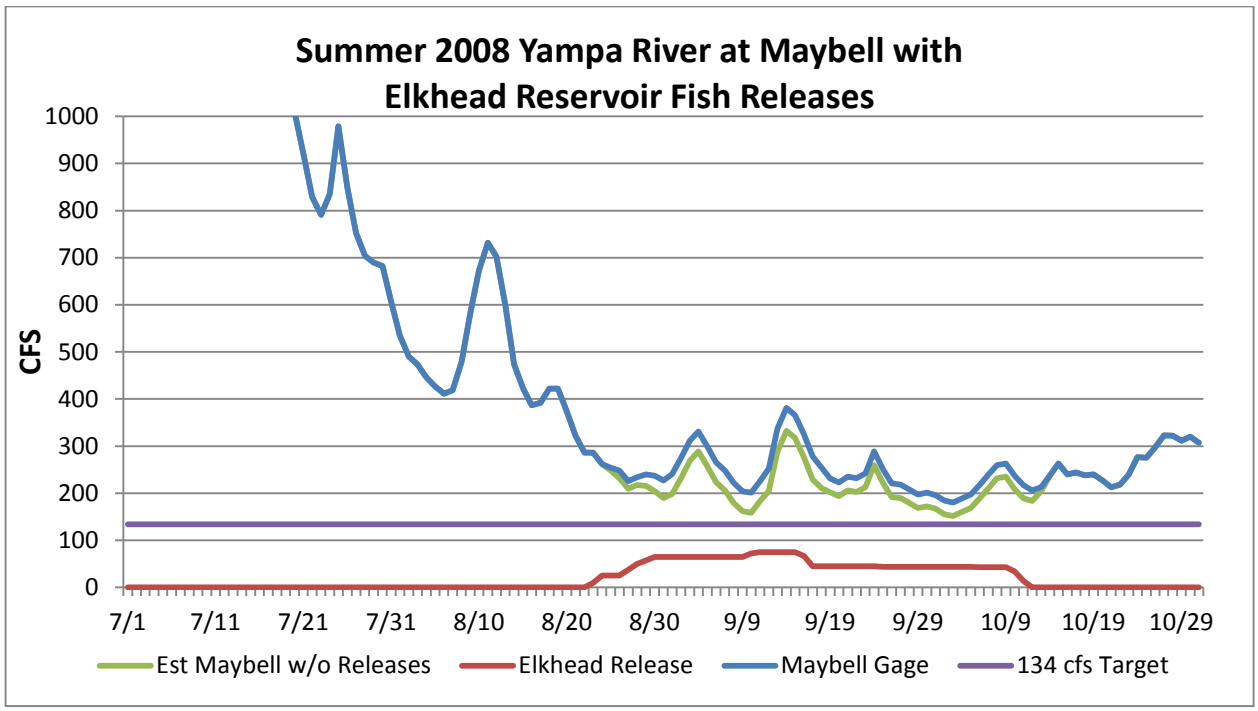
Flow loss/attenuation Downstream:

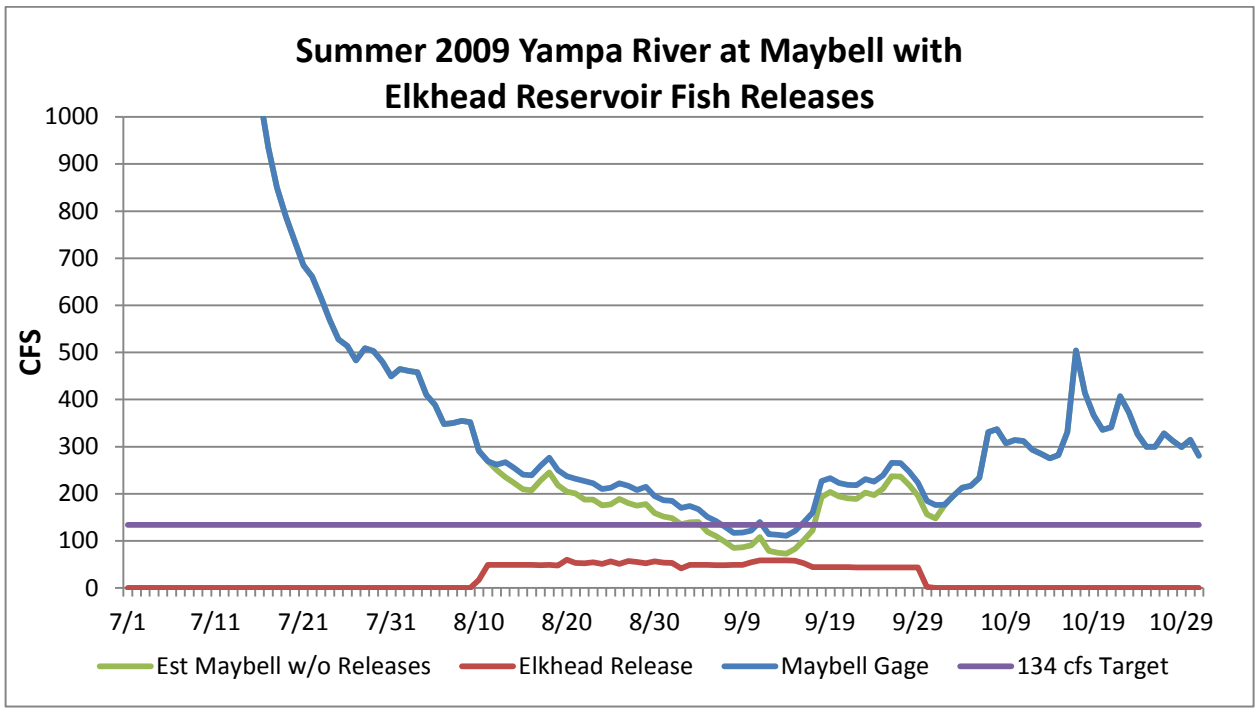
Erin Light (Division Engineer): transit loss assumption between Elkhead reservoir and the USGS Maybell gage: 0.5% per mile over approximately 72 miles for ~35% loss.

Appendix B
Recovery Program Flow Releases and Yampa River Summer Flow Graphs, 2007 through 2016

Note: These graphs assume a 35% loss and three-day transit time to the Maybell gage.






Summer 2009 Yampa River at Maybell with Elkhead Reservoir Fish Releases
CFS
1000
900
800
700
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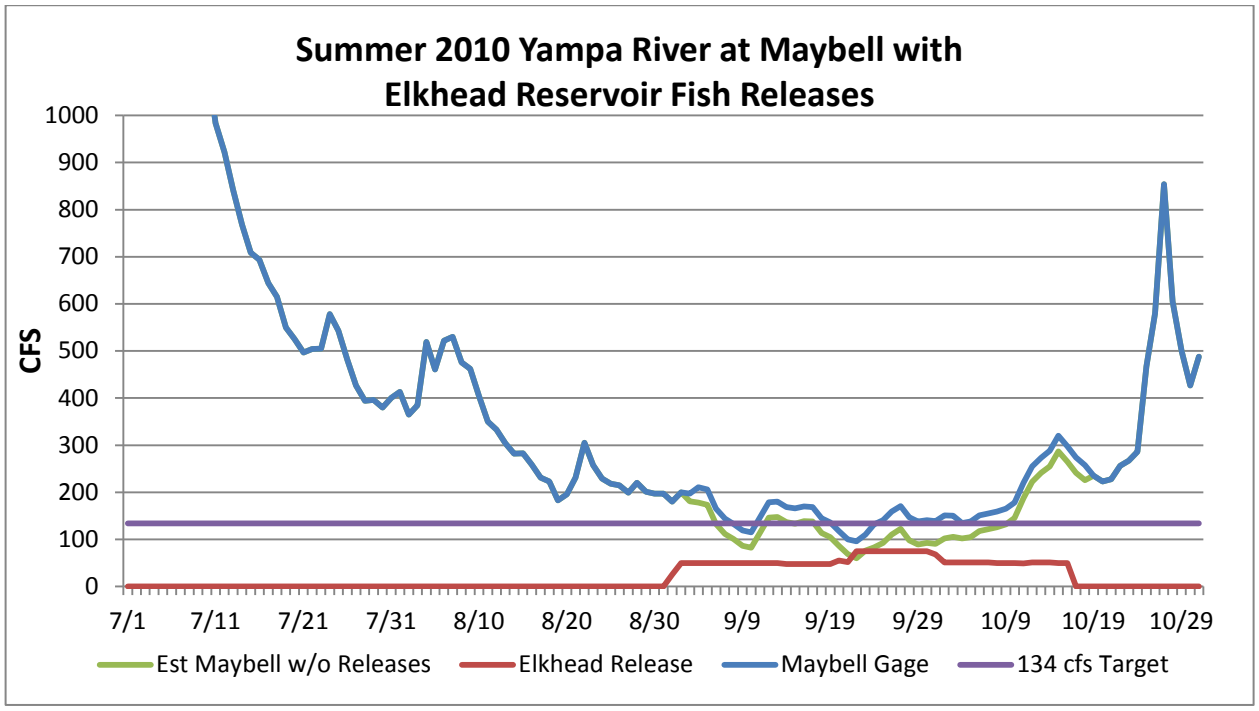
7/1
7/11
7/21
7/31
8/10
8/20
8/30
9/9
9/19
9/29
10/9
10/19
10/29
Est Maybell w/o Releases
Elkhead Release
Maybell Gage
134 cfs Target


Summer 2010 Yampa River at Maybell with Elkhead Reservoir Fish Releases
CFS
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7/1
7/11
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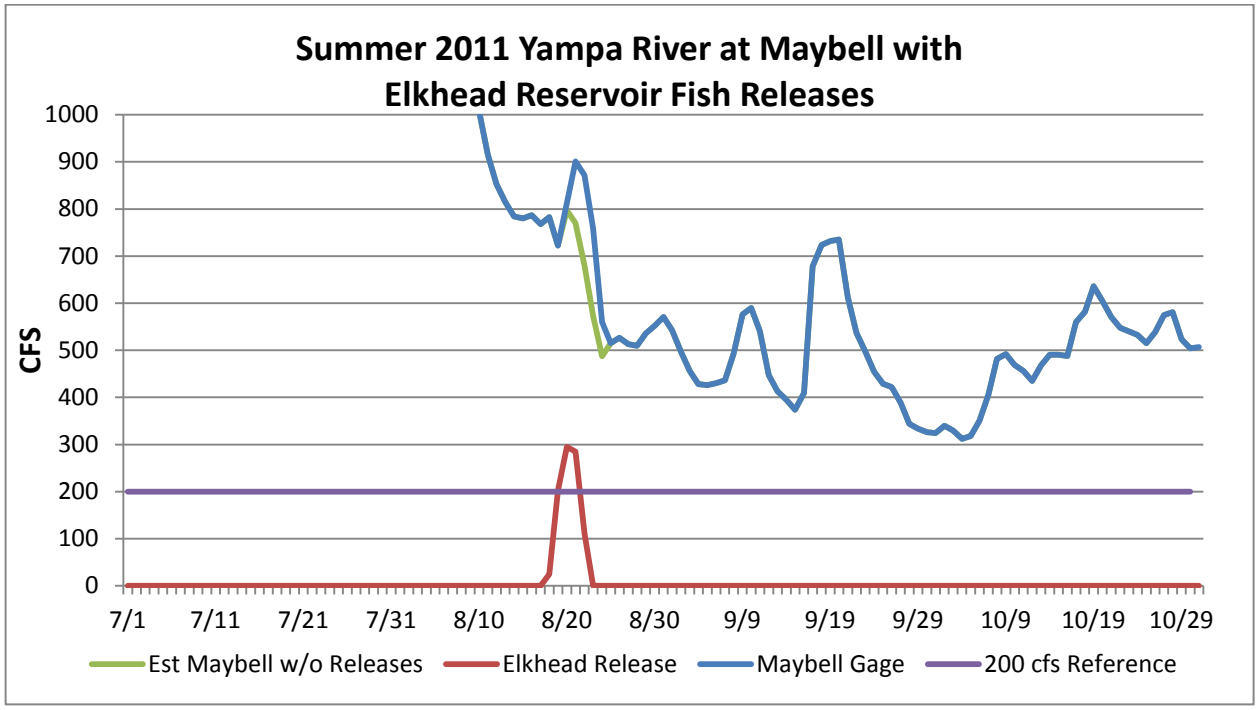
10/9
10/19
10/29
Est Maybell w/o Releases
Elkhead Release
Maybell Gage
134 cfs Target


Summer 2011 Yampa River at Maybell with Elkhead Reservoir Fish Releases
CFS
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7/1
7/11
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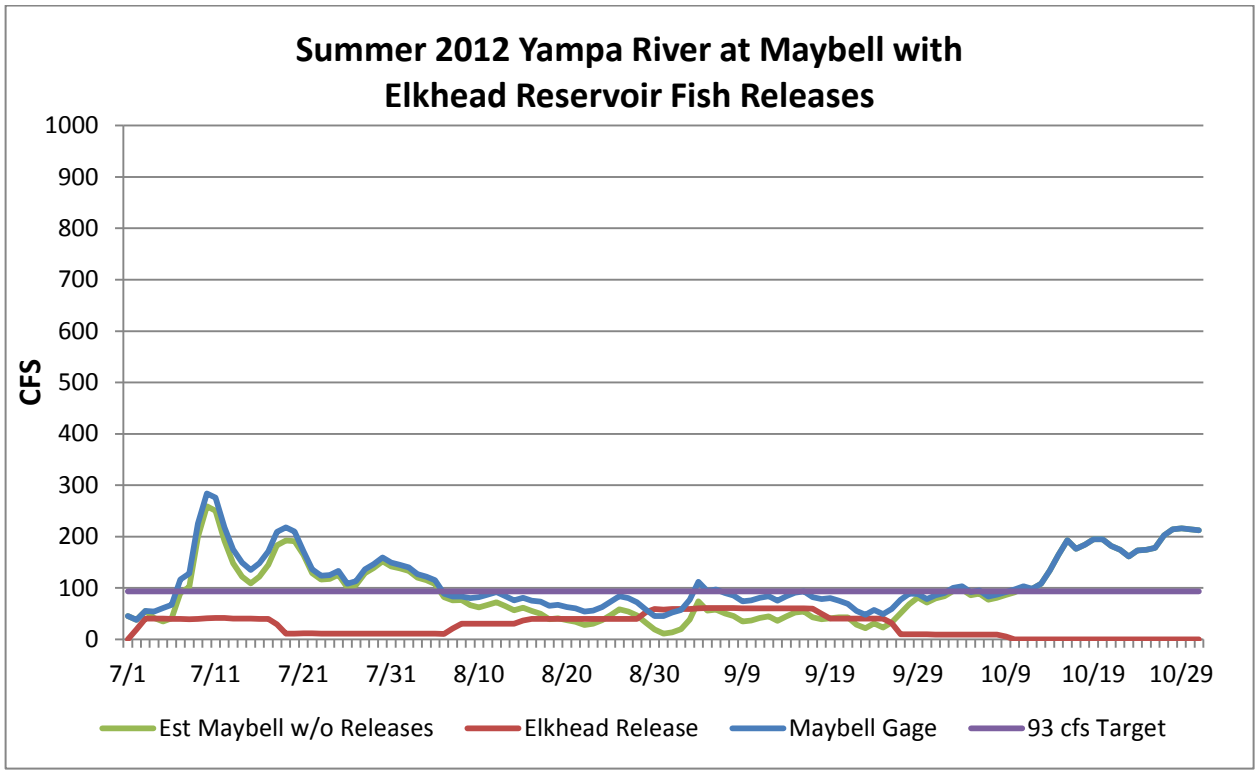
Est Maybell w/o Releases
Elkhead Release
Maybell Gage
200 cfs Reference


Summer 2012 Yampa River at Maybell with Elkhead Reservoir Fish Releases
CFS
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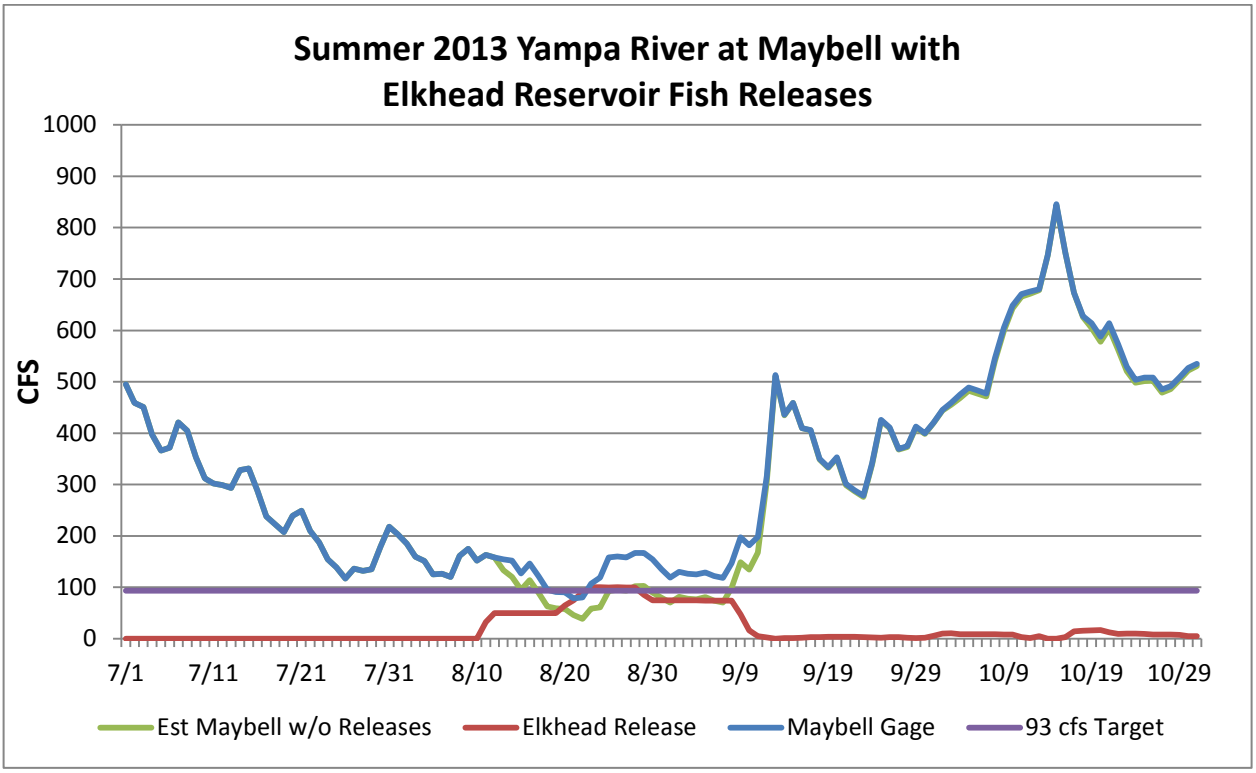
10/29
Est Maybell w/o Releases
Elkhead Release
Maybell Gage
93 cfs Target


Summer 2013 Yampa River at Maybell with Elkhead Reservoir Fish Releases
CFS
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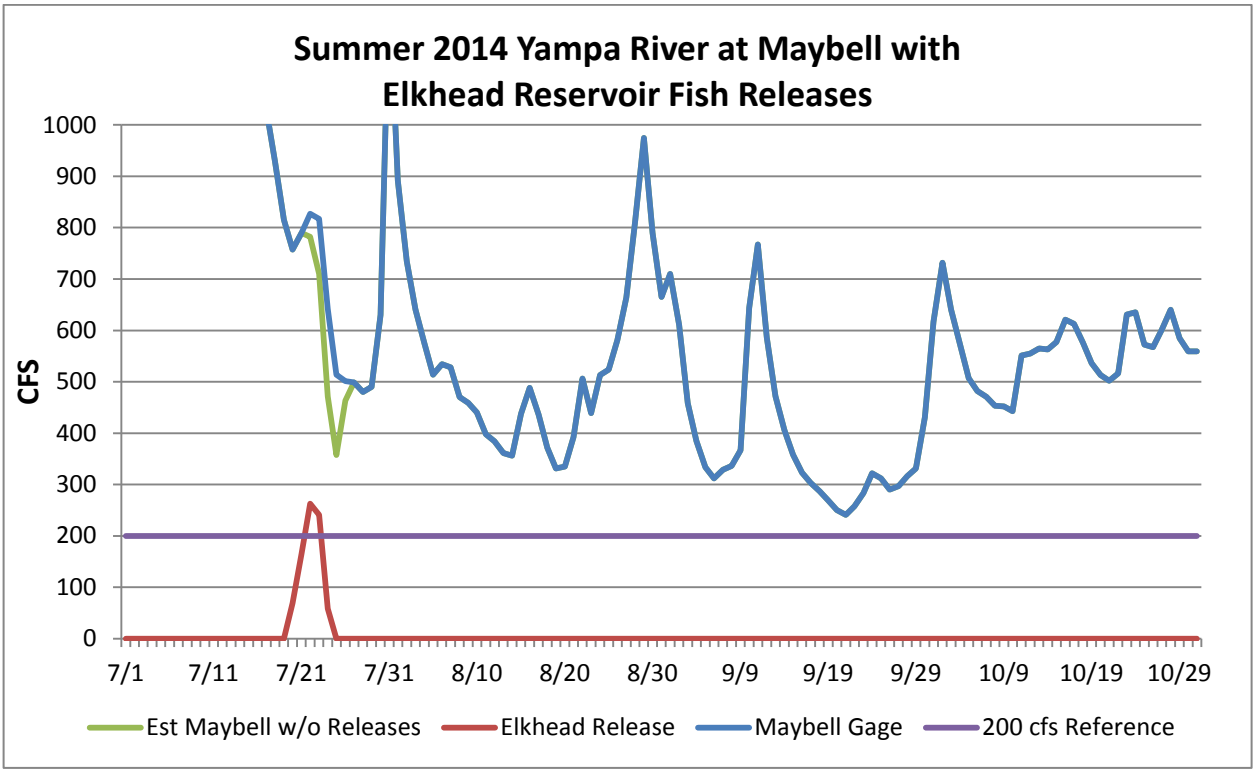
10/19
10/29
Est Maybell w/o Releases
Elkhead Release
Maybell Gage
93 cfs Target


Summer 2014 Yampa River at Maybell with Elkhead Reservoir Fish Releases
CFS
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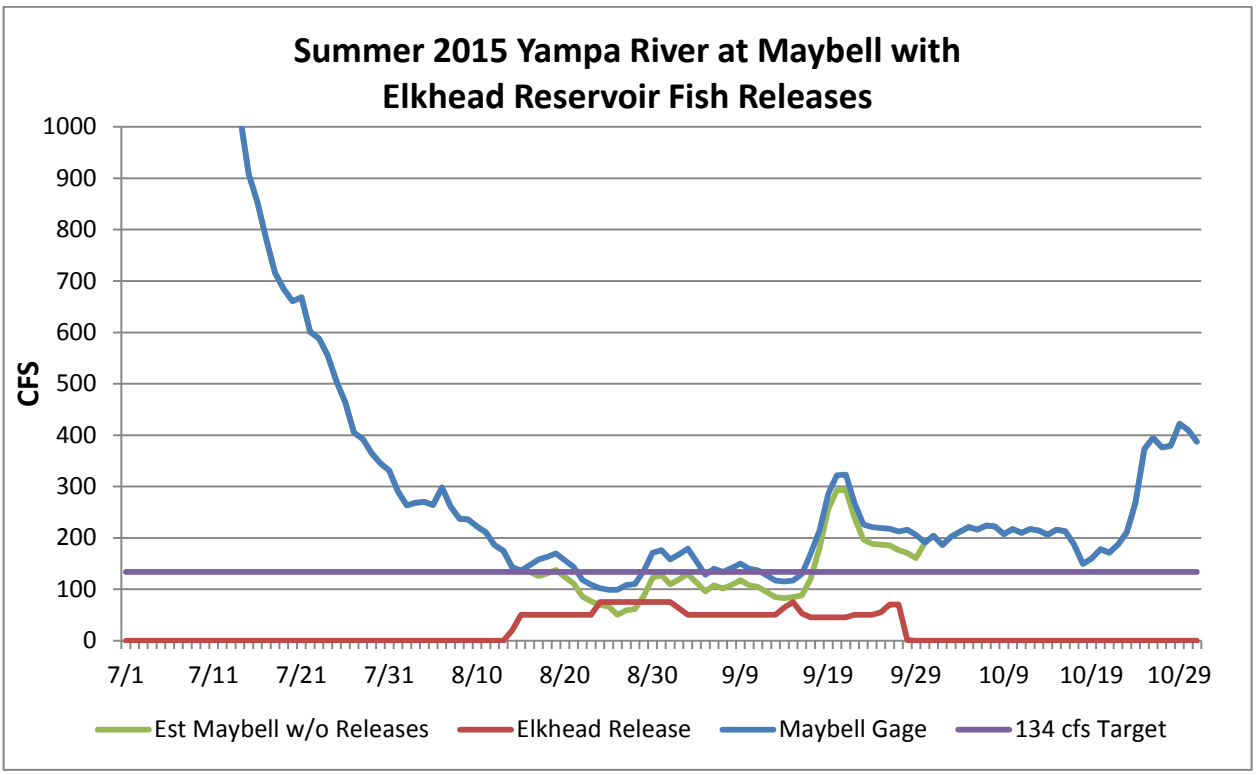
10/19
10/29
Est Maybell w/o Releases
Elkhead Release
Maybell Gage
200 cfs Reference


Summer 2015 Yampa River at Maybell with Elkhead Reservoir Fish Releases
CFS
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7/11
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7/31
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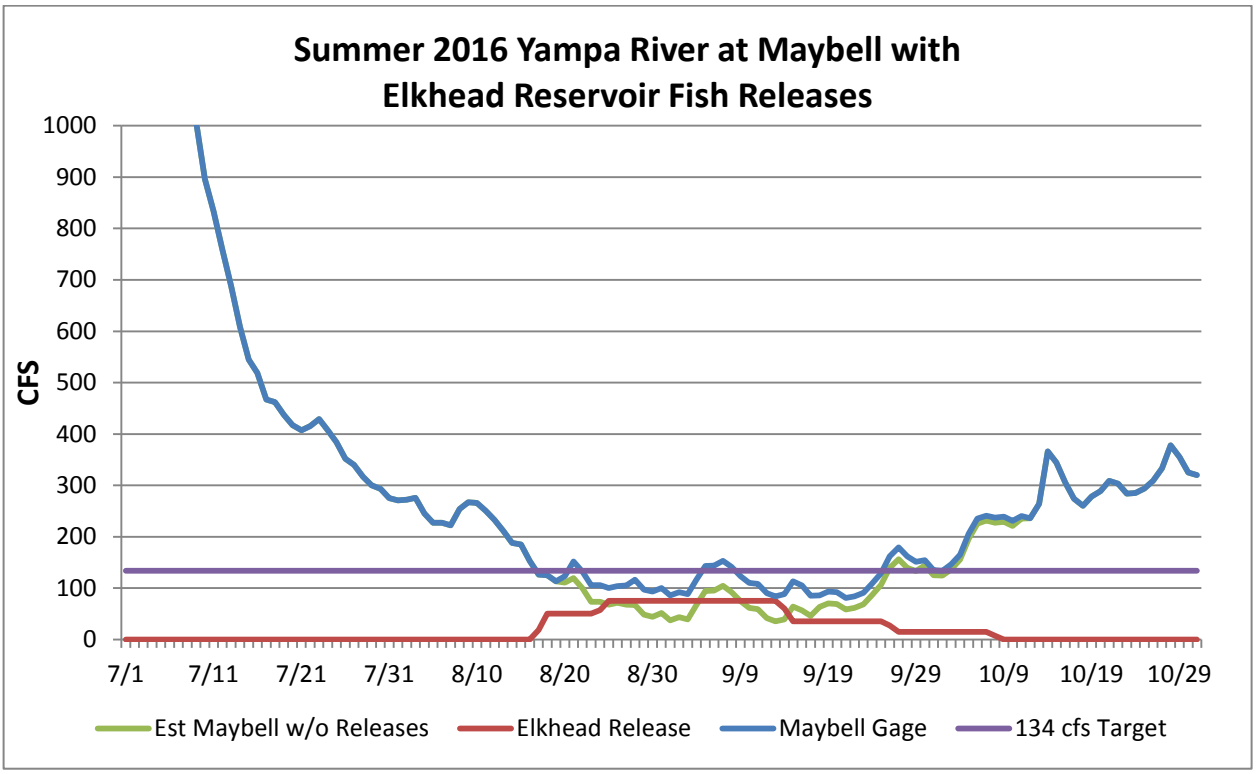
8/20
8/30
9/9
9/19
9/29
10/9
10/19
10/29
Est Maybell w/o Releases
Elkhead Release
Maybell Gage
134 cfs Target


Summer 2016 Yampa River at Maybell with Elkhead Reservoir Fish Releases
CFS
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7/21
7/31
8/10
8/20
8/30
9/9
9/19
9/29
10/9
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Est Maybell w/o Releases
Elkhead Release
Maybell Gage
134 cfs Target

2018 WATER USE AGREEMENT

This 2018 Water Use Agreement ("Agreement") is entered into by and between the COLORADO WATER TRUST ("Water Trust"), a Colorado nonprofit corporation and UPPER YAMPA WATER CONSERVANCY DISTRICT, a Colorado water conservancy district ("Upper Yampa"), collectively, the Parties.

RECITALS

A. Water Trust is a Colorado nonprofit dedicated to restoring streamflow to Colorado's rivers in need through voluntary, market-based efforts. Water Trust and Upper Yampa have worked together in five of the last six years to provide additional water to the Yampa River to support environmental and consumptive uses of the Yampa River.

B. As of June 1, 2018, runoff forecasts for the Yampa River indicate April through July discharge volume to be 72-84% percent of average. Water Trust and other Yampa River partners wish to again purchase water out of Upper Yampa's Stagecoach Reservoir to help meet in-river needs.

C. Upper Yampa has stored water in Stagecoach Reservoir on the Yampa River under the absolute storage water rights described in Appendix A ("Water Rights"). The Water Rights are decreed for several uses, including municipal use. Upper Yampa wishes to contract with Water Trust to release up to 600 acre-feet of water stored in Stagecoach Reservoir pursuant to the Water Rights ("Stored Water") to Water Trust. Water Trust intends to subcontract the Stored Water to water users for the Water Rights' decreed uses downstream of Lake Catamount, including but not limited to the City of Steamboat Springs for decreed municipal uses at either or both the City's Recreational In-Channel Diversion decreed in Case No. 03CW86 and/or the City's wastewater treatment outfall downstream of the City ("Subcontracted Uses").

D. Upper Yampa has designated certain pools of water within the Reservoir for the purpose of administration of the storage and release of water from the Reservoir, as follows:

   (i) 7,000 acre-feet of water allocated to Tri-State or its successors or assignees, or the municipal or industrial allottees of water from Stagecoach Reservoir who contract for all or part of the 7,000 acre-feet allotted to Tri-State if Upper Yampa's current contract with Tri-State for 7,000 acre-feet from Stagecoach is terminated or released or amended in whole or in part ("Tri-State Pool");

(ii) 2,000 acre-feet allocated for municipal use pursuant to existing contracts between Upper Yampa and such contracting entities or the municipal or industrial allottees of water from Stagecoach Reservoir who contract for all or part of the 2,000 acre-feet allotted to such contracting municipal users if Upper Yampa's current contract with any such municipal user for water from Stagecoach is terminated or released or amended in whole or in part ("Municipal Pool");

(iii) 2,000 acre-feet of water allocated for augmentation use pursuant to the decree entered in Case No. 06CW49, Water Division 6 ("Master Augmentation Pool");

(iv) 4,000 acre-feet of water formerly under contract to Tri-State and deliverable out of Yamcolo Reservoir pursuant to an exchange agreement which expired and was not renewed ("Exchange Pool");

(v) 3,164 acre-feet of water not currently under contract which represents the increase in capacity of the Reservoir resulting from the raise in the level of the spillway completed in 2011 ("Raise Pool");

(vi) 3,125 acre-feet of water not currently under contract which represents the remaining capacity of the Reservoir not allocated to the pools described in paragraphs 1(b)(i) through (v) above or 1(b)(vii) below ("Preferred Remainder Pool");

(vii) 15,000 acre-feet of water not currently under contract which represents the remaining capacity of the Reservoir not allocated to the pools described in paragraphs 1(b)(i) through (vi) above ("Emergency Remainder Pool");

(viii) Upper Yampa has agreed to make a one-time allotment of water to Water Trust of 600 AF of Stored Water in 2018, all of such water to be delivered from the Raise Pool, as hereinafter set forth.

E. Subject to the terms of this Agreement, Water Trust will pay Upper Yampa for the use of Stored Water.

NOW THEREFORE, in consideration of the mutual agreements contained herein and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Water Trust and Upper Yampa agree as follows:

USE OF WATER RIGHTS

1. Term. The term of this Agreement shall be from the effective date of this Agreement, until November 1, 2018 ("Term").

2. Purchase Price and Payment Procedure.

   a. For and in consideration of the payment of forty and 23/100 dollars ($40.23)("Purchase Price") per acre-foot paid to Upper Yampa by Water Trust, Upper Yampa shall release to Water Trust up to 600 acre-feet of Stored Water to be used by Water Trust in accordance with the provisions hereof. The total amount paid under this Agreement will be $24,138.

   b. Water Trust shall pay Upper Yampa the entire purchase price no later than October 15, 2018.

3. 2018 Price Guarantee. If available as determined by Upper Yampa and pursuant to a separate agreement, the Water Trust may purchase up to an additional 3,400 acre-feet of Stored Water in 2018 at forty and 23/100 dollars ($40.23) per acre-foot to be delivered from the Raise Pool and/or the Exchange Pool as determined by Upper Yampa.

4. First Use of Water Released. The first use of the Stored Water may be for hydropower by Upper Yampa, a decreed use of the Stored Water.

5. Subsequent Uses of Water Released. Water Trust, for the Stored Water's decreed uses, may subcontract the use of the Stored Water for Subcontracted Uses. Upper Yampa shall release the Stored Water in rates and at times as the Water Trust requests, except that Upper Yampa shall not be required to release water in excess of the amount of water that can be released through Upper Yampa's hydroelectric generating facilities. It is further understood that the Stored Water will be released at the outlet of Stagecoach Reservoir, that all losses by evaporation prior to release and during transit after release will be borne by Water Trust, that ramping rates must be approved by Upper Yampa, and that any part of the Stored Water not released before November 1, 2018, will revert to the ownership of Upper Yampa, and Water Trust will not have the right to call for the release of such Stored Water after October 31, 2018, for any purpose. Water Trust agrees in good faith to seek to find additional downstream uses of the Stored Water below the lowest structure in the City's Recreational In-Channel Diversion and within Upper Yampa's boundaries, provided that the arrangements for such uses and the control and delivery for such uses, and any compensation for such delivery for such uses, shall belong solely to Water Trust in conjunction with administration of such delivery by the Division Engineer, and Upper Yampa has no responsibility for such arrangements or implementing such arrangements beyond the release of the Stored Water at the Stagecoach Reservoir dam in accordance with this Agreement.

6. Insufficient Water. If insufficient water is stored in Stagecoach Reservoir to supply the full allocations for municipal, agricultural, industrial and other users holding contracts within Upper Yampa for allotments of water, as measured at time of peak annual storage, then the water in Stagecoach Reservoir shall be allocated to the pools described in Paragraph E above in the descending order listed in such paragraphs so that each pool is completely filled before any water is allocated to the next pool. It is agreed that the one time allotment of water to Water Trust under this Agreement consists of 600 acre-feet to be delivered from the Raise Pool. It is further agreed that water to be delivered under this Agreement from the Raise Pool shall entirely abate before any abatement of the 15,000 acre-feet allocated to the Tri-State Pool, the Municipal Pool, the Master Augmentation Pool, or the Exchange Pool. If there is less than 3,164 acre-feet of water in the Raise Pool at the time of peak annual storage, then the water allocated to all parties holding contracts in such pool shall abate proportionally so that such parties shall receive a prorated portion of their allotment. Provided, however, that Upper Yampa, at its sole discretion, may deliver some or all the water allocated to Water Trust under this Agreement from the Tri-State Pool, the Municipal Pool, the Master Augmentation Pool, or the Exchange Pool. If any part of the water allocated to Water Trust by this Agreement is to be reduced by abatement as provided herein, Upper Yampa shall notify Water Trust in writing of such fact and the amount of reduction of such water by July 16, 2018 and in the absence of such notice the full amount of water for Water Trust shall be deemed to have been in storage on or by July 16, 2018. If such notice of abatement occurs, the purchase price shall be adjusted accordingly.

7. Inspections. Upper Yampa grants Water Trust staff and any of their representatives access to the Stagecoach Reservoir subject to the Agreement at reasonable times to ensure compliance with the terms of the Agreement.

8. Miscellaneous Provisions.

   a. Water Trust may take such action as, in its sole discretion, is necessary or desirable to protect the use of the Stored Water for Subcontracted Uses. The Parties shall work together to provide information concerning implementation and monitoring of this Agreement.

   b. This Agreement shall not be assignable by any party without the prior written consent of the others.

   c. This Agreement obligates Upper Yampa to release the Stored Water presently in storage in Stagecoach Reservoir during the

period commencing on the date of this Agreement and terminating on November 1, 2018. The term of this Agreement ends unconditionally and absolutely on November 1, 2018. Upper Yampa has no obligation to renew this Agreement for subsequent years and may decline to do so in its absolute and sole discretion.

d. This Agreement does not and is not intended to confer any rights or remedies upon any person other than the Parties.

e. The Parties agree to coordinate, if needed, on any required or desired water use accounting.

f. It is expressly acknowledged that Upper Yampa shall be solely responsible for operating, repairing and maintaining Stagecoach Reservoir and that Upper Yampa shall be the sole owner of the Water Rights and the dam and all facilities used in connection with the construction, operation, repair, and maintenance of Stagecoach Reservoir.

g. Any notices required or permitted hereunder shall be sent to the addresses or email addresses set forth below, as may be changed from time to time by proper notice.

If to Water Trust:

Colorado Water Trust
1420 Ogden St., Suite A2
Denver, CO 80218
Attn: Mickey O'Hara, mohara@coloradowatertrust.org
Attn: Zach Smith, zsmith@coloradowatertrust.org

If to Upper Yampa:

Upper Yampa Water Conservancy District
P.O. Box 775529
Steamboat Springs, CO 80477
Attn: Kevin McBride, kmcbride@upperyampawater.com

With copy to:

Weiss and Van Scoyk, LLP
600 S. Lincoln Avenue, Suite 202
Steamboat Springs, CO 80487
Attn: Robert G. Weiss, bweiss@wvsc.com

9. Limited Representations By Upper Yampa.

a. Upper Yampa represents and warrants that it has full power and authority to execute this Agreement, allocate and deliver the Stored Water, and perform its obligations hereunder.

b. Upper Yampa represents and warrants that the Stored Water exists in Stagecoach Reservoir as of the execution of this Agreement, and has been so stored in compliance with decreed terms of existing Water Rights decrees for Stagecoach Reservoir prior to the date of execution of this Agreement.

10. Enforcement of this Agreement.

a. Pursuant to section 37-92-102(3), C.R.S., the terms of this Agreement shall be enforceable by each party as a water matter in a court of competent jurisdiction; provided, however, that before commencing any action for enforcement of this Agreement, the party alleging violation shall notify the other parties in writing of the alleged violation and the parties shall make a good faith effort to resolve their differences through informal consultation.

b. Specific performance of this Agreement shall be the exclusive remedy for the failure of either party to comply with any provision of this Agreement.

11. Effective Date. The effective date of this Agreement shall be the date it is executed by all parties.

IN WITNESS HEREOF, Water Trust and Upper Yampa have executed this Agreement.

UPPER YAMPA WATER
CONSERVANCY DISTRICT

By: _____ Pres. UYWCD Board

Date: 7/12/18

COLORADO WATER TRUST

By: _____
Andy Schultheiss
Executive Director

Date: 7/12/18