



COLORADO
Division of Water Resources
Department of Natural Resources
Water Division 5 - Main Office

STATE LINE DELIVERY PILOT RESERVOIR RELEASE

Conducted September 2020

REPORT

Prepared by the Colorado Division of Water Resources
April 1, 2021



John P. Elliott dam (Homestake Reservoir) with Homestake Creek in the foreground, photo by James Heath



State Line Delivery Pilot Reservoir Release Report

Introduction	4
Background	4
Authority	5
Purpose of the Report	6
River Conditions	9
General Conditions	9
Pre- Release Activities	11
The Cities' Efforts	11
Coordination with Local Entities	11
Coordination with HUP Partners	11
DWR's Efforts	12
Coordination with HUP Partners	12
United States Geological Survey	12
Colorado Basin River Forecast Center	12
National Weather Service	12
Coordination with Water Users	13
Endangered Fish Recovery Program	13
Hydropower Operations	13
Other Water Users	13
Implementation of Reservoir Release	13
Operations of the Homestake Reservoir Release	13
Administration of the Reservoir Release	15
Reservoir Release Administration	15
Eagle River Basin Administration	15
Colorado River Administration	16
Operations of Other Entities	16
Shoshone Power Plant Operations	16
Reservoir Operations (other than Green Mountain)	16
Green Mountain Reservoir HUP Operations	18
Gunnison River Operations	19
Grand Valley Irrigation Company Operations	19
Data Collection	19
Streamflow Gage Data	19

DWR Streamflow Measurement	20
USGS Streamflow Measurement	20
Provisional Diversion Records	21
Data Analysis	21
Transit Timing	21
CBRFC Forecast Model	21
Streamflow Gage Data	23
Real-Time Transit Timing Analysis	23
Final Transit Time Analysis	25
Eagle River Basin Graphs	25
Colorado River Basin Graphs	30
Shoshone Power Plant Forebay Release Transit Time Analysis	31
Transit Loss Analysis	32
Eagle River	32
Colorado River	37
Results	37
Administration	37
Transit Time	37
Transit Loss	38
Findings	39
Administration	39
Water User Operations	39
Communication	39
Large Flow Changes	39
Conclusion	40
References	
Appendices	
A. Letter from James Lochhead to Kevin Rein	
B. Protocol for Administration of the State Line Delivery Pilot Reservoir Release (An investigation conducted by the State Engineer pursuant to sections 37-80- 102(1)(f), C.R.S. and 37-92-301(1), and as further allowed by 37-92-102(1)(a))	
C. Reservoir Release Schedule	
D. Associated Approvals	
State Line Delivery Pilot Reservoir Release	

Introduction

Background

On August 25, 2020, Colorado Springs Utilities, Aurora Water and Pueblo Board of Water Works (“the Cities”) submitted a proposal to Kevin Rein, State Engineer, to release water from Homestake Reservoir, to successfully account for release, and shepherding of water within Colorado to the State Line (“Proposal”). The water to be released would be water the Cities would have otherwise diverted to the East Slope for beneficial use pursuant to their water rights decrees. The Proposal formalized discussions that the Cities had initiated with the State Engineer’s Office in preceding weeks regarding the nature and purpose of the release of water from Homestake Reservoir. The Cities’ Proposal is attached as Appendix A to this State Line Delivery Pilot Reservoir Release Report (“Report”).

The Proposal requested that the State Engineer administer the released water (“Reservoir Release”) from Homestake Reservoir, through Homestake Creek, the Eagle River, and the Colorado River to the Colorado-Utah state line without the water being diverted or consumed by downstream water rights. In consideration of the Cities’ Proposal, the State Engineer’s Office developed a document to memorialize the anticipated administration and accounting operations of the Reservoir Release entitled “Protocol for Administration of the State Line Delivery Pilot Reservoir Release” (“Administrative Protocol”) The Administrative Protocol is included in Appendix B to this State Line Delivery Pilot Reservoir Release Report (“Report”).

The stated objective of the Reservoir Release was to allow a one-time release of water from Homestake Reservoir to determine the efficacy of current administration practices to shepherd the released water in the Colorado River and its tributaries from Homestake Reservoir to the state line. The Reservoir Release would then allow the State Engineer to investigate important aspects of administration practices during streamflow and hydrologic conditions that may not otherwise present themselves, as well as to record and analyze hydrologic influences that would affect the timing and amount of the arrival of the released water at the state line. The results of the Reservoir Release would then provide the State and Division Engineers (“Engineers”), water users, and stakeholders with valuable information that would help plan for administration practices during compact administration in order to comply with the Colorado River Compact and the Upper Colorado River Compact, if actions would become necessary.

The Homestake System is a trans-mountain diversion project located in the headwaters of the Eagle River in the Colorado River basin. The water diverted by the Homestake System and stored in Homestake Reservoir is delivered to the East Slope for municipal purposes and is therefore 100-percent depletive to the Colorado River basin. As such, the Reservoir Release consisted of water that would not otherwise have been in the stream system downstream of Homestake Reservoir in Homestake Creek,

the Eagle River, or the Colorado River and was, therefore, available for purposes of the State Engineer's investigation to make the determinations in the stated objective.

The Reservoir Release occurred between September 23, 2020, at approximately 8:00 a.m. and September 29, 2020, shortly after 12:00 p.m. During that time, the release gradually increased from a discharge of 26 cfs to 174 cfs, which peak occurred at 12:15 pm on September 24, then gradually decreased until the Reservoir release ended on September 29 at 12:00 pm. A total volume of 1,666.9 acre feet was released.

The Administrative Protocol was prepared by the Engineers and the Cities. See Appendix B.

The Reservoir Release occurred in coordination with the Cities and others as described in the sections *Pre-Release Activities* and *Implementation of the Reservoir Release* later in the Report; and after the State Engineer's Office informed the Colorado River Water Conservation District of the Reservoir Release.

This Report was developed and prepared by the Engineers in consultation with the Cities and the Colorado River Water Conservation District, and with data contributed by other parties, as mentioned in the report below.

Authority

The Reservoir Release occurred in accordance with the authority set forth in Colorado Revised Statutes §§ 37-80-102(1)(f), (h), (k), 37-92-301(1) and as further allowed by 37-92-102(1)(a).

The applicable Colorado Revised Statutes establish the responsibility and the authority of the State Engineer for "the keeping and preparation of records and investigations as related to carrying out the functions of the division of water resources..." to engage in activities "as may be reasonably necessary to enable the state engineer to secure the effective and efficient operation of the division of water resources..." the authority to "[d]ischarge the obligations of the state of Colorado imposed by compact..." and to "be responsible for the administration and distribution of the waters of the state."

The development of the Administrative Protocol, the Reservoir Release, and the Engineers' Investigation that is documented in this Report occurred pursuant to these applicable state statutes and Colorado Supreme court precedent as to the State Engineer's authority to conduct such an investigation. However, nothing in the Engineers' Investigation establishes or acts as precedent for future investigations.

Nothing in the Engineers' Investigation is intended to be authorized by, or otherwise relate to, or considered to be a component of the feasibility investigation of a Demand Management program in Colorado. Nothing in the Engineers' Investigation establishes or acts as precedent for any operational and administrative elements of a potential future Demand Management program in Colorado.

Nothing in the Engineers' Investigation establishes or acts as any precedent for administering water in the State of Colorado, whether for intrastate administration or

Compact administration. Neither the Investigation nor the stated authority to conduct it will be interpreted or construed as establishing a precedent for implementing administrative practices or rules and regulations based on the elements contemplated by the Engineers' Investigation. Notwithstanding anything in the Administrative Protocol and this Report to the contrary, nothing in the Investigation prevents the State Engineer from engaging in acts related to this Investigation as may be reasonably necessary to enable the State Engineer to secure the effective and efficient operation of the Division of Water Resources.

Purpose of the Report

The purpose of the Reservoir Release was for the Engineers to conduct an administrative investigation and record the results to observe transit times and amounts originating from an Upper Colorado River basin headwaters reservoir in Colorado, to the state line and to identify and better understand administration issues that may be related to compact administration during streamflow and hydrologic conditions that may not otherwise present themselves.

In order to accomplish the purpose of the investigation pursuant to the authorities provided above, the Engineers outlined in the Administrative Protocol two administrative determinations: (1) the bypass of Reservoir Release water past calling water rights; and (2) the verification of the reduction in the amount of water diverted to the East Slope.

To determine potential impacts from the bypass of Reservoir Release water to calling water rights, the Engineers analyzed flow data in the identified reaches prior to the Reservoir Release and during the Reservoir Release. This analysis led to an administration approach that helped ensure that the Reservoir Release did not change the extent to which water rights were able to divert compared to the amount they would have diverted had there been no Reservoir Release water in the system.

To ensure that no expansion of the Cities' right to use water from their West Slope sources occurred as a result of the Reservoir Release, the Engineers also included in the Administrative Protocol requisite elements of a verification plan to be completed by the Cities to demonstrate the permanent reduction of water diverted by the Cities to the East Slope. Note that some steps of the verification plan will be completed after the date of this Report.

The elements of the verification plan to be accomplished by the Cities include demonstrating that a) there was space available on the East Slope to take and use the volume of water that was subject of the Reservoir Release; b) Homestake Tunnel deliveries of water stored during the 2020 diversion season were reduced, as demonstrated by a comparison of expected Homestake Tunnel operations compared to actual Homestake Tunnel operations that occurred as a result of the Reservoir Release; and c) the actual Homestake Tunnel deliveries during the 2020-2021 operation period do not create additional space in Homestake Reservoir to allow for greater storage in the 2021-2022 operation period. Upon review of all elements of the completed verification plan under part 4.5 of the Administrative Protocol, the

Engineers will work with the Cities or take other actions as necessary to ensure that no expansion of the water right occurred or will occur as part of the Engineers' verification.

As noted above, not all elements of the verification plan will be complete as part of this Report. The State Engineers Office will release a Supplemental Report to this Report when all elements are complete. The objective of the Supplemental Report will be to make a finding that the verification plan has satisfied all the elements to ensure no injury occurred to West Slope water rights as a result of the Reservoir Release or, if the State Engineer's Office cannot make that finding, to describe other administrative actions to prevent injury from occurring. Neither this Report, nor the Supplemental Report will make a finding that the elements of the verification plan are applicable during actual Compact administration.

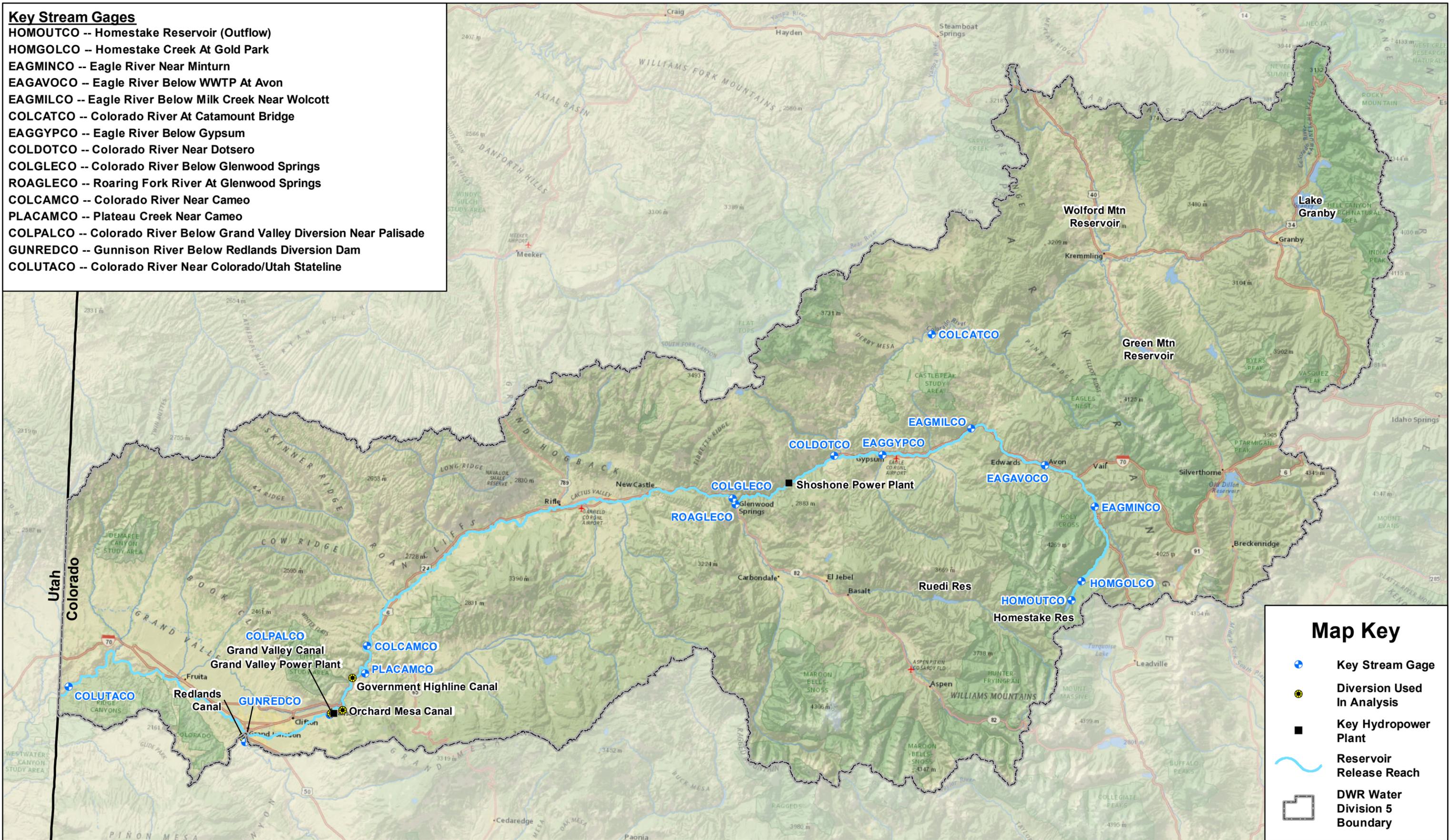
The State Engineer finalized the Administrative Protocol and executed the Reservoir Release in consultation with certain groups, as later identified in this Report, after they determined that the planned bypasses of the Reservoir Release water would not deprive West Slope water users of water that would have otherwise been present in Homestake Creek, the Eagle River, and the Colorado River and the development of a verification plan intended to demonstrate that for the purposes of conducting the Reservoir Release, the Cities would reduce the amount of water diverted to the Front Range in the amount of the Reservoir Release and that it would not result in an expansion of the water right in time and amount.

The State Engineer is encouraged by the results of the Engineers' Investigation and believes that it will help the Engineers, water users, and entities statewide to advance their planning for a potential future condition where there is a need for compact administration on the Colorado River and its tributaries in Colorado. To advance such planning efforts, the State Engineer determined that the results of the Engineers' Investigation set forth in this Report should be shared with interested stakeholders in Colorado and made available to the public.

This Report presents information about activities preceding the Reservoir Release, including the river conditions and other hydrologic considerations under which the Reservoir Release occurred; as well as the Cities' coordination with certain local entities and DWR's coordination with multiple parties; a description of the implementation of the Reservoir Release; a description of the data collection and analysis; and the results of the investigation associated with the Reservoir Release.

Key Stream Gages

- HOMOUTCO -- Homestake Reservoir (Outflow)
- HOMGOLCO -- Homestake Creek At Gold Park
- EAGMINCO -- Eagle River Near Minturn
- EAGAVOCO -- Eagle River Below WWTP At Avon
- EAGMILCO -- Eagle River Below Milk Creek Near Wolcott
- COLCATCO -- Colorado River At Catamount Bridge
- EAGGYPCO -- Eagle River Below Gypsum
- COLDOTCO -- Colorado River Near Dotsero
- COLGLECO -- Colorado River Below Glenwood Springs
- ROAGLECO -- Roaring Fork River At Glenwood Springs
- COLCAMCO -- Colorado River Near Cameo
- PLACAMCO -- Plateau Creek Near Cameo
- COLPALCO -- Colorado River Below Grand Valley Diversion Near Palisade
- GUNREDCO -- Gunnison River Below Redlands Diversion Dam
- COLUTACO -- Colorado River Near Colorado/Utah Stateline



Map Key

-  Key Stream Gage
-  Diversion Used In Analysis
-  Key Hydropower Plant
-  Reservoir Release Reach
-  DWR Water Division 5 Boundary

River Conditions

Leading up to the Reservoir Release, the Colorado River basin within Colorado had a peak snow pack of 108 percent of normal, which generated near average streamflow runoff through the beginning of June. Peak runoff for 2020 occurred at the beginning of June on both the Eagle and Colorado Rivers. Summer precipitation was below average and resulted in below average streamflow through the remainder of the summer and fall. Streamflow dropped to near winter baseflow conditions by September. Streamflow conditions during the Reservoir Release were below normal. The streamflow conditions that occurred during the Reservoir Release were conditions that could also be present during compact administration.

With the lower flows throughout the summer, the Colorado River went on call beginning on July 24, 2020, with a call placed at the Shoshone Power Plant and then on July 30, 2020, with a call placed at the Grand Valley Canal. On September 22, 2020, just prior to the Reservoir Release, the Shoshone Power Plant went down for planned maintenance prior to winter and that call came off the river. The call at the Grand Valley Canal remained on throughout the Reservoir Release.

Reservoir operations throughout the basin leading up to the Reservoir Release were typical operations - passing inflows and making releases for evaporation, augmentation, Historic User Pool beneficiaries, and enhanced flows in the 15-Mile Reach.

General Conditions

The week prior to the Reservoir Release, the National Weather Service provided two weather outlook briefings. The weather forecast was for a high-pressure ridge to dominate with temperatures near to above normal and very little precipitation for much of the time around the Reservoir Release. During the Reservoir Release a minor storm system moved through and brought cooler temperatures and minor precipitation (0.00 - 0.03 in total precipitation between 9/22/2020 - 10/6/2020 from Community Collaborative Rain, Hail & Snow Network (CoCoRaHS) locations, as depicted on the map below). The minimal precipitation that occurred during the Reservoir Release had no significant effect on the gaged streamflow.

Pre- Release Activities

To ensure a common understanding of how the Reservoir Release would be executed and how accounting related to the Reservoir Release would be done, the State Engineer's Office completed the Administrative Protocol on August 28, 2020. The State Engineer's Office developed the Administrative Protocol in cooperation with the Cities and the Cities accepted the Administrative Protocol and its use in executing the Reservoir Release.

The Administrative Protocol designated a contact for the Cities ("Cities' Contact") and for DWR ("DWR Contact") to manage communications during the Reservoir Release. The Cities' Contact was Kalsoum Abbasi with Colorado Springs Utilities and the DWR Contact included both Alan Martellaro, Division 5, Division Engineer and James Heath, Division 5, Lead Assistant Division Engineer.

In early September the Cities' Contact submitted and DWR reviewed a Reservoir Release Schedule to start on September 23, 2020. Appendix C.

On September 17, 2020, the State Engineer accepted the request of the State Line Delivery Pilot Reservoir Release of the FRWC, see Appendix D. The approval outlined the terms by which the Reservoir Release would be administered and in the response to the Cities, the State Engineer included the Administrative Protocol.

The Cities' Efforts

Coordination with Local Entities

On September 9, 2020, the Cities' Contact sent an email to the Eagle County local interests to inform them of the upcoming Reservoir Release. Recipients included several representatives from Eagle County and various emergency response, utility and municipal representatives from communities along the Eagle River. Recreational interests and the US Forest Service were also contacted so they would be aware of increased flow along Homestake Creek and the Eagle River.

Coordination with HUP Partners

On September 11, 2020, the Cities' Contact sent an email to the HUP Weekly Coordination Meeting email distribution list to inform them of the upcoming Reservoir Release and at the September 16, 2020, HUP Weekly Coordination Meeting, Justin Zeisler, Senior Project Engineer, with Colorado Springs Utilities provided the group with background on the Reservoir Release and an overview of the Reservoir Release Schedule.

DWR's Efforts

Coordination with HUP Partners

On September 11, 2020, following the Cities' Contact's email sent out to the HUP email distribution list, the DWR Contact sent an email communication to some of the technical partners on the HUP list - Steve Anders, USGS Data Section Chief; Cody Moser, Senior Hydrologist, Colorado Basin River Forecast Center; and Aldis Strautins, National Weather Service. This communication led to several collaborative efforts from the HUP technical partners, discussed immediately below.

United States Geological Survey

The USGS provided guidance on the accuracy of their streamgage data. The USGS anticipated that the 15-minute data for most of the streamgages would be excellent to good (within 5-8 percent of the true values). The USGS also identified streamgage sites that had less reliability but should still report with at least a "fair" rating. Those streamgages were - *Homestake Creek at Gold Park, CO*; *Eagle River near Minturn, CO*; *Colorado River below Glenwood Springs, CO*; and *Colorado River near Cameo, CO*. A general description of the USGS's record accuracy and citations were provided at:

<https://pubs.usgs.gov/sir/2006/5036/section7.html>
<https://waterdata.usgs.gov/nwis?provisional>

USGS staff performed a streamflow measurement at the *Homestake Creek at Gold Park, CO* gage on September 25, 2020, see *Data Collection* section below for additional information.

Colorado Basin River Forecast Center

DWR consulted with the Colorado Basin River Forecast Center ("CBRFC"). The CBRFC (NOAA/NWS) provides forecasts of water supply for the entire Colorado River basin. CBRFC provided insights on how their streamflow forecast model calculates transit times between modeled gaged locations. The methodology is dynamic based on the rate of flow in the stream, therefore, CBRFC did not provide a table of expected transit times and as a result, DWR decided to use DWR's historical transit time estimates for initial administration of the Reservoir Release. Further discussions between DWR and CBRFC led to the concept of completing streamflow forecast modeling immediately prior to the Reservoir Release to estimate the transit time to various gages. The results from the modeling are discussed in further detail in the *Data Analysis* section below.

National Weather Service

The National Weather Service provided weather briefings on September 16, 2020, and September 18, 2020, as discussed above in the *General Conditions* section. These weather briefings assisted DWR in planning to administer the Reservoir Release with an expectation of steady river conditions.

Coordination with Water Users

Endangered Fish Recovery Program

Don Anderson, Hydrologist/Instream Flow Coordinator Upper Colorado River Endangered Fish Recovery Program (“UCRIP”), with the U.S. Fish and Wildlife Service contacted DWR on September 15, 2020, to discuss possible changes to the fish flow releases from Ruedi, Granby, and Wolford Reservoirs. DWR and the UCRIP collaborated on how changes in the fish flow releases could be modified to both meet the needs of the recovery program while also not causing significant impact on the Reservoir Release study.

DWR consulted with the U.S. Bureau of Reclamation Western Area Office about any changes in Aspinall unit operations and any impact to flows in the Colorado River from its confluence with the Gunnison River downstream to the *Colorado River near Colorado-Utah State Line, CO* gage. No operational changes were anticipated.

Hydropower Operations

There are two hydropower plants that divert from the Colorado River, the upstream plant is Xcel Energy’s Shoshone Power Plant located in Glenwood Canyon below the *Colorado River near Dotsero, CO* gage and the downstream plant is the Grand Valley Power Plant that is located in Palisade, Colorado and receives its water from the Orchard Mesa Irrigation District’s canal that diverts at the Roller Dam from the Colorado River. Normal operations for the Power Plants are to divert all sources of water in the river, place it to hydropower generation use, and return the water back to the stream without consumptive use and injury to other water rights. These operations are authorized because the diversion and use for hydropower is non-consumptive and does not diminish the timing, quantity, or quality of the water for its intended beneficial downstream use. DWR informed the contacts at the Power Plants that they would be able to operate as normal during the Reservoir Release.

Other Water Users

In mid-September, shortly after the Cities’ communications with the Local Entities and HUP Partners, several water users contacted several different DWR staff requesting to exchange against the Homestake release along the Eagle River and/or to vary their operations to divert at alternate points of diversion that were precluded under decree terms and conditions at the lower flows. DWR denied these request since the exchanges and alternate operations could impact the study and therefore were not authorized to occur.

Implementation of Reservoir Release

Operations of the Homestake Reservoir Release

In order to properly analyze and administer the Reservoir Release as it occurred, DWR collected data before and during the Reservoir Release. DWR then analyzed the data collected for inclusion in this Report. Specifically, DWR:

- Increased observations of diversion structures along Homestake Creek, the Eagle River, and the Colorado River between Homestake Reservoir and the State Line before and during the Reservoir Release.
- Adjusted some of the above-mentioned diversion structures to ensure that they would not take more water than they were legally entitled to based on the flows excluding the Reservoir Release.
- Conducted a spot streamflow measurement to verify the release rate.

The anticipated Reservoir Release Schedule is provided in Appendix C. The actual releases, based on the *Homestake Reservoir (Outflow)* gage, are presented in the table below:

Date	Day	Time	Scheduled Release	Average Flow (cfs)	Deviation from Schedule (cfs)
9/23/2020	Wednesday	8:00	25	24	-1
		10:00	50	49	-1
9/24/2020	Thursday	8:00	75	73	-2
		10:00	125	120	-5
		12:00	175	173	-2
9/25/2020	Friday	hold	175	174	-1
9/26/2020	Saturday	hold	175	174	-1
9/27/2020	Sunday	hold	175	174	-1
9/28/2020	Monday	8:00	150	153	3
		10:00	125	127	2
		12:00	100	97	-3
9/29/2020	Tuesday	8:00	50	58	8
		10:00	25	29	4
		12:00	0	13	13

The actual releases from Homestake Reservoir matched reasonably well with the anticipated Reservoir Release Schedule. In the table directly above, the "Average Flow (cfs)" is the average of the 15-minute streamflow data measured at the *Homestake Reservoir (Outflow)* gage between time intervals, and the "Deviation from Schedule (cfs)" is the difference of the scheduled release for that time interval and the Average Flow for that interval. The Reservoir Release began at approximately 8:00 am on September 23, 2020, and ended shortly after 12:00 pm on September 29, 2020. The

total volume of water released from Homestake Reservoir was 1,667 af based on the *Homestake Reservoir (Outflow)* gage below the reservoir.

Administration of the Reservoir Release

Reservoir Release Administration

In order to administer the Reservoir Release past the calling water rights in the Grand Valley, beginning with the Roller Dam at Cameo and downstream past the Grand Valley Canal diversion dam, DWR made initial estimates of the anticipated transit time and transit losses based on timing and transit losses used to administer reservoir releases from other reservoirs within Division 5. The initial administrative values were:

- 1 day transit time with 5 percent loss from Homestake Reservoir to *Colorado River near Dotsero, CO* gage,
- 2 day transit time with 10 percent loss from Homestake Reservoir to the *Colorado River near Cameo, CO* gage.

It became apparent from gage observations shortly into the Reservoir Release Schedule that the transit time along the Eagle River would be longer than initially anticipated. On September 25, 2020, the initial administrative values were adjusted to be:

- 1.5 day transit time with 5 percent loss from Homestake Reservoir to *Colorado River near Dotsero, CO* gage,
- 2.5 day transit time with 10 percent loss from Homestake Reservoir to *Colorado River near Cameo, CO* gage.

Transit loss was not adjusted from the initial estimate nor was it analyzed in real-time during the Reservoir Release because flows measured at the gage below the calling location exceeded the required bypasses from all reservoir releases by 90 cfs or more based on a 24-hour average.¹

Eagle River Basin Administration

The Reservoir Release more than doubled the flows on the streams within the Eagle River basin along the Reservoir Release Reach. With the Reservoir Release being a significant proportion of the overall flow on Homestake Creek and the Eagle River, additional administrative actions were needed. Prior to the Reservoir Release, DWR water commissioners contacted ditch owners in the subject reach to notify them of the upcoming Reservoir Release. DWR observed actual diversions in the reach on September 22 and 23, 2020, prior to the Reservoir Release reaching the diversion structures. Additional observations were made at times when the Reservoir Release was at the diversion structures. In cooperation with the ditch owners, headgates were adjusted as needed to ensure that the ditches were receiving their in-priority amounts, while tracking the bypassed released reservoir water.

¹ Grand Valley Canal and into the 15-Mile Reach as measured at the *Colorado River below Grand Valley Diversion near Palisade, CO*

There were numerous ditches along the Eagle River that were taking less water than they were in priority to take prior to the Reservoir Release. The water right owners on these ditches had chosen in the past not to improve their diversion infrastructure to be able to capture the water that they were entitled to and therefore were considered to be satisfied by DWR. These structures were adjusted one or more times during the Reservoir Release to ensure that the ditch did not take more water during the Reservoir Release than they were taking prior to the Reservoir Release.

Of note, most water users were amenable to working with DWR through the Reservoir Release. However, through administration of the Reservoir Release on the Eagle River, with smaller flows, DWR learned that it may be necessary to actively administer structures.

Colorado River Administration

The increase in flows on the Colorado River from the Reservoir Release were a much smaller proportion of the overall flow compared to the Eagle River. As the Reservoir Release made its way down the Colorado River, water commissioners made additional observations of diversion structures in the subject reach and found that diversions did not change from pre-Reservoir Release conditions. Diversion structures through the subject stream reach are accustomed to bypassing flows for downstream uses. Therefore, no adjustments to diversion structures along the Colorado River were needed.

Operations of Other Entities

Shoshone Power Plant Operations

Just prior to the Reservoir Release on September 22, 2020, Xcel Energy decided to take the Shoshone Power Plant offline to complete maintenance prior to winter and that call came off the river. DWR coordinated with Xcel Energy to slowly drawdown the forebay to evacuate the tunnel over a 48-hour period, to minimize the impact to the downstream irrigators and complete the power plant operations prior to the Reservoir Release initially reaching the power plant's location. Late on September 23, 2020, drawdown of the forebay concluded but resulted in the release of a larger slug of water into the river at the end of the operation than initially planned. The approximately 700 cfs pulse of increased flow from the forebay drawdown put a distinct signal into the hydrograph at the *Colorado River below Glenwood Springs, CO* gage and downstream streamgages to the state line. This pulse was used to evaluate the transit time along the subject reach of the Colorado River between gages, as discussed in more detail below in the *Shoshone Power Plant Forebay Release Transit Time Analysis*. The Shoshone Power Plant remained offline for the duration of the Reservoir Release.

Reservoir Operations (other than Green Mountain)

The Reservoir Release prompted other entities to modify their reservoir release schedules.

Having been notified of the Reservoir Release, the UCRIP chose to adjust their planned reservoir releases to the 15-Mile Reach because of the additional water that would be in the system from the Reservoir Release.

The week leading up to the Reservoir Release, the UCRIP was making releases from three upstream reservoirs at consistent release rates:

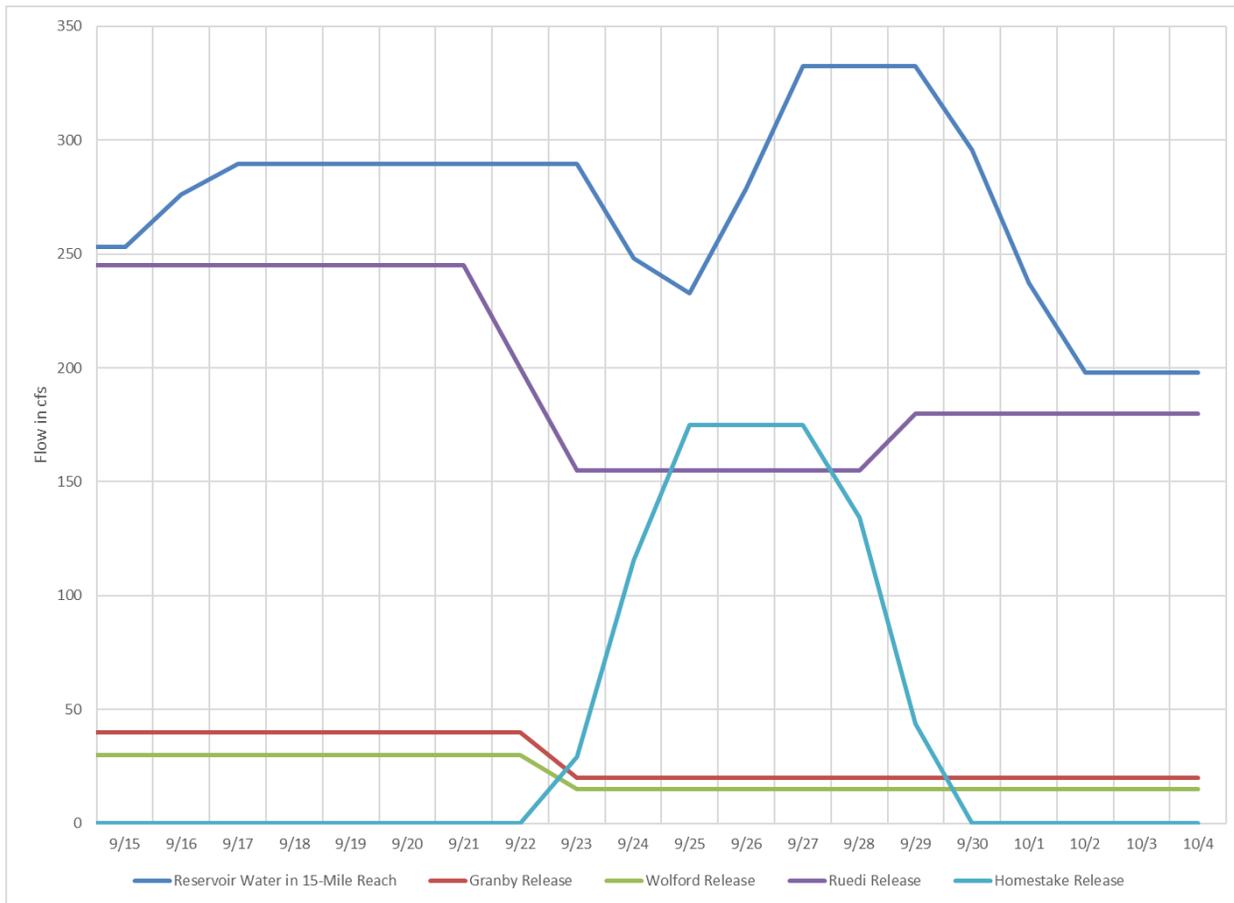
- Granby Reservoir - 40 cfs
- Wolford Reservoir - 30 cfs
- Ruedi Reservoir - 245 cfs

At the start of the Reservoir Release, the UCRIP made the following adjustments to their releases:

- Granby Reservoir - On 9/23 reduced to 20 cfs
- Wolford Reservoir - On 9/23 reduced to 15 cfs
- Ruedi Reservoir - On 9/22 reduced to 185 cfs and on 9/23 reduced to 155 cfs

These adjusted UCRIP releases continued throughout the Reservoir Release until September 29, 2020, when the release at Ruedi Reservoir was increased to 172 cfs.

The adjusted release schedules described above, intentionally created a small lag between the changed releases and the Reservoir Release to be able to distinguish between the two different sources of reservoir water being released through the 15-Mile Reach. The graph below shows the idealized planned adjusted release schedules and the impact on the flows in the 15-Mile Reach with the lag between the arrivals of the upstream reservoir release reductions and the Reservoir Release. The intent of this lag was to help identify the amount of time that it took for the Reservoir Release to reach the *Colorado River below Grand Valley Diversion near Palisade, CO* gage.



The intent for the reduced releases was to extend the length of the releases this season for the benefit of the critical habitat in the 15-Mile Reach.² Granby, Wolford, and Ruedi reservoirs continued with their other regular release operations.

Denver Water also continued to operate Dillon and Williams Fork reservoirs as they normally would.

Green Mountain Reservoir HUP Operations

Due to drier than average conditions in 2020, Green Mountain Reservoir’s Historic User Pool (“HUP”) direct delivery releases to the irrigation water rights in the Grand Valley began on August 6, 2020. The water users recognized early on that the HUP might run out prior to the end of the irrigation season if full replacements and direct deliveries would have been made through the irrigation season. The Grand Valley Water Users Association and Orchard Mesa Irrigation District elected to conserve some of the HUP water starting on August 10, 2020, so as to ensure that enough HUP water remained to finish out the irrigation season. In order to administer the partial call, total streamflow at the *Colorado River near Cameo, CO* gage was used as a goal to set the

² A snowstorm on October 25-26, 2020 shut down irrigation operations in the Grand Valley, the Cameo call was released, and increased flows through the 15-Mile Reach. As a result, there was 170 af of water remaining in the fish pools in Ruedi Reservoir that otherwise would have been released this season.

total release from Green Mountain Reservoir and the associated HUP component of the total release each morning. Leading up to the Reservoir Release the total streamflow goal was 1,650 cfs.

With the dynamics caused by numerous reservoirs making changes for water to be delivered to the 15-Mile Reach and state line before and during the Reservoir Release, an alternative goal was needed to set the HUP release each morning. Rather than looking at total flows in the system, natural flows plus HUP direct deliveries were utilized at a rate of 1,450 cfs during the Reservoir Release. This new goal was roughly equivalent to the old goal and allowed for a consistent value to be used as the numerous upstream reservoir changes occurred. During the Reservoir Release, several adjustments occurred to the HUP release amount, most were counterbalanced by changes in other components of the total release, therefore only one change in total release at Green Mountain Reservoir was required and that was an increase of 50 cfs on September 27, 2020.

Gunnison River Operations

One change in the releases from the Aspinall Unit occurred during the Reservoir Release. On September 23, 2020, the release was reduced by 100 cfs while the Crystal power plant went offline for maintenance. This reduction was unrelated to the Reservoir Release.

Grand Valley Irrigation Company Operations

On Sunday, October 4, 2020, Mesa County Sheriff's Department ordered the Grand Valley Irrigation Company to cease diversions to allow for a law enforcement investigation. Diversions ceased at 9:00 am on Sunday, October 4, 2020, and GVIC was allowed to resume diversions starting at about 4:00 pm.

Data Collection

Data collected for this investigation included streamflow gage data, DWR streamflow measurement, USGS streamflow measurement, and provisional diversion records. Due to various aspects of the scope of this Reservoir Release, DWR did not conduct a thorough gain/loss study to definitively evaluate transit losses along the Eagle River basin and/or Colorado River segments of the Reservoir Release Reach.

Streamflow Gage Data

Across the state of Colorado DWR operates numerous gages. The gage data and third party gage data is compiled into DWR's database HydroBase. The gaged streamflow data in HydroBase was relied upon in this report. Through the Reservoir Release study period, there were streamflow gage data issues that were encountered but were able to be resolved.

- The *Colorado River near Colorado-Utah State Line, CO* gage had periods of intermittent data transmission to the online datasets. The USGS was able to acquire the missing data from field visits and backfilled their online datasets.

- The Colorado Office of Information Technology performed an enterprise level data center electrical upgrade between 5:00 pm Sunday, October 4, 2020, and 8:00 am Monday, October 5, 2020. This electrical upgrade took down all networks, servers, and applications relied upon by DWR. During this outage, near real-time data acquisition from third party sources (i.e. USGS) were not executed.

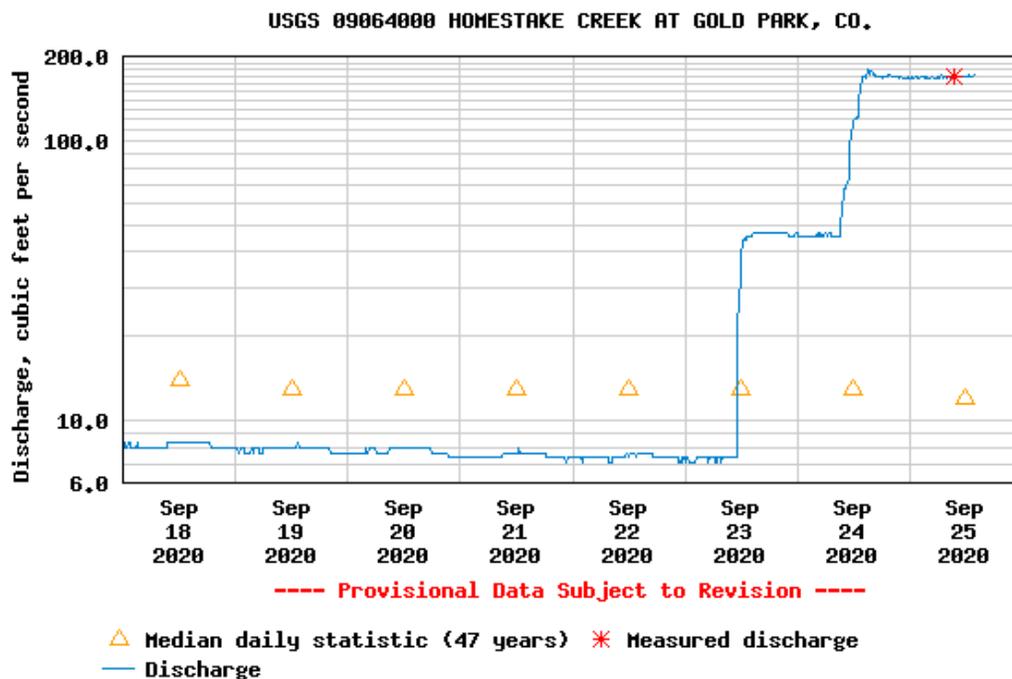
These data gaps required DWR to backfill the raw data housed in HydroBase to ensure the reliability of the data for analysis.

DWR Streamflow Measurement

On September 25, 2020, DWR performed one streamflow measurement at the *Homestake Reservoir (Outflow)* gage and determined a flow of 153.9 cfs. During the measurement, the streamgage reported an average gage height of 2.86 ft and an average flow of 173.4 cfs. However, due to the infrequency in which DWR consults the *Homestake Reservoir (Outflow)* gage and because this was the first known streamflow measurement by DWR at this location, this streamflow measurement was not used to adjust the streamgage data utilized in this Report. However, this streamflow measurement now provides a data point for future reference.

USGS Streamflow Measurement

As indicated on the graph below, on September 25, 2020, the USGS performed one streamflow measurement at the *Homestake Creek at Gold Park, CO* gage. The measurement allowed them to increase the accuracy of the shift and the computed flows changed from approximately 161 cfs to 173 cfs.



Provisional Diversion Records

During the Reservoir Release, DWR water commissioners who administer water rights along the Reservoir Release Reach increased monitoring efforts of diverting structures. These observed diversions were entered into HydroBase, as provisional diversion records where they can be analyzed in a data centered process. More than 1000 structures along the Reservoir Release Reach and key neighboring tributaries were evaluated and their provisional diversion records were analyzed.

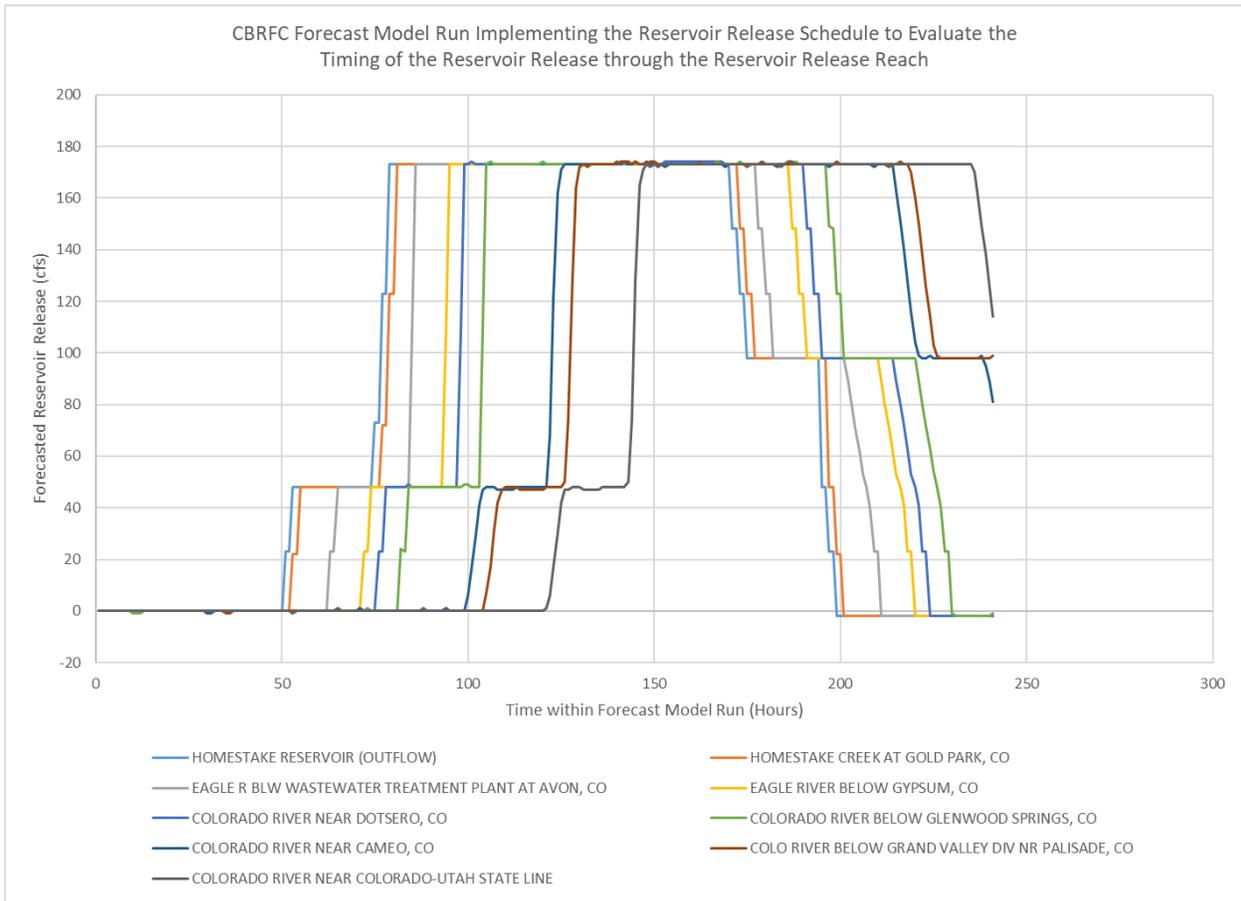
Data Analysis

Transit Timing

As noted earlier, understanding transit timing will provide valuable information for administrators to ensure that water is appropriately delivered. This section includes a review of the CBRFC initial estimates of transit timing; then, using streamgage data - analysis of the Eagle River basin data where the Reservoir Release was very visible; analysis of the Colorado River basin data where the Reservoir Release was less apparent; and review of the Shoshone Power Plant forebay release along the Colorado River. Below the term "separation" refers to commonly used "baseflow separation" methods performed by hydrographers and engineers to "separate out" a "release" from normal flows as part of transit and losses analysis.

CBRFC Forecast Model

CBRFC completed streamflow forecast modeling on the morning of September 21, 2020, that provided insight into the timing of the Reservoir Release at modeled streamflow gages within the Reservoir Release Reach. The modeling implemented the Reservoir Release Schedule as presented in Appendix C. The graph below shows the timing of the Reservoir Release at each of the modeled streamflow gages in the Reservoir Release Reach. The CBRFC modeling was initiated two days prior to the implementation of the release and projected forward for a total of ten days. For the farthest downstream gages the forecast didn't capture the complete Reservoir Release, but provided more than enough data to evaluate the modeled timing of the Reservoir Release through the Reservoir Release Reach.



Within the Reservoir Release Schedule there was a built-in ramp up to the sustained release. On the first day the release maxed out at 50 cfs and then on the second day the release was brought up to 175 cfs. The timing of these two separate flow scenarios was evaluated. The results of the two flow scenario evaluations are presented in table below:

Streamgage Location	50 cfs Release Timing (hours)	175 cfs Release Timing (hours)
HOMESTAKE RESERVOIR (OUTFLOW)	0	0
HOMESTAKE CREEK AT GOLD PARK, CO	2	2
EAGLE R BLW WASTEWATER TREATMENT PLANT AT AVON, CO	12	7
EAGLE RIVER BELOW GYPSUM, CO	21	16
COLORADO RIVER NEAR DOTSERO, CO	25	20
COLORADO RIVER BELOW GLENWOOD SPRINGS, CO	31	26
COLORADO RIVER NEAR CAMEO, CO	50	45
COLO RIVER BELOW GRAND VALLEY DIV NR PALISADE, CO	55	50
COLORADO RIVER NEAR COLORADO-UTAH STATE LINE	72	67

The results of the analysis were provided to DWR water commissioners on September 22, 2020, to inform them of the anticipated transit timing of the Reservoir Release between gage locations along the Reservoir Release Reach to assist them in their administration of the Reservoir Release.

Streamflow Gage Data

Real-Time Transit Timing Analysis

As discussed above, DWR acquired streamflow data for the streamgages that the USGS maintains and operates within the Reservoir Release Reach and nearby streamgages. DWR conducted a real-time analysis of the streamgage data during the Reservoir Release to ensure that the initial transit timing values used to administer the bypass of the Reservoir Release around the calling water right in the Grand Valley were correct. Below is a table summarizing the preliminary real-time comparison of the transit timing from actual streamgage data with the CBRFC forecast:

Streamgage Location	Streamgage Data		CBRFC Forecast	
	50 cfs Release Timing (hours)	175 cfs Release Timing (hours)	50 cfs Release Timing (hours)	175 cfs Release Timing (hours)
HOMESTAKE RESERVOIR (OUTFLOW)	0	0	0	0
HOMESTAKE CREEK AT GOLD PARK, CO	3	1	2	2
EAGLE RIVER NEAR MINTURN, CO	17	10	n/a	n/a
EAGLE R BLW WASTEWATER TREATMENT PLANT AT AVON, CO	23	15	12	7
EAGLE RIVER BELOW MILK CREEK NEAR WOLCOTT, CO	32	22	n/a	n/a
EAGLE RIVER BELOW GYPSUM, CO	40	29	21	16
COLORADO RIVER NEAR DOTSERO, CO	*	*	25	20
COLORADO RIVER BELOW GLENWOOD SPRINGS, CO	*	*	31	26
COLORADO RIVER NEAR CAMEO, CO	*	*	50	45
COLO RIVER BELOW GRAND VALLEY DIV NR PALISADE, CO	*	*	55	50
COLORADO RIVER NEAR COLORADO-UTAH STATE LINE	*	*	72	67

* At the time of this real-time analysis data was not yet available to be analyzed at these gages.

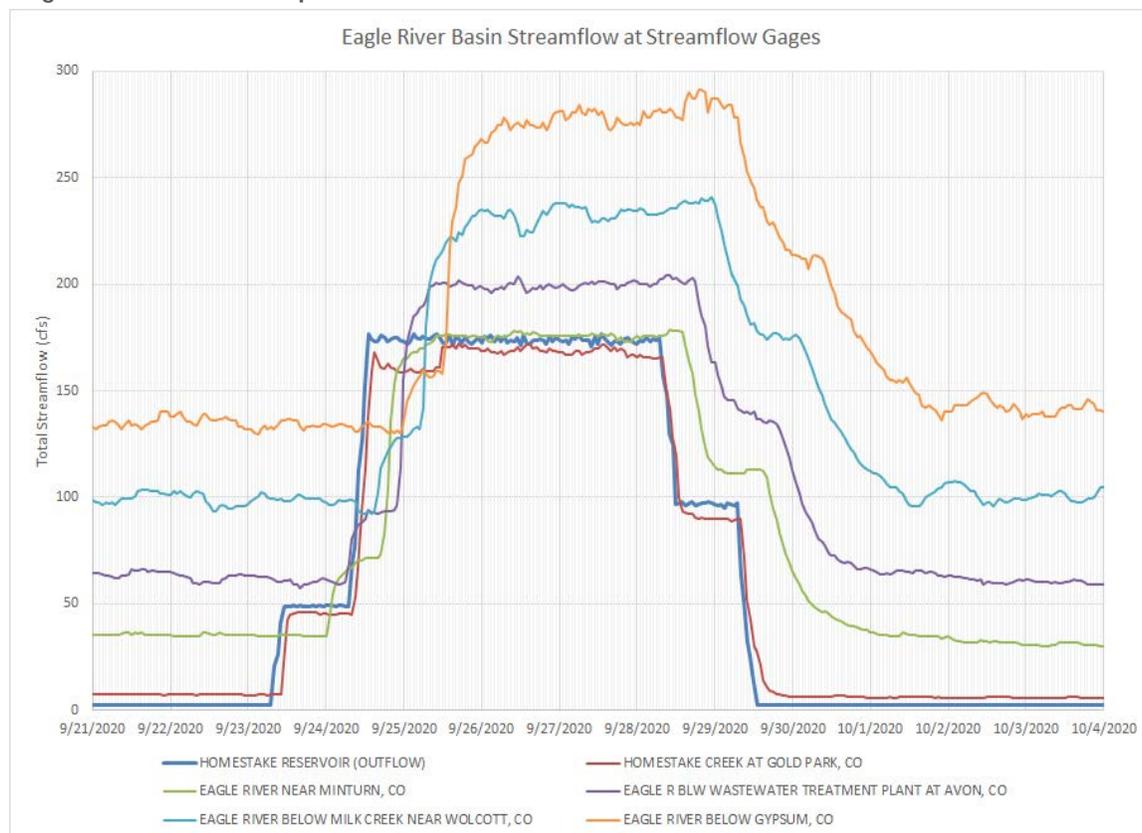
Based on the above comparison, on September 25, 2020, DWR modified the transit timing values used to administer the bypass of the Reservoir Release around the calling water right in the Grand Valley from a 2-day transit time to a 2.5 day transit time.

Final Transit Time Analysis

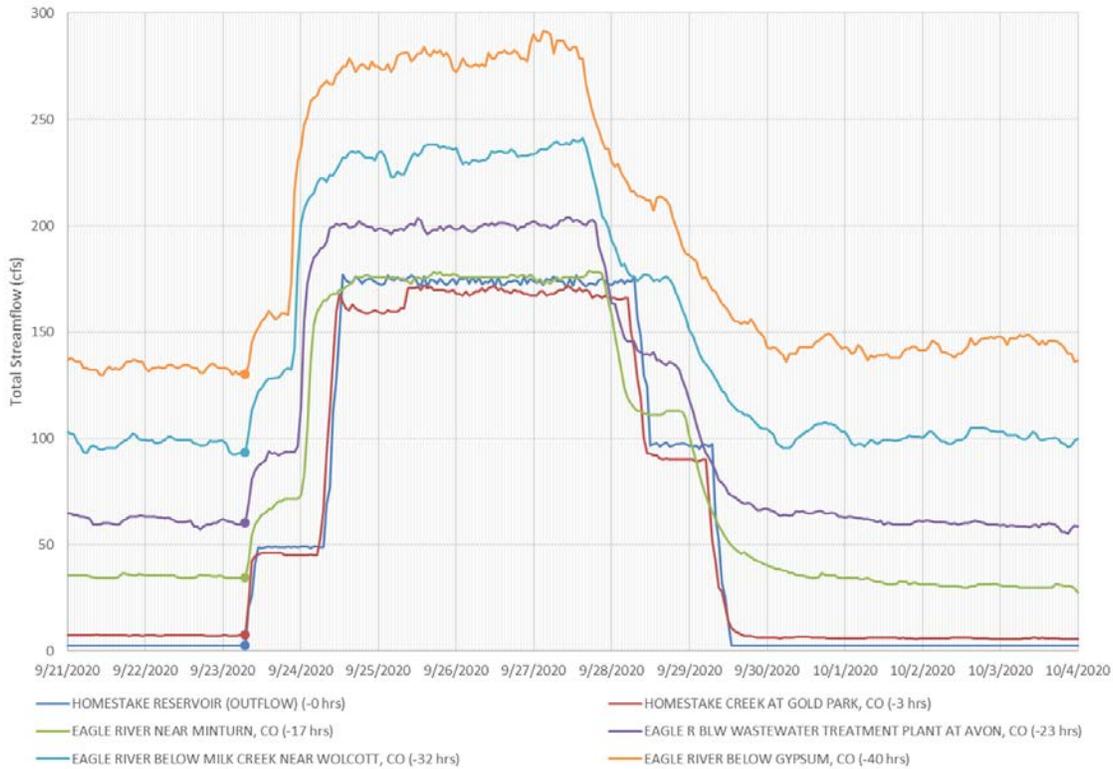
The transit time analysis was completed utilizing hourly streamflow data. Two analyses were attempted, the first evaluating the 50 cfs release and the second evaluating the 175 cfs release. The analyses were completed by taking the time between the 50 cfs Reservoir Release and the 175 cfs Reservoir Release, as compared to the initial change observed at the downstream gages for these two release conditions.

The Reservoir Release was distinguishable from the remainder of the streamflow in the hydrographs within the Eagle River basin. For these gages the total streamflow data was directly analyzed. The first graph below depicts the Eagle River basin streamflow data. The second graph below shifts in time the downstream gages data so that the 50 cfs release matches the 50 cfs release at the *Homestake Reservoir (Outflow)* gage. The graph's legend contains the number of hours between the observed 50 cfs release at the *Homestake Reservoir (Outflow)* gage and each downstream gage. The third graph below provides a similar time shifted analysis for the 175 cfs release.

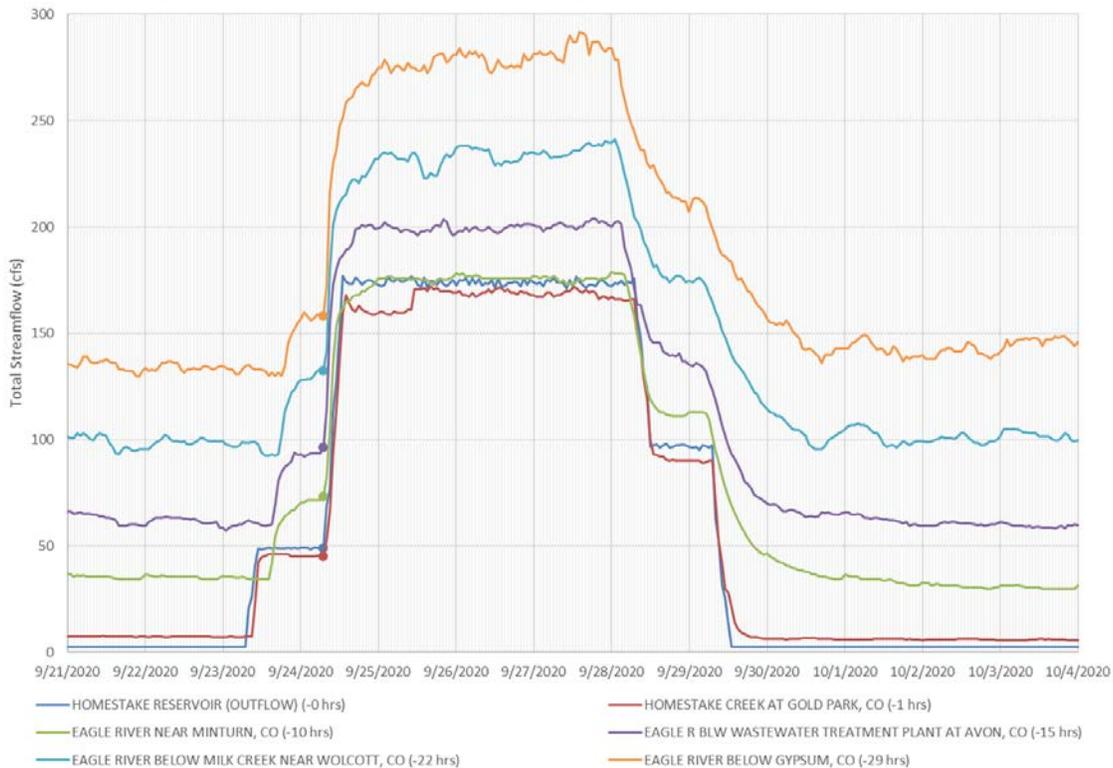
Eagle River Basin Graphs



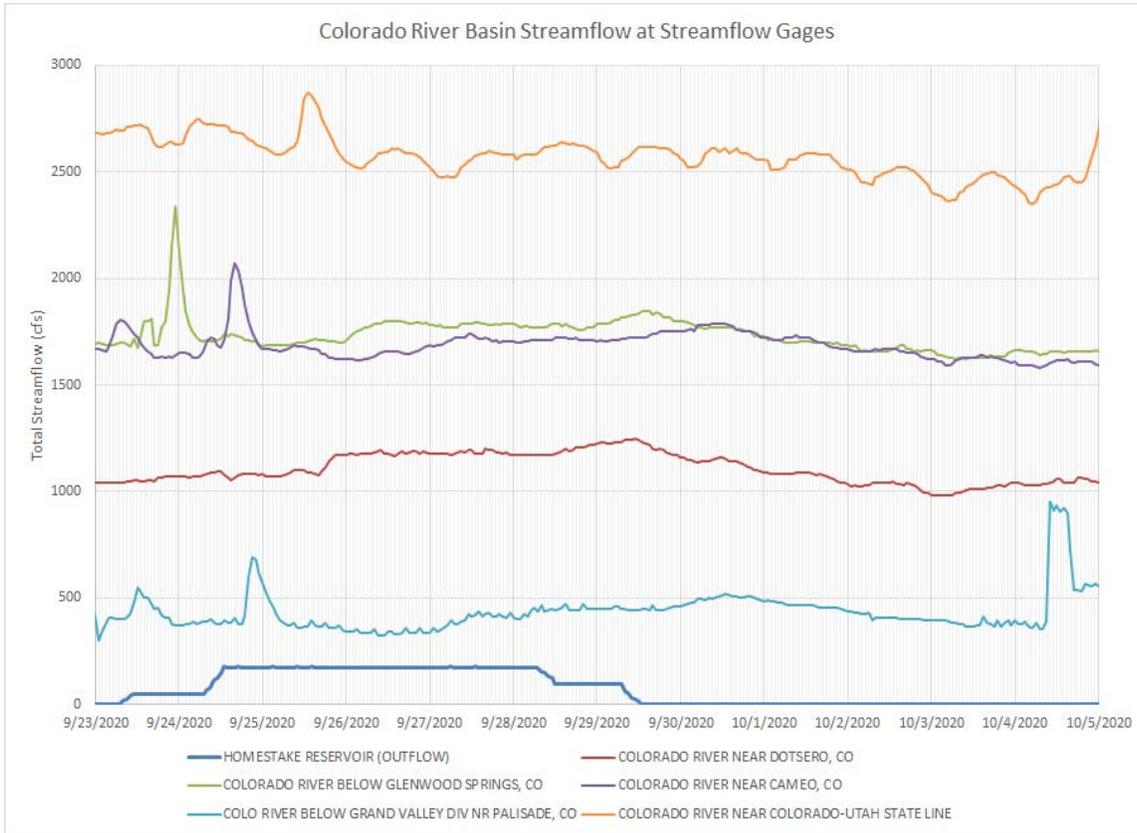
Eagle River Basin Streamflow at Streamflow Gages Time Shifted to Match 50 cfs Release



Eagle River Basin Streamflow at Streamflow Gages Time Shifted to Match 175 cfs Release



Once the Reservoir Release reached the Colorado River, it became a small fraction of the overall flow in the river and was visually indistinguishable from the overall flow as illustrated in the graph below. As a result, for the gages along the Colorado River additional data analysis was required to separate the Reservoir Release from the total streamflow hydrograph, at which point the timing of the Reservoir Release could be analyzed.

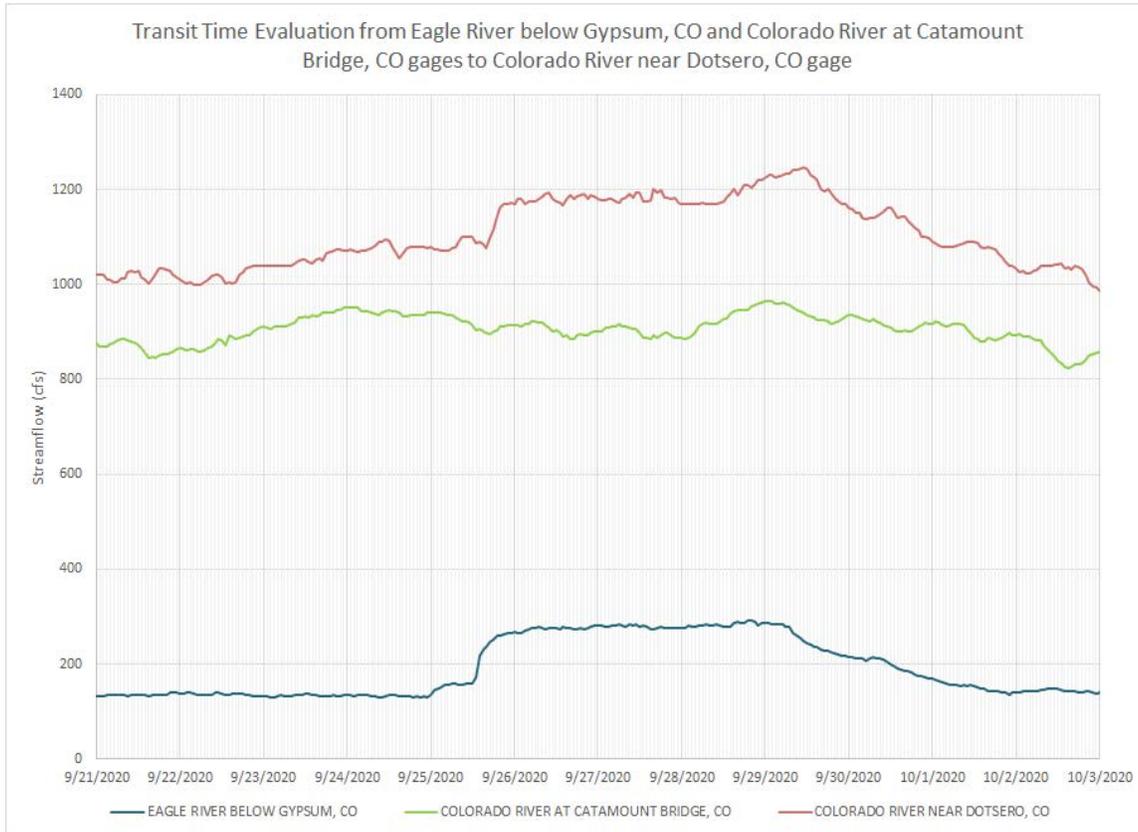


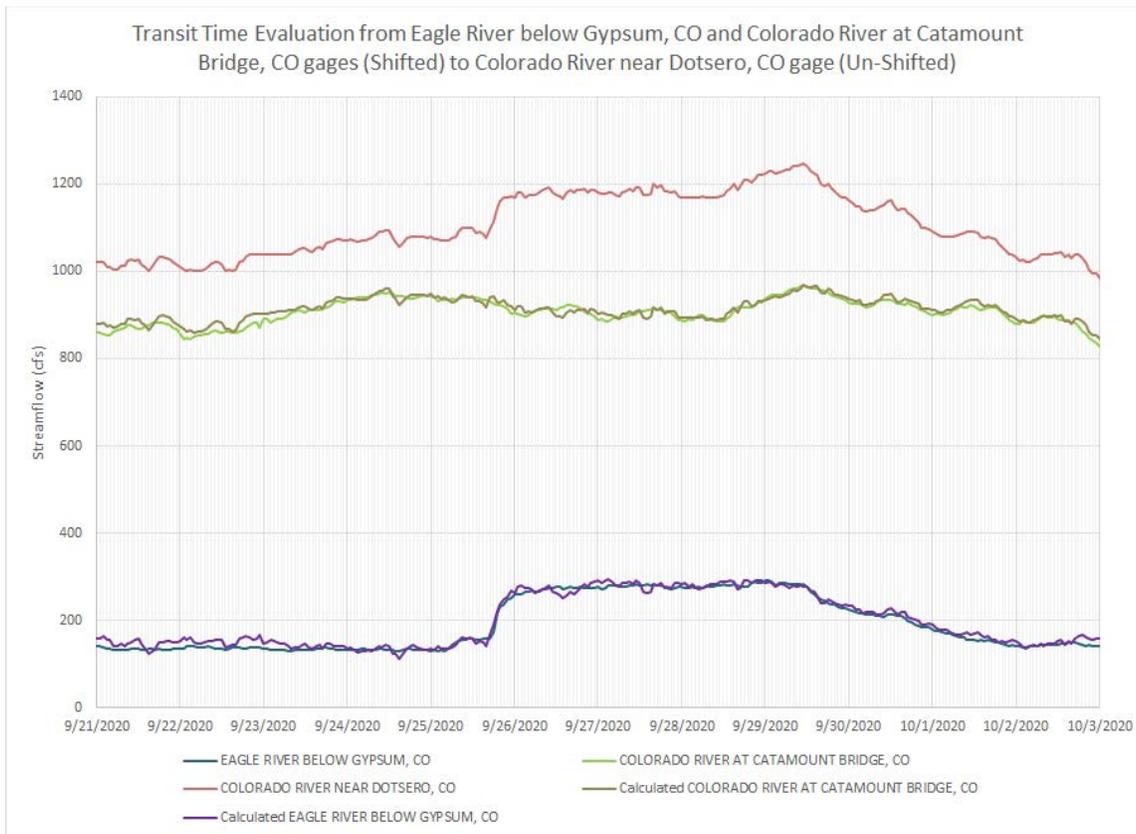
In order to perform a separation analysis on the streamflows in the Colorado River, DWR needed to determine the transit time of streamflows between the *Colorado River near Dotsero, CO* gage and two upstream gages - the *Colorado River at Catamount Bridge, CO* gage and the *Eagle River below Gypsum, CO* gage. Transit time between *Eagle River below Gypsum, CO* and *Colorado River at Catamount Bridge, CO* gages to *Colorado River near Dotsero, CO* gage were also evaluated utilizing a separation procedure. Relying on hourly streamflow data for the period of time around the Reservoir Release, two comparisons were completed simultaneously:

- *Colorado River near Dotsero, CO* - time-shifted *Eagle River below Gypsum, CO* = calculated time shifted *Colorado River at Catamount Bridge, CO*
- *Colorado River near Dotsero, CO* - time shifted *Colorado River at Catamount Bridge, CO* = calculated time shifted *Eagle River below Gypsum, CO*.

Least squares regression analyses were conducted comparing the calculated time shifted data to the time-shifted data for both the *Eagle River below Gypsum, CO* and *Colorado River at Catamount Bridge, CO* gages. These analyses resulted in a 10-hour transit time from *Colorado River at Catamount Bridge, CO* gage to *Colorado River near*

Dotsero, CO gage and a 5-hour transit time from *Eagle River below Gypsum, CO* gage to *Colorado River near Dotsero, CO* gage. The first graph below shows the gaged streamflow for the three gages in this analysis. The second graph below presents the results of the transit time analysis and shifts the time of the data for the upstream gages to be consistent with the downstream gage.

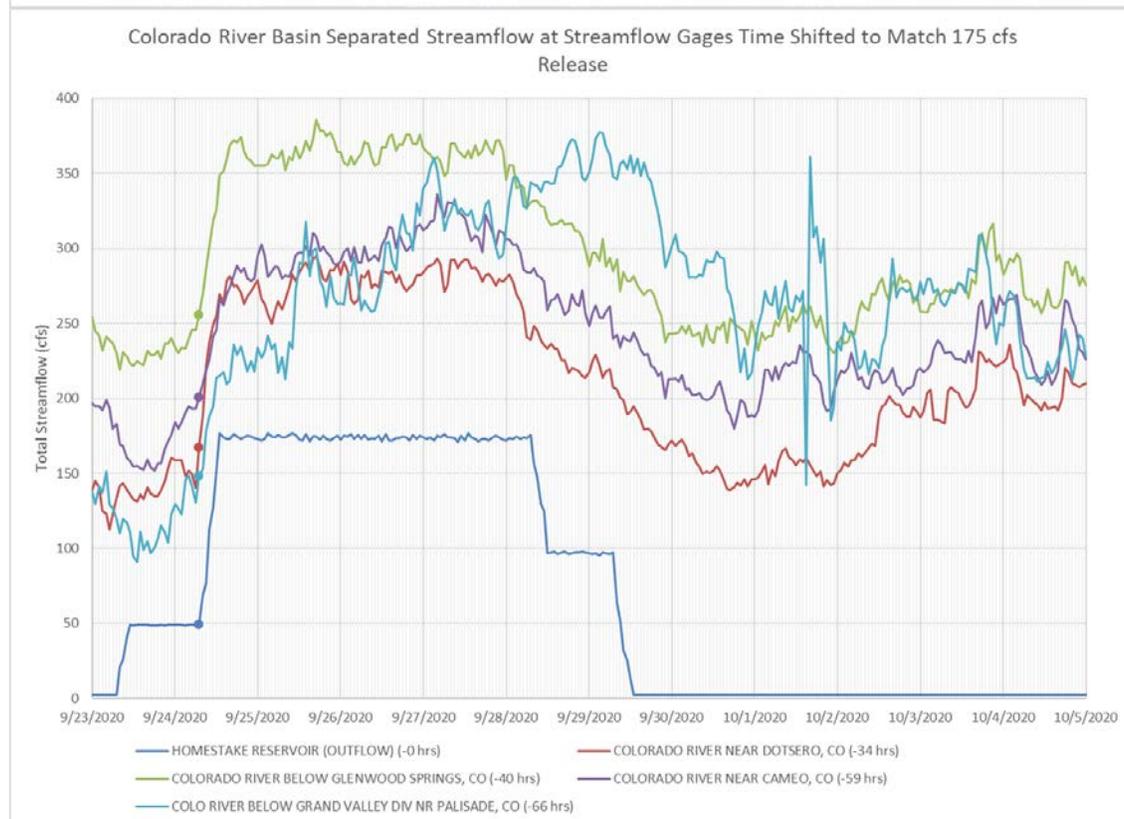
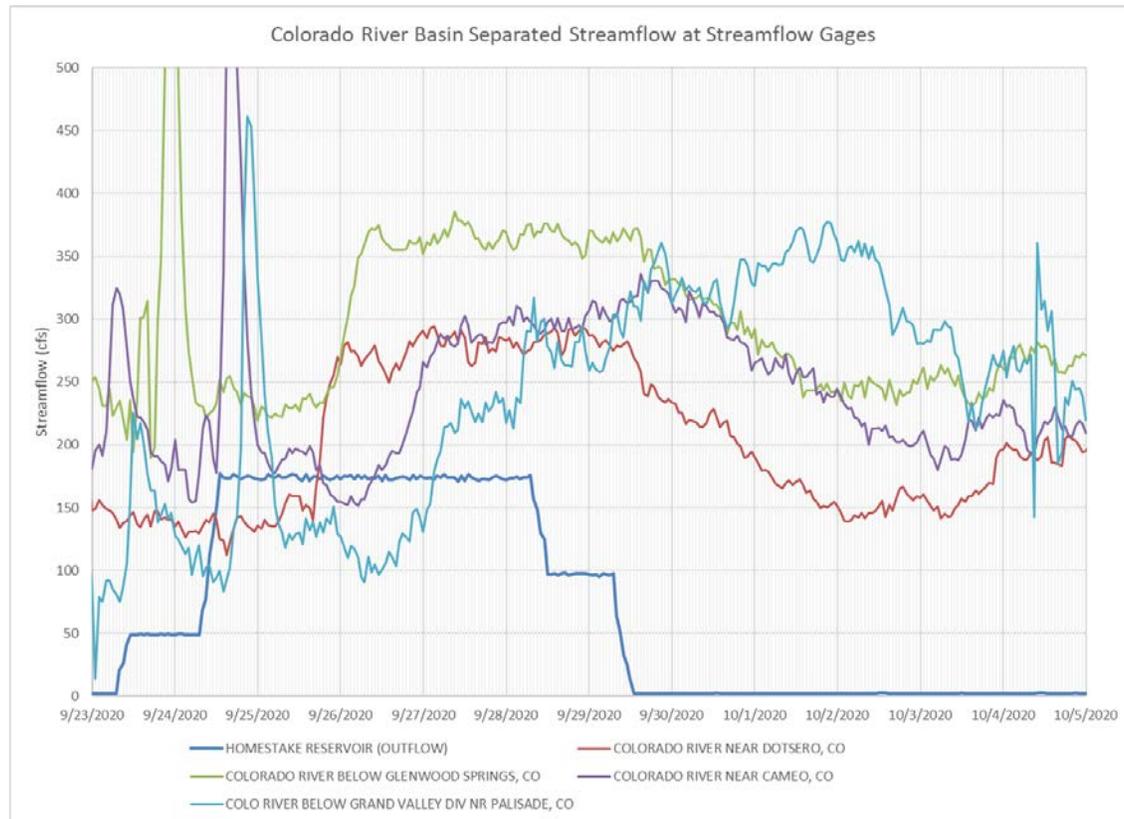




The separation analyses on the gages downstream along the Colorado River were completed by subtracting off upstream Colorado River flows, subtracting off upstream gaged tributary inflows, and adding back upstream gaged diversions to each of the Colorado River gages. Timing between the gage being analyzed and the upstream inflows and diversions were accounted for in the separation analysis.

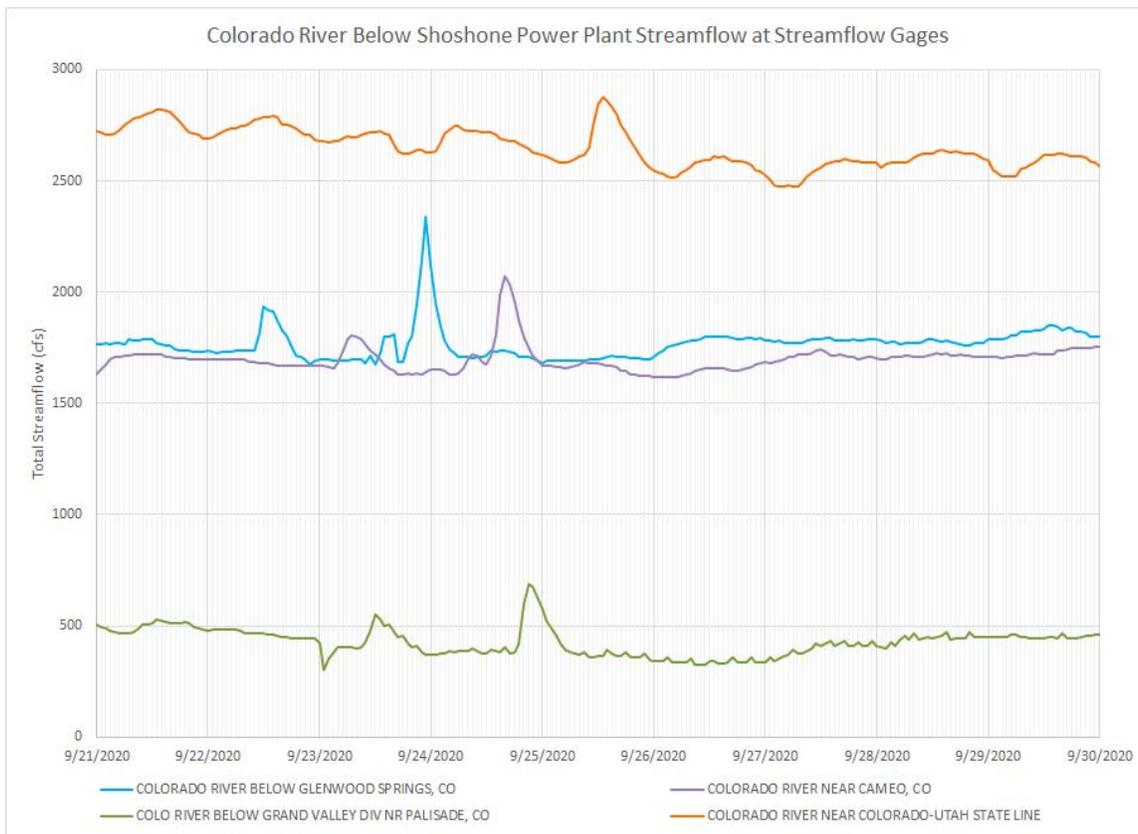
Even with the separation analysis, it was not possible to discern the change in flow caused by the 50 cfs Reservoir Release at the gages along the Colorado River. Therefore, for the Colorado River gages, the transit time analysis was only performed on the 175 cfs Reservoir Release. The first graph below depicts the Colorado River basin separated streamflow data. The second graph below shifts in time the downstream gages separated data so that the 175 cfs release matches the 175 cfs release at the *Homestake Reservoir (Outflow)* gage. The graph's legend contains the number of hours between the observed 175 cfs release at the *Homestake Reservoir (Outflow)* gage and each downstream gage. It was also not possible to clearly identify the Reservoir Release based on gage flows at the Colorado River near *Colorado-Utah State Line, CO* gage due to the significant ungaged inflows to the Colorado River below the *Colorado River below Grand Valley Diversion near Palisade, CO* gage that could not be removed in the separation analysis. Therefore, the timing of the Reservoir Release to the *Colorado River near Colorado-Utah State Line, CO* gage was not evaluated. The graphs below depict the separated Colorado River basin streamflow data and the time shifted analysis to evaluate the 175 cfs release timing.

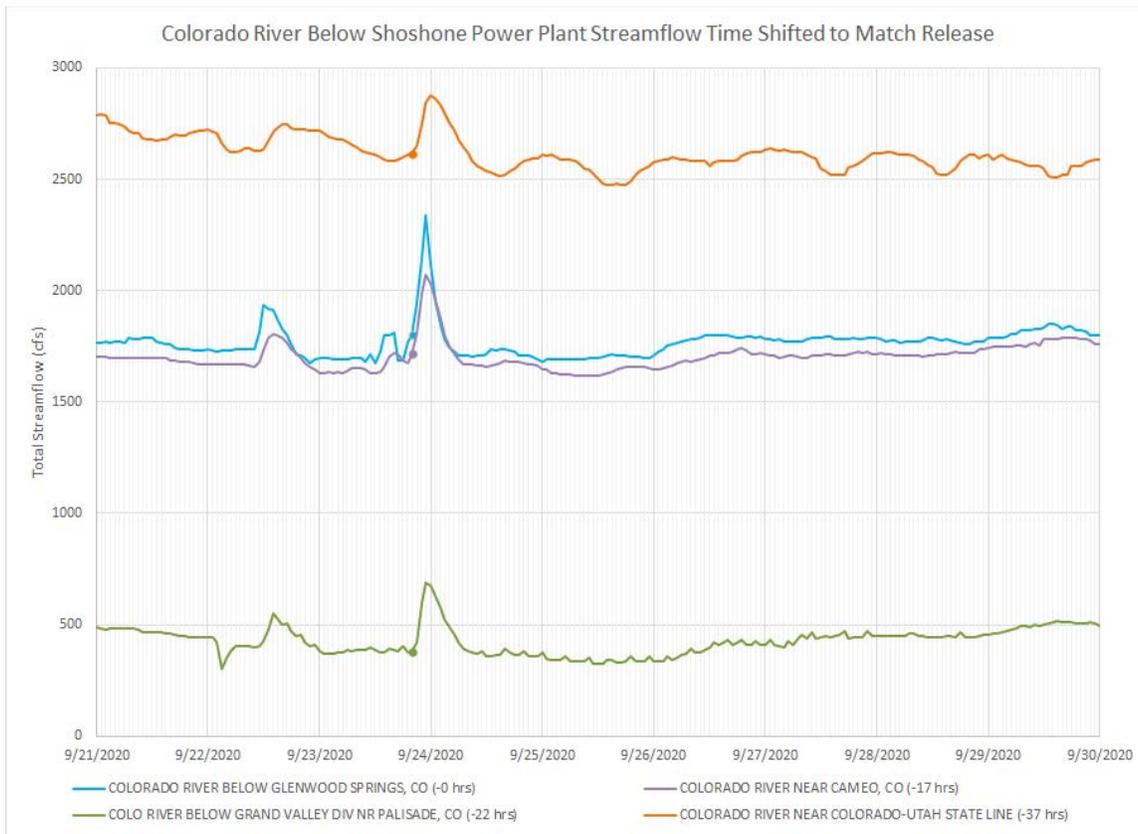
Colorado River Basin Graphs



Shoshone Power Plant Forebay Release Transit Time Analysis

As discussed above, on September 23, 2020, Shoshone Power Plant made an approximately 700 cfs short duration release from their diversion dam forebay when shutting the plant down to complete maintenance projects prior to the winter. This release created a distinct signal in the hydrographs at gages on the Colorado River downstream from the power plant and can be seen on the two graphs below. The forebay release was distinguishable from the remainder of the streamflow allowing the total streamflow data to be directly analyzed. The graphs below depict the Colorado River streamflow data below Shoshone Power Plant and the time shifted analysis to evaluate the shutdown release timing.





Transit Loss Analysis

Understanding losses under dry conditions will assist the administrators in ensuring appropriate volumes of water are delivered. This section includes analysis of losses within the Eagle River basin and issues that precluded successful analysis on the Colorado River.

Eagle River

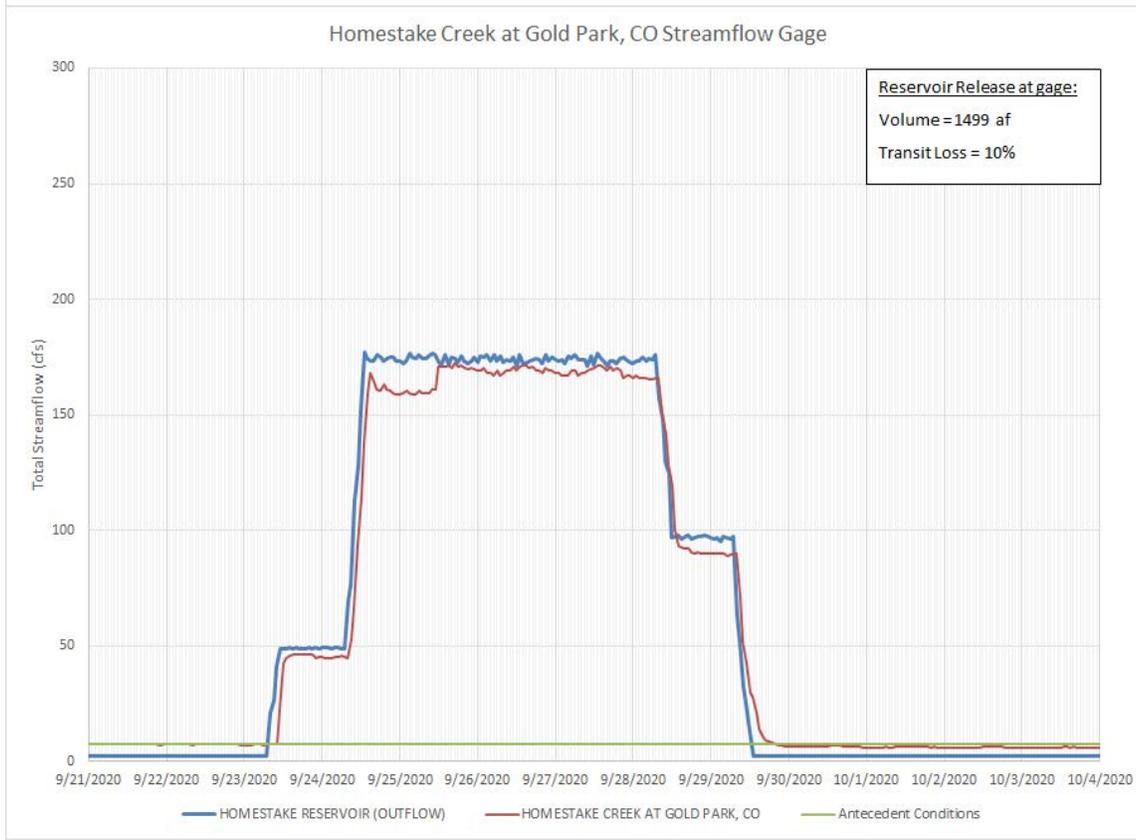
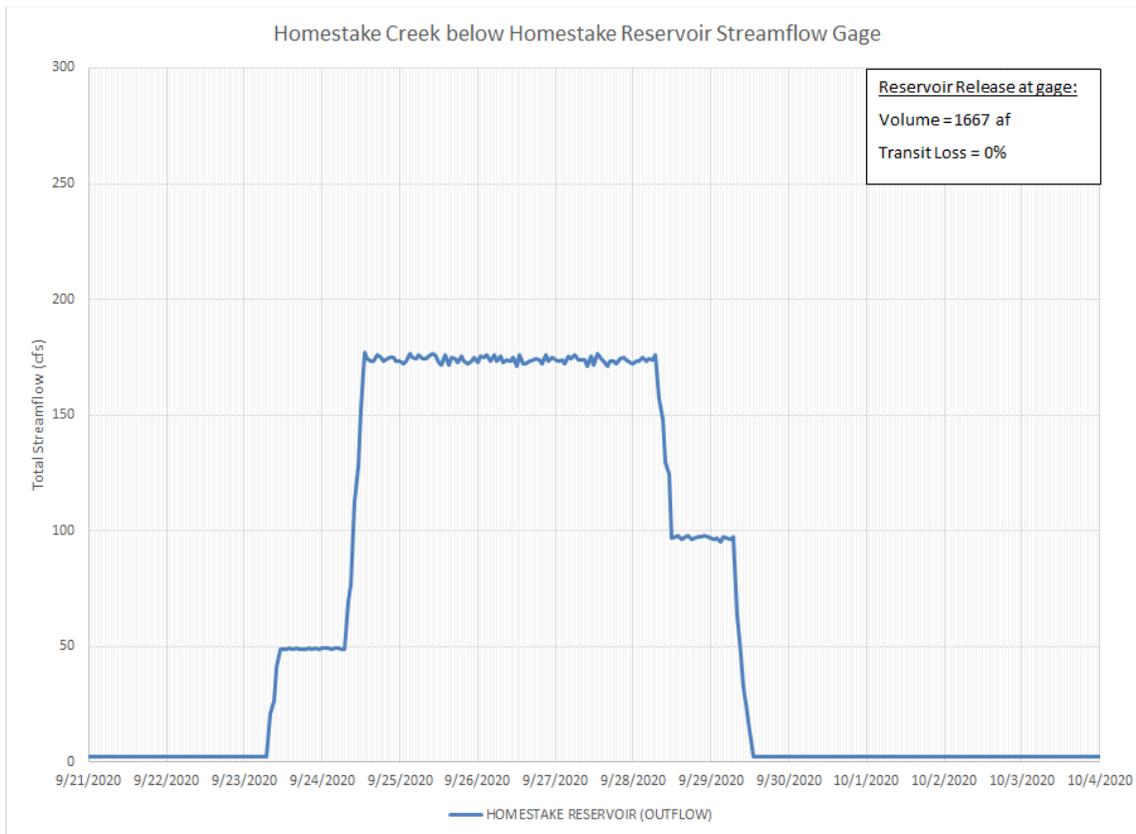
Prior to and during the Reservoir Release, the streamflow hydrology was consistent within the Eagle River basin. The minimal precipitation that occurred had no significant effect on the gaged streamflow. Therefore, in order to estimate the transit losses within the Eagle River basin, the antecedent streamflow condition³ was subtracted from the total streamflow over the duration of the Reservoir Release resulting in estimated total volume of the Reservoir Release at some of the streamgages. The average flow at each streamgage for September 21 and 22, 2020, was used as the antecedent condition.

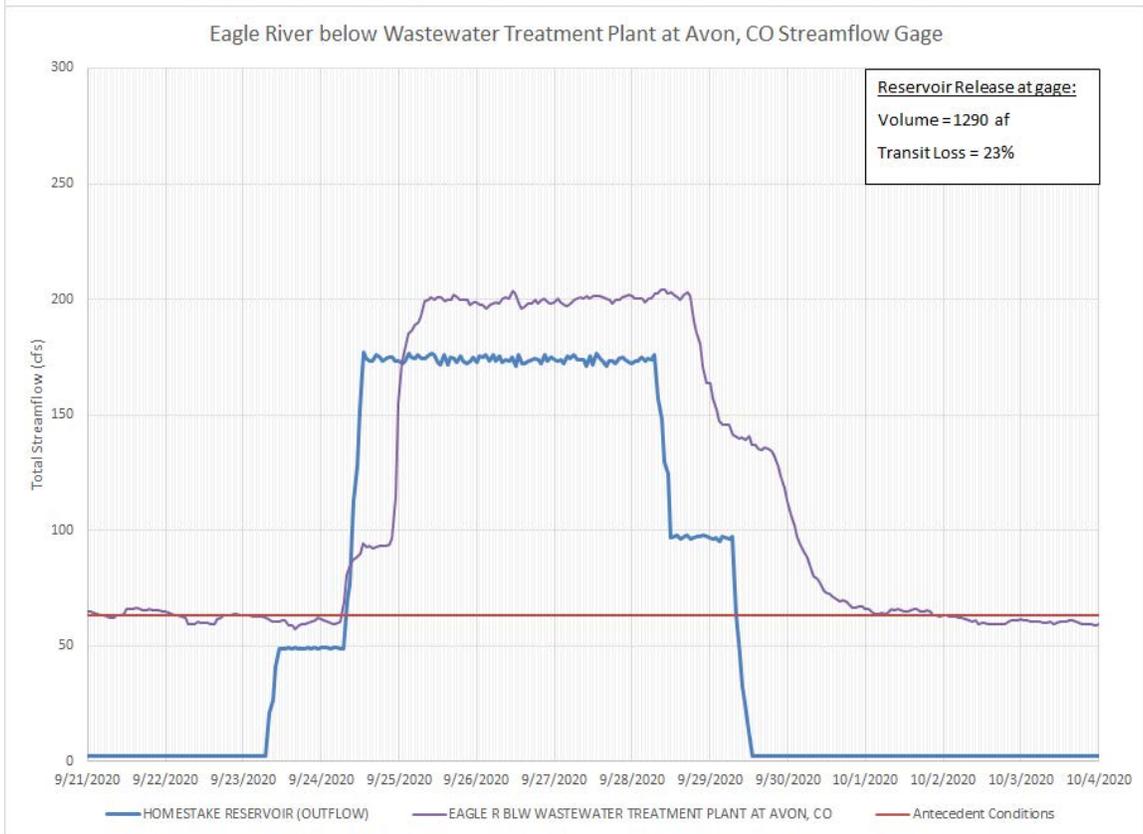
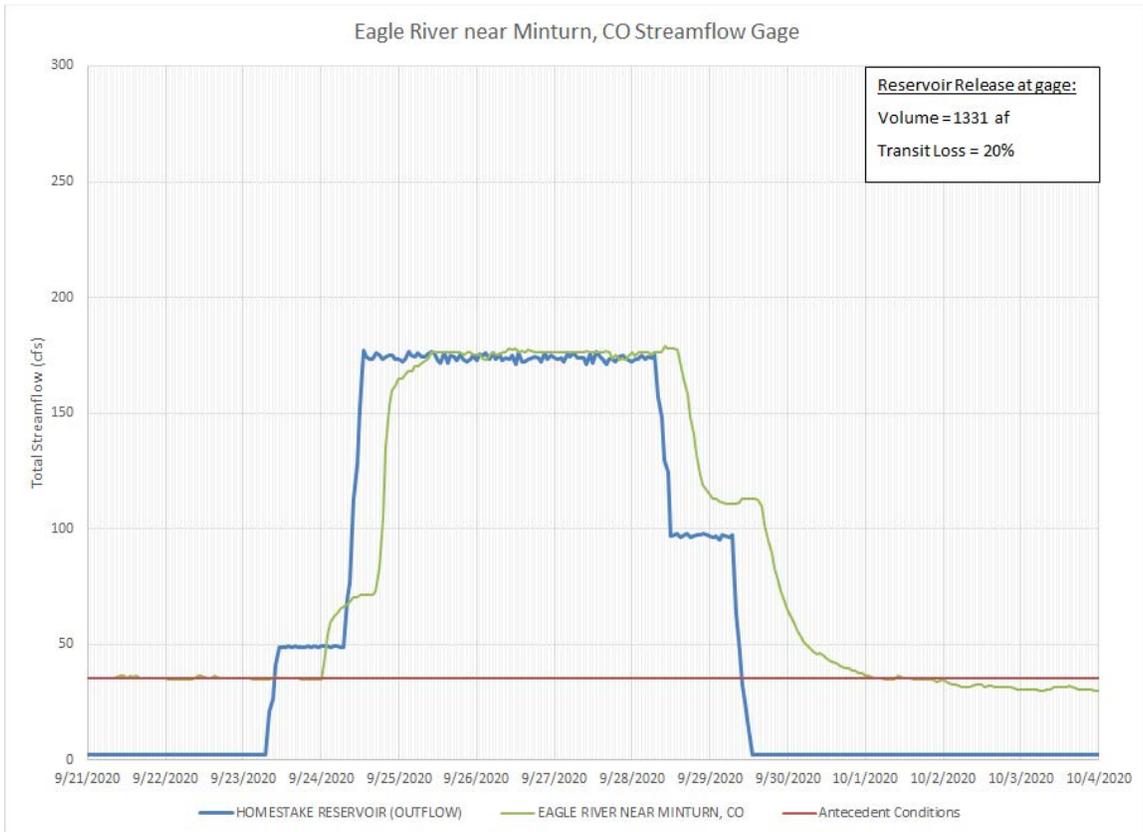
The analysis of transit loss within the Eagle River basin from Homestake Reservoir down to the *Eagle River below Milk Creek near Wolcott, CO* gage appears to be reliable for the period of time that the Reservoir Release hydrograph was visible at the

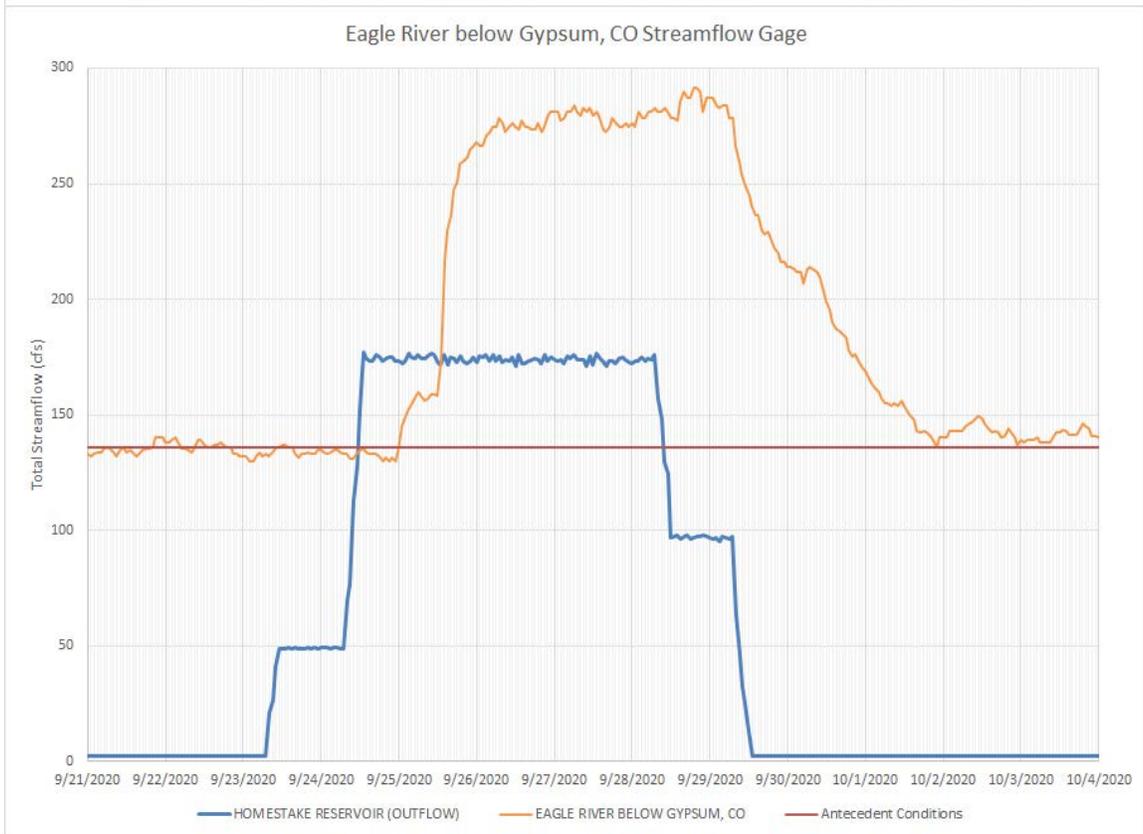
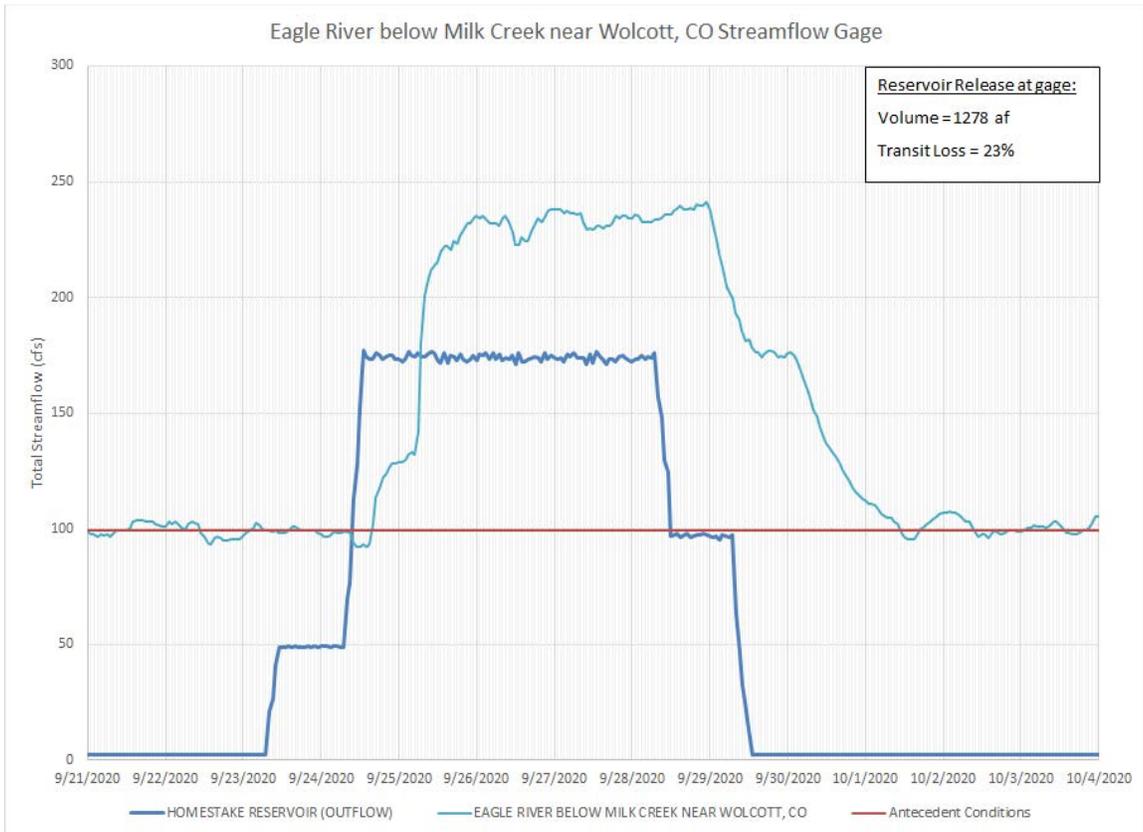
³ "Antecedent streamflow condition" or "antecedent conditions" are the streamflows that immediately preceded the Reservoir Release.

gages. However, streamflow conditions at the *Eagle River below Gypsum, CO* gage did not return to antecedent conditions and remained about 10 cfs higher after the Reservoir Release concluded. Two key ungaged tributaries, Brush Creek and Gypsum Creek, enter the Eagle River between the *Eagle River below Milk Creek near Wolcott, CO* gage and the *Eagle River below Gypsum, CO* gage. Provisional diversion records were investigated on these two tributaries and on the Eagle River between the two gages which indicated minimal changes that do not account for the increase of ~10 cfs from antecedent conditions to post Reservoir Release conditions. Had a full gain-loss study been completed, there may have been sufficient data to be able to explain the gains seen at the *Eagle River below Gypsum, CO* gage. Therefore, we determined that the Reservoir Release did provide reliable empirical information regarding transit losses down to the *Eagle River below Milk Creek near Wolcott, CO* gage, but further studies would be helpful to evaluate transit losses below the *Eagle River below Milk Creek near Wolcott, CO* gage.

The following graphs show the Reservoir Release as it moved downstream through the Eagle River basin. Each graph shows the Reservoir Release as measured at the *Homestake Reservoir (Outflow)* gage and the total streamflow at downstream gages within the Eagle River basin. Antecedent conditions are depicted by the horizontal line. The volume of water that flowed through the gage minus the antecedent conditions was calculated for each gage and compared against the total Reservoir Release volume to quantify the transit losses in the Eagle River basin to that gage. See text box in upper right-hand corner of the graphs. On the graph for the *Eagle River below Gypsum, CO* gage the volume and transit loss were not calculated as the flows did not return to antecedent conditions as discussed above.







Colorado River

A transit loss analysis along the Colorado River was attempted utilizing the separated Reservoir Release analysis gage data and the results appear to be unreliable. The operations along the Colorado River upstream and downstream of the confluence with the Eagle River were not as static or controlled as the conditions along the streams within the Eagle River basin. It was also not possible to reliably determine the antecedent conditions along the Colorado River. Determining the antecedent conditions was impacted by the upstream reservoir release changes (which should mostly be mitigated by the separation analysis) and the releases from the Shoshone Power Plant diversion dam forebay. The Grand Valley Canal ceased diverting for part of the day on October 4, 2020, which may have also impacted the attempted transit loss analyses at the *Colorado River below Grand Valley Diversion near Palisade, CO* and *Colorado River near Colorado-Utah State Line, CO* gages.

Results

Administration

The administration of the Reservoir Release was completed on a 2.5-day transit time from Homestake Reservoir to the *Colorado River near Cameo, CO* gage, with a 10-percent transit loss assessed. DWR actively administered the Reservoir Release on Homestake Creek and Eagle River due to the low flow conditions. On the Colorado River, the Grand Valley Canal was the calling location and was sweeping the river. The Reservoir Release was diverted upstream of the dry-up point through the Grand Valley Power Plant and returned to the Colorado River unconsumed below the dry-up point at the head of the 15-Mile Reach. The Colorado River is a gaining stream below the 15-Mile Reach with significant inflows from the Gunnison River, irrigation return flows, and numerous minor tributaries. Therefore, no additional administration below the Grand Valley Canal was needed to ensure that the Reservoir Release was delivered on to the state line.

Transit Time

The streamgage data analysis from the 175 cfs Reservoir Release resulted in different transit times than the CBRFC forecast with a majority of the difference occurring within the Eagle River basin. The 175 cfs Reservoir Release took approximately 16 hours longer to reach the Colorado River below *Grand Valley Diversion near Palisade, CO* gage than was forecast. The transit time along the Colorado River segment of the Reservoir Release Reach was similar for the 175 cfs Reservoir Release, CBRFC forecast, and Shoshone Power Plant diversion dam forebay release. See the table below.

Streamgage Location	Streamgage Data		CBRFC Forecast		Streamgage Data
	50 cfs Release Timing (hours)	175 cfs Release Timing (hours)	50 cfs Release Timing (hours)	175 cfs Release Timing (hours)	Shoshone Release Timing (hours)
HOMESTAKE RESERVOIR (OUTFLOW)	0	0	0	0	c
HOMESTAKE CREEK AT GOLD PARK, CO	3	1	2	2	c
EAGLE RIVER NEAR MINTURN, CO	17	10	b	b	c
EAGLE R BLW WASTEWATER TREATMENT PLANT AT AVON, CO	23	15	12	7	c
EAGLE RIVER BELOW MILK CREEK NEAR WOLCOTT, CO	32	22	b	b	c
EAGLE RIVER BELOW GYPSUM, CO	40	29	21	16	c
COLORADO RIVER NEAR DOTSERO, CO	a	34	25	20	c
COLORADO RIVER BELOW GLENWOOD SPRINGS, CO	a	40	31	26	0
COLORADO RIVER NEAR CAMEO, CO	a	59	50	45	17
COLO RIVER BELOW GRAND VALLEY DIV NR PALISADE, CO	a	66	55	50	22
COLORADO RIVER NEAR COLORADO-UTAH STATE LINE, CO	a	a	72	67	37

a - insufficient data to be able to analyze, b - no data available, c - not applicable

The Reservoir Release was monitored by the CBRFC to evaluate the accuracy of their forecast model's transit time methodology. CBRFC staff anticipate being able to make some minor improvements to their routing model based on the data from the Reservoir Release. These improvements will be incorporated into their model at the same time as the 1981-2020 model recalibration update.

Transit times determined by this study are specific to the antecedent river conditions that occurred prior to the Reservoir Release and may not be appropriate for all future flow conditions.

Transit Loss

Transit losses, as quantified by a volumetric analysis over the duration of the Reservoir Release, along the approximately 18 miles of Homestake Creek below Homestake Reservoir to the *Eagle River near Minturn, CO* gage was 20 percent, which is about 1.1 percent per mile. Transit losses along the approximately 25 miles of Eagle River between the *Eagle River near Minturn, CO* gage and the *Eagle River below Milk Creek near Wolcott, CO* gage was 3 percent, which is about 0.12 percent per mile.

Transit losses determined by this study are specific to the antecedent river conditions that occurred immediately prior to the Reservoir Release and may not be appropriate for all future flow conditions.

Findings

Administration

- Improved diversion dams, headgates and measuring devices may be needed at intervening structures for accurate administration and accounting of deliveries for purposes of compact administration.
- Further analysis of transit time for various reaches and under various hydrologic conditions may be needed to effectively convey water for compact administration purposes, recognizing transit times vary due to both antecedent conditions and the flow rate of a release.
- DWR data processing tools may require upgrades regarding access to provisional diversion records if they are used for compact administration operations.
- Higher volume test releases in coordination with hydrographic measurements would be needed to determine transit losses for reaches of the river with higher flows.
- Under dry hydrologic conditions, transit times were slower than anticipated for the reaches of the river with higher flows.
- More frequent gage calibrations may be needed to ensure reliable accounting to the state line, including pre- and post-release calibrations at key gages.

Water User Operations

In the event water is delivered to the state line for compact administration purposes, the delivery rates, volume, and timing will likely cause other entities within the basin to react and operate their systems differently.

For example, releases to the 15-Mile Reach were reduced to take advantage of the increased flows from the Reservoir Release, which extended releases later into the year. This year's operational change resulted in 170 af of water being carried over in the fish pools in Ruedi Reservoir.

Communication

Early communication/outreach with water users and stakeholders could enhance understanding and avoid operations that could impact, hinder, or complicate efforts to release water for the purposes of compact administration.

Large Flow Changes

Coordinating with key groups as to the precise timing of compact administration operations may be a solution to avoiding inadvertent impacts in environmentally

sensitive areas. Moreover, communication with local emergency operations centers and the recreational community will be important to address safety concerns for operations that cause large changes in flows.

For instance, in the event water is being delivered to the state line for compact administration purposes, large changes in flow rates, especially in dry years where there are only a few hundred cfs flowing through the 15-Mile Reach, should be made in a phased ramping manner, taking into account the timing of such releases if possible. Such gradual changes reduce impacts to critical habitat for endangered fish and more importantly, mitigate risks to health and safety caused by large, sudden changes in flow rates through a stream reach.

Improved outreach and communication prior to such releases could also help water providers avoid or plan for water quality changes at their intakes. For example, the Eagle River Water & Sanitation District noted that there were unanticipated spikes in total organic carbon and turbidity at the District intakes when the release started. Observations like these should be investigated further.

Conclusion

The Engineers and the Cities conducted the Reservoir Release for the express purposes stated in the Proposal. The information provided in this Report indicates that the Reservoir Release was successful in affirming the appropriateness and effectiveness of much of the Engineers' current administration, but also brought to light areas where administration may need to be adapted. The Reservoir Release created hydrologic and administrative conditions that would not otherwise have been seen on the river, but may be seen during actual compact administration. Those conditions created the opportunity to identify important considerations for the Engineers, Colorado River water users, and other West Slope entities going forward.



East Fork Conduit release into Homestake Reservoir, photo by James Heath

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Livingston, R.K. 2011. Transit Losses and Travel Times of Reservoir Releases along the Arkansas River from Pueblo Reservoir to John Martin Reservoir.

Luckey, R.R. and Livingston, R.K. 1975. Colorado Water Resources Circular No. 27: Reservoir Release Routing Model for the Upper Arkansas River Basin of Colorado.

Appendices

A. Letter from James Lochhead to Kevin Rein



1600 West 12th Avenue
Denver, CO 80204-3412

Sent Via Email: kevin.rein@state.co.us

August 27, 2020

Mr. Kevin Rein
State Engineer
Colorado Division of Water Resources
1313 Sherman St., Room 821
Denver, CO 80203

Re: Front Range Water Council Request to Conduct a State Line Delivery Pilot Reservoir Release

Dear Mr. Rein:

I am writing as Chair of the Front Range Water Council (FRWC) to request your approval of and assistance in conducting a State Line Delivery Pilot Reservoir Release as described in the attached project description. The City of Aurora, Colorado Springs Utilities, and the Board of Water Works of Pueblo, all members of the FRWC, have agreed to make up to 1,800 acre-feet of water stored in Homestake Reservoir available for this pilot project. These entities are not seeking any future right or credit for any part of the water made available for the pilot project.

As members of the FRWC have discussed with you and your staff, the purpose of the pilot project is to demonstrate that sufficient legal and institutional frameworks are in place to successfully account for, release, and shepherd water within Colorado for State Line delivery purposes. The pilot project is simply an empirical feasibility test from which the members of the FRWC hope to learn more about the feasibility of using reservoir releases for compact compliance purposes and for any future demand management program in the Upper Division of Colorado River basin.

The Homestake Partners would like to commence and complete the State Line Delivery Pilot Reservoir Release within the next three to four weeks, and certainly before the end of September. Thus, we request that you approve the pilot project and assist us in its implementation. For implementation purposes the principal contact for coordination of operations will be Kalsoum Abbasi of Colorado Springs Utilities. She can be reached at kabbasi@csu.org. Like most of us, Kalsoum is working remotely, so email is the best initial means to contact her.

The FRWC thanks you and your staff for your time in discussing this proposal with members of the FRWC, and looks forward to carrying out the pilot project. We believe it will advance the state of our knowledge of the tools potentially available for use by the State of Colorado for Colorado River Compact

Kevin Rein
August 27, 2020
Page 2

compliance purposes and for any future demand management program in the Upper Division of Colorado River basin.

Sincerely,

FRONT RANGE WATER COUNCIL

A handwritten signature in black ink, appearing to read "James S. Lochhead". The signature is written in a cursive style with a large initial "J".

James S. Lochhead
Chair

Enclosure

cc: Marshall Brown
Earl Wilkinson
Seth Clayton
Jim Broderick
Brad Wind
Kevin Lusk

State Line Delivery Pilot Reservoir Release
August 25, 2020

Proposed Pilot Program Description

Colorado Springs Utilities, Aurora Water, and the Pueblo Board of Water Works (the Cities) are municipal water providers and members of the Front Range Water Council (Council). Based on discussions with the State Engineer's Office, these water users, with cooperation and full support of the Council, propose to operate a State Line Delivery Pilot Project ("Pilot Project") by releasing water they own and/or control from Homestake Reservoir. The purpose of the Pilot Project is to demonstrate that sufficient legal and institutional frameworks are in place to successfully account for, release, and shepherd water within Colorado for State Line delivery purposes. The Cities are not seeking any future right or credit for any part of the water made available for the Pilot Project. Rather, the Pilot Project is simply a feasibility test from which the Cities hope to learn more about the feasibility of using reservoir releases for compact compliance purposes and for any future demand management program in the Upper Division of Colorado River basin.

The Homestake System is a trans-mountain diversion project located in the headwaters of the Eagle River in the Colorado River Basin. The water diverted by the Homestake System and stored in Homestake Reservoir is delivered to the East Slope for municipal purposes and is used and successively used with the goal of full consumption of such water. The Homestake water taken to the East Slope is 100% depletive to the Colorado River Basin.

The Cities propose to release up to 1,800 acre-feet of water stored in Homestake Reservoir during 2020 under the Pilot Project. The released water will be measured as outflow from Homestake Reservoir, and then be shepherded down Homestake Creek, the Eagle River, and the Colorado River to a point effectively at the Colorado-Utah state line ("State line") by the Colorado Division of Water Resources, including the Division Engineer for Water Division No. 5.

Pilot Project Location

The Homestake System, and more specifically Homestake Reservoir, located near the headwaters of Homestake Creek, tributary to the Eagle River, tributary to the Colorado River, in Eagle and Pitkin Counties, Colorado.

Diversion Points and Measurement Devices

The Homestake System consists of a number of components that divert water from Homestake Creek and its tributaries, including the East Fork Conduit Collection System, the Homestake Conduit Collection System, and Homestake Reservoir. The collection systems convey all their water to Homestake Reservoir. The Homestake Tunnel physically takes water from the bottom of the reservoir and delivers it beneath the Continental Divide to the Arkansas River Basin. The operation of the Homestake System allows for storage of collected water in

Homestake Reservoir and/or for direct delivery of collected water immediately through the reservoir and the tunnel to the East Slope, depending on operational needs and preference.

The Cities propose to release up to 1,800 acre-feet of water stored in Homestake Reservoir back to the Colorado River System instead of delivering it through the Homestake Tunnel to the East Slope. The outlet of Homestake Reservoir has two measuring flumes to directly measure all releases. These flumes are monitored electronically by the Colorado Division of Water Resources, and can be accessed at these links:

https://dwr.state.co.us/surfacewater/data/detail_graph.aspx?ID=HOMOUTCO&MTYPE=DISCHRG

https://dwr.state.co.us/surfacewater/data/detail_graph.aspx?ID=HOMOUTCO&MTYPE=DISCHRG2

Homestake Reservoir storage volume is also monitored electronically by DWR, and reported at:

https://dwr.state.co.us/surfacewater/data/detail_graph.aspx?ID=HOMRESCO&MTYPE=STORAGE

Homestake Tunnel Releases are monitored and recorded at:

https://dwr.state.co.us/surfacewater/data/detail_graph.aspx?ID=HOMTUNCO&MTYPE=DISCHRG

Water Right and Description of Current Water Use

The water rights associated with the Homestake System, including those decreed in Case CA-1193 that have been made absolute, are diverted from Homestake, French, Fancy, Missouri, Sopris, and East Fork Homestake Creeks and points along the Homestake Conduit. The Homestake System has direct flow and storage rights with co-equal priorities. Homestake System water is either directly diverted through the reservoir and the Homestake Tunnel to storage on the East Slope or is diverted and stored in Homestake Reservoir and subsequently delivered to the East Slope. The water and its associated return flows are used and successively used for municipal purposes. As a transmountain diversion, no return flows accrue to the Colorado River Basin, so all diversions are therefore 100% depletive to the Colorado River System.

Representative Operation of Homestake System

In this document, 'diversion season' refers to the period the Homestake System is in priority to divert water, typically from May through late summer. Also, in this document 'winter months' is a period generally defined as November through April. The representative operation of the Homestake System is to divert and deliver to the East Slope the full amount of water that is legally and physically available to the system each diversion season, as it varies from year to year. This is accomplished by delivering water from storage to the East Slope and lowering the level of Homestake Reservoir over the winter months through Homestake Tunnel deliveries to East Slope storage by an amount that is enough to allow capture and storage of most of the forecasted Homestake System yield (i.e. the legally and physically available amount) of the next diversion season. By May, Homestake Reservoir has been lowered enough to capture most of the expected runoff. A smaller amount of runoff is sometimes delivered through the tunnel

during the diversion season rather than being stored. As runoff varies from year to year, so does the volume of tunnel deliveries and space in Homestake Reservoir. In general, the goal of Homestake System operations is to just fill Homestake Reservoir each year, to maximize yield and minimize spills.

Other factors may also affect reservoir operations. In dry years, the reservoir may be drawn down further to provide more Homestake water for use in the Cities, and/or hydrology may not be sufficient to fill the reservoir. Conversely, in very wet years or after a series of wetter years, the Cities may preferentially choose to stage other water in East Slope storage and reduce deliveries from the Homestake System to use on the East Slope. In such cases, Homestake Reservoir drawdown is reduced, resulting in less diversion and storage of Colorado River water. Construction and maintenance activities on Homestake System infrastructure or other parts of the Cities' systems also may affect operations as well.

Estimated Amount of Conserved Colorado River Consumptive Use to be Released.

As all the water diverted through the Homestake System is fully consumed vis-à-vis the Colorado River System, the released water represents a 100% reduction in consumption for those diversions. The Cities propose a one-time Pilot Project release to the Colorado River System of up to 1,800 acre-feet in 2020, and that amount of water would be conserved water that will be delivered to the State line under this Pilot Project.

Verification Method

The reduction in consumptive use would be verified by direct measurement of reservoir releases to the Colorado River System. Because it will be a release of water stored in priority in Homestake Reservoir that, but for the Pilot Project, would have been delivered to the East Slope, the release represents a reduction in consumptive use to the Colorado River System (see above). The West Slope release will be made after the Homestake Project is out of priority to store water, and the empty space created by the Pilot Project release will not be refilled in the same diversion season. To simplify operations, accounting, and verification during participation in this program, the cities will not deliver water to the East Slope under its direct flow water rights during the 2020 and 2021 diversion seasons. Also, after fill of the reservoir in the 2020 diversion season, the cities will only make tunnel deliveries from stored water after the release to the West Slope has been completed. Further, the Cities propose to verify that the release represents an actual reduction in delivery volume to the East Slope by providing evidence that the water released would have been taken to the East Slope over the winter months prior to the 2021 storage season "But For" the operation of this pilot program. Evidence will include:

1. A description of representative operations, including diversions, reservoir levels, and releases through the tunnel to the East Slope.
2. Current and forecasted East Slope storage levels for the cities demonstrating ability to take and use the water stored in Homestake Reservoir.

3. Estimated tunnel deliveries (absent Pilot Project release), Pilot Project release amount, and net estimated tunnel deliveries.
4. Demonstration of no increase in Colorado River Diversion through the Homestake System the following year as a result of this operation.

Detailed documentation of this evidence is provided in the Pilot Project Verification Submittal described below.

Timeframe/Schedule

The Cities propose to release up to 1,800 acre-feet in August or September of 2020 from storage in Homestake Reservoir. The release will be made after the Homestake System is fully out of priority, and prior to October 1, 2020. To facilitate the tracking and shepherding of the release, the Cities propose to release the water at a rate of up to 200 c.f.s. over a period of approximately 4 ½ days. The timing, schedule, and flow rates of the releases will be coordinated with the Division Engineer for Water Division No. 5 to facilitate the delivery (shepherding) of the water effectively to the State line. All operations under this Pilot Project shall be completed prior to the commencement of runoff and fill during the spring of 2021.

Additional Information

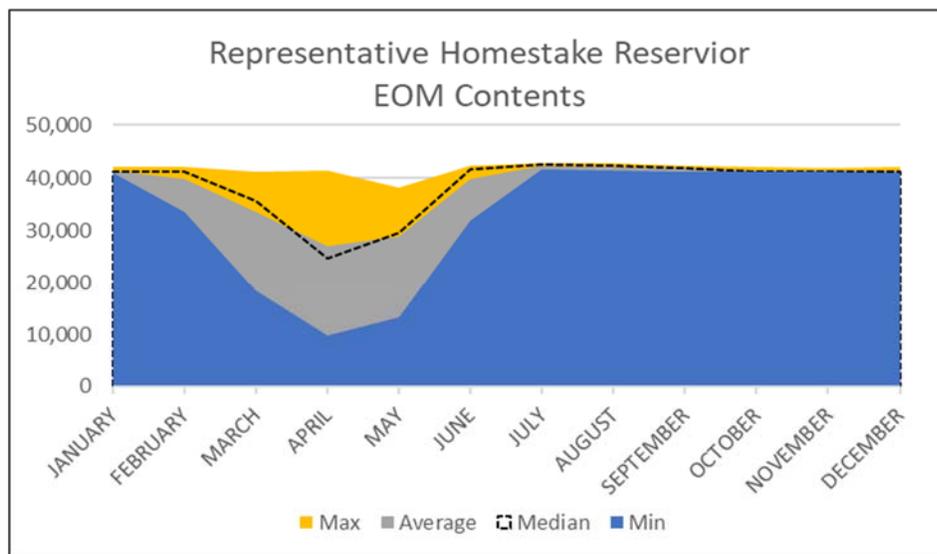
The Cities have developed this Pilot Project to operate as a state-approved water conservation program authorized under C.R.S. § 37-92-305(3)(c)(II)(A). To that end, this Pilot Project is predicated and contingent on these assumptions and/or requirements:

- 1) The release is dependent on the Cities securing necessary approvals and cooperation of the Office of the State Engineer and Division Engineer for Water Division No. 5;
- 2) The proposal to release water from Homestake Reservoir is dependent on the Division Engineer for Water Division No. 5 or other appropriate authority assuring that the water is protected from diversion by other water uses (i.e., shepherded) as it is routed downstream and delivered effectively at the State line, which is a point on the Colorado River below the lowest stream gauge and lowest diversion structure in Colorado near the State line;
- 3) The Cities propose to make the release if it is determined, by whatever legal means or determination is appropriate and binding, that the operation of this program and release of this water will not affect their water rights in any negative way, including no requirement to “paper fill” the Homestake storage right after the 2020 water year or any restriction on its right to divert and/or refill its storage in any subsequent water year, and;
- 4) The actions taken under this Pilot Project are done for the purposes of demonstration, learning, and advancing the concept of reservoir releases as a mechanism for compact compliance or as part of a future demand management program. While the Cities may elect to conduct future pilot projects, they will not be held to the same operations undertaken as part of this pilot program in the future.

Pilot Project Verification Submittal

1. Description of Representative Operations:

The representative operation of the Homestake System is to divert and deliver to the East Slope the full amount of water that is legally and physically available to the system each year, as its supplies vary from year to year. This is accomplished by lowering the level of Homestake Reservoir over the winter months through Homestake Tunnel deliveries to East Slope storage by an amount that is enough to capture most of the forecasted Homestake System yield (i.e. the legally and physically available amount) of the next diversion season. By the end of April, Homestake Reservoir has been lowered enough to capture most of the expected runoff.

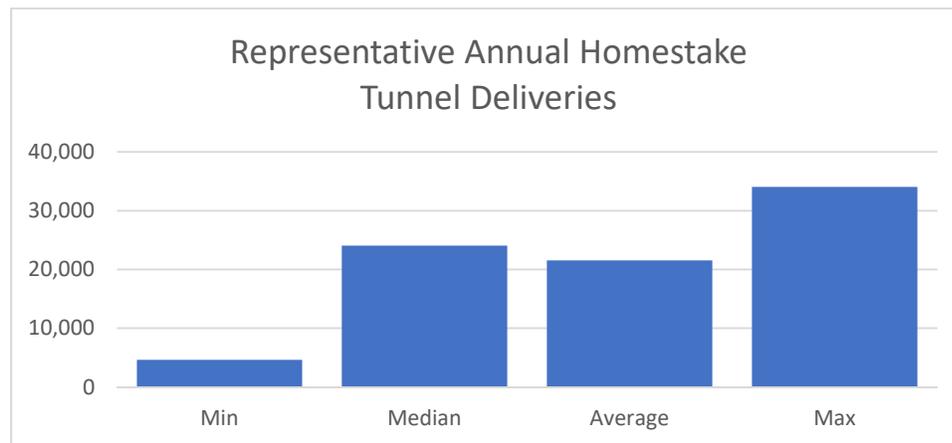


- The average April 30 storage is 28,849 AF, with a range between 13,207 AF and 38,152 AF for the representative period¹.

As hydrology varies from year to year, so does the expected runoff, and consequently the volume of tunnel deliveries and space in Homestake Reservoir. In general, the goal of Homestake System operations is to just fill the reservoir each year, to maximize yield and minimize spills. Other factors may also affect operations. At times, a smaller amount of runoff may be delivered through the tunnel during runoff to adjust to differences in forecasted and actual operations. In dry years, the reservoir may be drawn down further to provide more Homestake water for use in the Cities, and/or hydrology may not be sufficient to fill the reservoir. Conversely, during wetter periods, tunnel deliveries may

¹ The representative period is 2008, and 2016 – 2019. The period of 2009 – 2015 was excluded because operations were impacted due to reservoir maintenance and construction activities, and do not reflect “normal” operations.

actually be less due to available East Slope storage capacity. In such cases, Homestake Reservoir drawdown is reduced, resulting in less diversion and storage of water. Construction and maintenance activities on Homestake Project infrastructure (such as in 2009 – 2015) or other parts of the cities’ systems may affect operations as well.



- The average annual Homestake Tunnel delivery during the representative period was 21,545 AF, with a range between 4,617 AF and 34,060 AF.

2. Current and Forecasted Homestake Reservoir Storage and Diversions

Homestake Reservoir is forecasted to fill in 2020, to a level of 42,600 AF. All water that will be in storage in Homestake reservoir as of the end of the 2020 diversion season was and will have been stored in priority under the Cities’ water rights. To simplify operations, accounting, and verification during participation in this program, the Cities will not make any tunnel deliveries under its direct flow rights to the East Slope during the 2020 and 2021 diversion seasons, making all tunnel deliveries from stored water after all Pilot Project releases to the West Slope have been completed. Homestake Reservoir is forecasted to be drawn down to a level of 12,600 AF by the end of May 2021, resulting in the evacuation of 30,000 AF of stored water. Therefore, the diversion of Colorado River water by the Homestake system in 2021 is forecasted to be equal to 30,000 AF. Homestake Reservoir levels can be monitored and verified by the storage gauge monitored electronically by the Colorado Division of Water Resources, as described above.

3. Proposed West Slope Storage Release

The Cities propose to release up to 1,800 acre-feet in August or September of 2020 from storage in Homestake Reservoir. The release will be made after the Homestake System is fully out of priority, and prior to October 1, 2020. To facilitate the tracking and shepherding of the release, the Cities propose to release the water at a rate of up to 200 c.f.s. over a period of approximately 4 ½ days. The release will be monitored and verified

by measurement at the outlet of Homestake Reservoir using the two measuring flumes monitored electronically by the Colorado Division of Water Resources, as described above.

4. Forecasted Tunnel Deliveries

So long as there is a corresponding reduction in tunnel delivery to the East Slope, then the Pilot Project release is a reduction in the Cities’ Colorado River consumptive use. Homestake Tunnel delivers directly into Turquoise Reservoir, and from there water can be and is delivered to the Cities’ East Slope water supply systems for storage in multiple reservoirs or for direct use. As described above, the Cities will not make any tunnel deliveries to the East Slope under their direct flow rights during this Pilot Project, making all tunnel deliveries after all releases to the west slope have been completed. Based on current forecasting, the expected tunnel delivery in 2021 is 30,000 AF prior to the end of April, before the diversion season begins. Therefore, the Cities propose to decrease the planned tunnel delivery to 28,200 AF to demonstrate an actual reduction in delivery to the East Slope due to the Pilot Project release. The release can be monitored and verified using the Homestake Tunnel Gauge monitored electronically by the Colorado Division of Water Resources, as described above. Forecasted operations without and with the Pilot Project release are shown below.

Expected Homestake Operations Absent Pilot Project
 values in acre-feet

	Homestake Res EOM Storage (42.6 KAF max)	West Slope DMP Pilot Release	Homestake Tunnel Deliveries
Jun-20	42,600	0	0
Jul-20	42,600	0	0
Aug-20	42,600	0	0
Sep-20	42,600	0	0
Oct-20	42,600	0	0
Nov-20	42,600	0	0
Dec-20	42,600	0	0
Jan-21	42,600	0	0
Feb-21	34,600	0	8,000
Mar-21	19,600	0	15,000
Apr-21	12,600	0	7,000
May-21	19,800	0	0
Jun-21	33,100	0	0
Jul-21	41,100	0	0
Aug-21	42,600	0	0
Totals		0	30,000

Expected Homestake Operations with Pilot Project
 values in acre-feet

	Homestake Res EOM Storage (42.6 KAF max)	West Slope DMP Pilot Release	Homestake Tunnel Deliveries
Jun-20	42,600	0	0
Jul-20	42,600	0	0
Aug-20	42,600	0	0
Sep-20	40,800	1,800	0
Oct-20	40,800	0	0
Nov-20	40,800	0	0
Dec-20	40,800	0	0
Jan-21	40,800	0	0
Feb-21	32,800	0	8,000
Mar-21	17,800	0	15,000
Apr-21	12,600	0	5,200
May-21	19,800	0	0
Jun-21	33,100	0	0
Jul-21	41,100	0	0
Aug-21	42,600	0	0
Totals		1,800	28,200

5. Homestake Reservoir Storage and Colorado River Diversions

West Slope storage in Homestake Reservoir is the same at the end of May 2021 both without the Pilot Project release and with the Pilot Project release. Therefore, no additional storage or Colorado River diversion is facilitated by this operation.

6. Demonstration of Storage Capacity to Receive Deliveries

The Cities forecast a minimum amount of empty storage space in East Slope Storage in excess of 19,500 AF during this Pilot Project. This is many times the volume of the Pilot Project release, so the next season’s diversions by the Homestake Pilot Project will not be limited or facilitated by East Slope storage by operation of this program. As a result, deliveries through the tunnel to the East Slope after 2021 will be the same with or without the Pilot Project, and the 1,800 AF Pilot Project release will not be recovered in either 2021 or later. Therefore, this operation is not a retiming of diversions.

7. Verification of Reduced Tunnel Deliveries

The Cities will measure and collect the relevant data to verify these operations and will compile this data into a verification report by September 2021.

Authority of the State Engineer to Implement a State Line Delivery Pilot Project

1. General Statutory Authority.

The State Engineer has executive responsibility and authority for: discharge of the obligations of the state of Colorado imposed by interstate compact, C.R.S. § 37-80-102(1)(a); investigations related to carrying out the functions of the Division of Water Resources, C.R.S. § 37-80-102(1)(f); and general supervisory control over distribution of the public waters of the state, C.R.S. § 37-80-102(1)(g). Rulemaking is not a prerequisite to performance of the State Engineer's duties under any compact, treaty, or judicial decree or decision that does not, by its specific terms, require implementation by rule. C.R.S. § 37-80-102(1) (k).

Neither the Colorado River Compact nor the Upper Colorado River Compact require the State Engineer to adopt rules to discharge his responsibilities under the compacts. Moreover, under *Hinderlider v. La Plata River & Cherry Creek Ditch Co.*, 304 U.S. 92 (1938), the State Engineer may order the curtailment of Colorado water rights as necessary to ensure delivery of water apportioned to another state by interstate compact.

Under C.R.S. § 37-80-102, the State Engineer has the statutory authority to carry out investigations related to the discharge of the obligations of the state of Colorado imposed by interstate compact and may carry out such investigations without the need for rulemaking to do so. The State Line Delivery Pilot Project is proposed as an investigation by the State Engineer to test the feasibility of releases of reservoir water for delivery to the Colorado-Utah state line as a means to assist Colorado in meeting its obligations under both the Colorado River Compact and the Upper Colorado River Compact. It may also provide useful information for any future Upper Division Demand Management Program.

Consistent with general supervisory control over the distribution of the public waters of the state, the State Engineer is also empowered to approve water conservation plans, including pilot programs. C.R.S. § 37-92-305(3)(c)(A). The statute does not define water conservation plans, but there can be no doubt that the reduction of consumptive use of water and the delivery of such water to the Colorado-Utah state line in partial satisfaction of Colorado's obligations under the Colorado River and Upper Colorado Compacts conserves water for future use in Colorado.

2. Administration of Water Right for Compact Compliance.

A bedrock principle of Colorado water law is that a decree of a state court cannot confer a right in water of an interstate stream in excess of the State's equitable portion of such water. *Hinderlider v. La Plata*, 304 U.S. at 102; see *People ex rel. Simpson v. Highland Irr. Co.* 917 P.2d 1242 (Colo. 1996). When the apportionment of the water of an interstate stream is made by compact, "the apportionment is binding upon the citizens of each State and all water claimants, even where the State had granted the water rights before it entered into the compact." *Id.* at 106. Accordingly, state created water rights only attach to the state's equitable share of the waters apportioned to the state.

Compact administration varies depending upon the terms of the compact. What is not in doubt is the state engineer's ability to curtail diversions by state created water rights in order to deliver water to the state line under an interstate compact. For example, the waters of the Rio Grande (Water Division No. 3) have been apportioned by the Rio Grande Compact which establishes an annual (calendar year) scheduled delivery by Colorado, subject to allowance for annual and accrued credits and debits. In Water Division No. 3, the State and Division Engineers make daily decisions concerning the curtailment of state water rights for purposes of satisfying Colorado's obligations under the Rio Grande Compact. During the irrigation season the Division Engineer determines the amount of water that is available for diversion by water rights on the Conejos River and Rio Grande, and the quantity of the flow in those rivers that must be left in the stream in order to meet the two stream's respective annual delivery obligations under the Rio Grande Compact. The water that is left in the streams for compact compliance purposes is shepherded past all diversion and delivered to the Lobatos gauge, the point on the Rio Grande where Colorado's compact deliveries are measured, downstream of all diversions in Colorado.

Due to the vagaries in the estimate of annual stream flows, and to maximize the amount of water available for diversion in Colorado, beginning in the mid-1970's the State and Division Engineers have developed a program of "compact storage" on the Rio Grande. That program operates by storing in upstream pre-compact reservoir (with the consent of the reservoir owner) water that would otherwise be curtailed from the downstream water rights for delivery to the Lobatos gauge. The water so stored is available to assist in meeting the Rio Grande's schedule of deliveries. If the water is needed for compact delivery, it is typically released late in the year and shepherded to the Lobatos gauge. If it is not needed for compact delivery in the year in which it was stored, the practice in recent years has been to carry the compact water over in storage and release the water before the beginning of the next irrigation season as a compact delivery, thereby reducing the amount of water that must be curtailed from water rights on the Rio Grande during that year.

There is no decree or other express judicial confirmation of the practice of compact storage. Rather, compact storage is operated under the State Engineer's executive responsibility and authority to discharge the obligations of the state of Colorado imposed by interstate compact, and his general supervisory control over distribution of the waters of the state.

3. The State Engineer's authority to carry out investigations in aid of fulfilling his statutory duties.

The State Engineer has executive responsibility and authority for investigations related to carrying out the functions of the Division of Water Resources. C.R.S. § 37-80-102(1)(f). Compliance with interstate compacts is a responsibility of the State Engineer. Accordingly, the State Engineer has authority to carry out investigations to assist him in determining how to comply with the requirements of an interstate compact.

The State Engineer's authority to conduct investigations as part of the administration of water rights was confirmed in *Purgatoire River Water Cons. Dist. v. Kuiper*, 593 P.2d 333 (Colo. 1979). That case involved the operation of Trinidad Reservoir, near Trinidad, Colorado, and the potential impact of winter storage of direct flow winter irrigation water on the senior water rights of the Highland and Nine Mile ditches located many miles downstream near Las Animas, Colorado. There was no empirical data available to determine the actual effect of the proposed storage. After consultation with the State Engineer, the Division Engineer issued an order pursuant to C.R.S. § 37-80-120 permitting upstream out-of-priority storage in Trinidad Reservoir to determine what affect, if any, such storage had on the water supply available downstream to the Highland and Nine Mile ditches. If it appeared the test was reducing the water available to downstream seniors, the water from the reservoir could be released for delivery to them. *Id.*, 593 P.2d at 339-40. The water court enjoined the Division Engineer from allowing the out-of-priority storage. On appeal, and in reliance on C.R.S. §§ 37-92-301(1) and 502(2), the Colorado Supreme Court stated that "[t]his is the type of matter in which the water authorities and not the court have the right to make the initial determination." 593 P.2d at 340. It went on to conclude that under the statute the division engineer had the right to make an evaluation, and "[a]fter the division engineer has conducted a reasonable empirical study, the court has its role to play in judging whether his orders of release or impoundment have been correct." *Id.*

A State Line Delivery Pilot Project is an empirical investigation that can be carried out by the State Engineer within his authority under C.R.S. § 37-80-102(1)(f). It is a learning-by-doing Pilot Project to help the State Engineer and water users in Colorado to determine whether reservoir releases are a viable mechanism for delivery of water to the state line for compact compliance purposes. It may also provide information useful for any future Demand Management Program intended to reduce the need for compact curtailment. It is also intended to qualify as a conservation pilot program as contemplated by C.R.S. § 37-92-305(3)(c)(II)(A). The participating entities have volunteered to provide water that they otherwise would have diverted from the Colorado River basin to the east slope of Colorado and fully used. As described earlier, this is water that, but for the release under the Pilot Project, would have been a depletion to the Colorado River system by the state of Colorado under the Colorado River and Upper Colorado River Compacts. The participating entities' contemplated delivery to the State line will reduce the state of Colorado's beneficial consumptive use of water under both compacts. The Pilot Program will enable the State Engineer to learn if and how this type program can be used as part of an overall program to assure Colorado remains in compliance with its obligation under the compacts. It does so without depriving any other Colorado water right of water that would otherwise have been physically and legally available to divert.

B. Protocol for Administration of the State Line Delivery Pilot Reservoir Release (An investigation conducted by the State Engineer pursuant to sections 37-80-102(1)(f), C.R.S. and 37-92-301(1), and as further allowed by 37-92-102(1)(a))

Protocol for Administration of the State Line Delivery Pilot Reservoir Release
(An investigation conducted by the State Engineer pursuant to sections 37-80-102(1)(f),
C.R.S. and 37-92-301(1), and as further allowed by 37-92-102(1)(a))

1. Purpose

The purpose of this Administrative Protocol is to provide a reference document for use by the State Engineer and Division Engineers for Water Divisions 1, 2, and 5 (collectively “Engineers”) when administering the State Line Delivery Pilot Reservoir Release (“Reservoir Release”) as described in greater detail below. The Reservoir Release will be conducted by the State Engineer’s Office and the Division Engineer’s Office for Division 5, with concurrence from the Division Engineers in Divisions 1 and 2. The Reservoir Release will be conducted in cooperation with Colorado Springs Utilities, Aurora Water, and the Pueblo Board of Water Works (“the Cities”), with full support of the Front Range Water Council. The objective of the Reservoir Release is to allow a one-time release of water from Homestake Reservoir to determine the efficacy of current administration practices to administer the released water on the Colorado River and its tributaries from Homestake Reservoir to the state line. The Reservoir Release will allow the State and Division Engineers to investigate important aspects of Division 5’s administration practice as well as hydrologic influences that would affect the timing and amount of the arrival of the released water at the state line. The results of the Reservoir Release will provide the State and Division Engineers as well as water users on the West Slope and East Slope with valuable information that help plan actions related to compliance with the Colorado River Compact and the Upper Colorado River Compact.

2. Background and Authority

The Reservoir Release will consist of a release of up to 1800 acre-feet of water from Homestake Reservoir, which water has been stored in priority according to water rights owned by the Cities and is transbasin water, decreed for use on the East slope. The Cities will document a commensurate reduction in supply to their systems from Homestake Reservoir. The release will entirely comprise water that would have been diverted from, and is 100-percent consumptive to, the Colorado River Basin. The release of the water and the resulting reduction in the amount of water storage in Homestake Reservoir in 2020 for use on the East Slope will not result in greater diversions in priority under the water right from the Colorado River Basin.

The water will be released continuously during a period of time in August or September, 2020 at an initial discharge of approximately 20 to 25 c.f.s. that will incrementally increase over 24 to 36 hours to as high as 200 cfs and will be administered past all structures on the Reservoir Release Reach, including calling senior water rights and all other diversions. The Division Engineer will monitor the release of the water to the state line with regard to the timing of the release, gauge flows at points along the Reservoir Release Reach, inflows and diversion, and transit losses, among other things to determine

the ability to track the release of water, losses incurred, and the attenuation of the release's hydrograph.

The Division Engineer's authority to administer the water past all structures, including senior calling water rights and all other diversions derives from the responsibility and authority given the State Engineer in section 37-80-102(1)(f): "The state engineer has executive responsibility and authority with respect to: (f) The keeping and preparation of records and investigations as related to carrying out the functions of the division of water resources..." The investigation accomplished by this Reservoir Release relates back to the responsibilities identified in 37-80-102(1)(a): "(a) Discharge of the obligations of the state of Colorado imposed by compact or judicial order on the office of the state engineer;..." and section 37-92-301(1) "the state engineer shall be responsible for the administration and distribution of the waters of the state, and, in each division, such administration and distribution shall be accomplished through the offices of the division engineer..."

3. Definitions. The following definitions apply for purposes of this Administrative Protocol ("Protocol"). In addition, terms defined elsewhere in this Protocol will have the meanings there provided.

3.1.1. Administrative Reach: Any discrete reach of the stream system along the Reservoir Release Reach used by DWR for administration purposes.

3.1.2. Discharge: The flow rate in cubic feet per second.

3.1.3. Reservoir Accounting: The accounting typically used for the administration of Homestake Reservoir by the Cities that is accepted by the State Engineer, with added information identifying the timing and Discharge of the Reservoir Release.

3.1.4. Reservoir Release Reach: The Reach of the stream system through which the Reservoir Release will be conducted, beginning on Homestake Creek below Homestake Reservoir, continuing to the confluence of Homestake Creek and the Eagle River, continuing to the confluence of the Eagle River and the Colorado River, and continuing to the farthest downstream gauge on the Colorado River upstream of the state line.

3.1.5. Reservoir Release Schedule: The date and time at which the Reservoir Release will begin and end, the Discharge, and the total volume to be released. Releases under the Reservoir Release Schedule will be continuous and as one single Discharge.

3.1.6. Reservoir Release Water: The Discharge flowing through any Administrative Reach and identified by DWR as the water released from Homestake Reservoir as part of the Reservoir Release.

4. Administrative Protocol

4.1. Communication and Final Approval

- 4.1.1. The Cities' contact for the purposes of all communications during the operation of the Reservoir Release will be: Kalsoum Abbasi at Colorado Springs Utilities, kabbasi@csu.org.
- 4.1.2. The Division of Water Resources' contacts for the purposes of all communications during the operation of the Reservoir Release will be: Alan Martellaro, Division 5, Division Engineer and James Heath, Division 5, Lead Assistant Division Engineer (together, "the DWR Contact").
- 4.1.3. The Cities will have the responsibility to identify and communicate with the appropriate local interests on Homestake Creek, the Eagle River, and the Colorado River to:
 - 4.1.3.1. Determine an initial and maximum Discharge and a schedule for the increase of Discharge to ensure proper notice for the purposes of safety and property protection at every appropriate location on the Reservoir Release Reach
 - 4.1.3.2. The Cities shall develop a plan to maintain communication with the identified local interests to advise them, and through them, the public of the planned increase to Discharge on the Reservoir Release Reach
- 4.1.4. The Cities and the DWR Contact will coordinate the Reservoir Release Schedule. The Cities contact will contact the DWR Contact no later than seven days prior to their proposed release for approval of the Reservoir Release Schedule and the Reservoir Accounting, and to advise the DWR Contact of the plan to communicate with the local interests.
 - 4.1.4.1. The DWR Contact will approve of the Reservoir Release Schedule and Reservoir Accounting. The DWR Contact may also propose an alternate Reservoir Release Schedule in consideration of stream conditions, the river call, or other factors for the sole purpose of maximizing the value of information derived from the Reservoir Release.
- 4.1.5. The Cities contact will continue to consult with DWR to agree on the Reservoir Release Schedule and the Reservoir Accounting. Once consultation is completed, the Cities will e-mail the Reservoir Release Schedule to DWR for the DWR Contact's final approval by e-mail response.

4.2. Administration

- 4.2.1. DWR agrees to conduct, or administer the Reservoir Release Water past all calling structures or all other diversions in the Reservoir Release Reach.

4.3. Measurement and Accounting

4.3.1. DWR agrees to record data associated with the Reservoir Release as to the time and Discharge along with other information at time intervals and locations in the Reservoir Release Reach, as determined by DWR including:

4.3.1.1. Stream gauge readings along the Reservoir Release Reach,

4.3.1.2. Calculated transit losses for discrete Administrative Reaches along the Reservoir Release Reach,

4.3.1.3. Inflows and diversions, and their locations along the Reservoir Release Reach.

4.4. Results

4.4.1. DWR agrees to document the results of the Reservoir Release (“Results”) in the following areas:

4.4.1.1. Obstacles to administering the Reservoir Release through the Reservoir Release Reach past diversion structures,

4.4.1.2. Measured Discharge in Administrative Reaches as compared to flow estimates that are based on the amount of the Reservoir Release entering the Administrative Reach, transit losses, inflows, and diversions,

4.4.1.3. The amount and timing of the Reservoir Release Discharge that occurs in Administrative Reaches throughout the Reservoir Release Reach up to and including the lowest gauge in Colorado upstream of the state line.

4.4.1.4. Any impacts to the public, as reported by the local interests

4.4.2. DWR and the Cities agree that DWR will make all Results available to the Cities and, as a matter of public record, all Results will be available upon request to members of the public. The Results will include this Protocol, the Reservoir Release Schedule, the Reservoir Accounting, and the associated approvals, as well as the Results identified above (currently numbered 4.4.1).

4.5. Reservoir Accounting, Reservoir Fill Status, and Diversion Records

4.5.1. The Cities will verify that the release represents an actual reduction in delivery volume to the East Slope by providing evidence that the water released would have been taken to the East Slope over the winter months prior to the 2021 fill season “But For” the operation of this pilot program. Evidence will include:

4.5.1.1. A description of representative operations, including diversions, reservoir levels, and releases through the tunnel to the East Slope.

- 4.5.1.2. Current and forecasted East Slope storage levels for the cities demonstrating ability to take and use the water stored in Homestake Reservoir.
- 4.5.1.3. Estimated tunnel deliveries (absent Reservoir Release), Reservoir Release amount, and net estimated tunnel deliveries.
- 4.5.1.4. Demonstration of no increase in Colorado River Diversion through the Homestake System the following year as a result of this operation.
- 4.5.2. For the purposes of Homestake Reservoir's fill status, the Reservoir Release amount will be treated as a diversion of the Cities' water previously stored in priority, to their water supply systems according to their water rights.
 - 4.5.2.1. The volume of the Reservoir Release, like all actual diversions to the Cities' water supply systems, cannot be refilled during the 2020 fill season. The fill season typically begins in May and ends when the Homestake water rights are out of priority.
 - 4.5.2.2. The Cities will not deliver water to the East Slope under the direct flow water rights during the 2020 and 2021 fill seasons. All deliveries through the Homestake Tunnel in 2020 have been from storage.
 - 4.5.2.3. The Cities will verify through accounting that the Reservoir Release resulted in no additional storage in the Homestake system during the 2020 fill season and that no direct flow deliveries will take place during the remainder of 2020 or 2021 fill seasons.
- 4.5.3. In recognition of the fact that the Reservoir release is an investigation conducted by the State Engineer's Office and due to the protective conditions and limitations set forth in this Protocol:
 - 4.5.3.1. The Cities will have no reduction in the amount they are allowed to fill Homestake Reservoir during the 2021 fill season due to the volume of the Reservoir Release.
 - 4.5.3.2. The DWR diversion records will be tabulated to indicate that the amount of the Reservoir Release does not affect a future historical use analysis nor does it indicate an intent to abandon that portion of Homestake Reservoir's water right.
 - 4.5.3.3. The Reservoir Release will in no way impair the Cities' operation of Homestake Reservoir and their ability to divert water stored in priority for its decreed beneficial use in the Cities' water supply systems other than the limitations on the ability to store and divert water specifically identified in this Administrative Protocol.

C. Reservoir Release Schedule

Date	Day	Time	Change flow to:	Units
9/23/2020	Wednesday	8:00	25	cfs
		10:00	50	cfs
9/24/2020	Thursday	8:00	75	cfs
		10:00	125	cfs
		12:00	175	cfs
9/25/2020	Friday	hold	175	cfs
9/26/2020	Saturday	hold	175	cfs
9/27/2020	Sunday	hold	175	cfs
9/28/2020	Monday	8:00	150	cfs
		10:00	125	cfs
		12:00	100	cfs
9/29/2020	Tuesday	8:00	50	cfs
		10:00	25	cfs
		12:00	0	cfs

D. Associated Approvals

State Line Delivery Pilot Reservoir Release

Attachments:

Ltr from FRWC to Kevin Rein re State Line Reservoir Release Pilot Project 08-27-2020.pdf, (see Appendix A);

Attachment to K Rein Letter - State Line Delivery Pilot Project Reservoir Release 8-25-2020.pdf, (see Appendix A);

Reservoir Release Admin Protocol - Final 2020-08-26.pdf (see Appendix B).

James Heath - DNR

From: Rein - DNR, Kevin <kevin.rein@state.co.us> on behalf of Rein - DNR, Kevin
Sent: Thursday, September 17, 2020 8:07 AM
To: Williams, Pat E.
Cc: mbrown@auroragov.org; Earl Wilkinson <ewilkinson@csu.org>; Seth Clayton (sclayton@pueblowater.org); Jim Broderick (jwb@secwcd.com); Brad Wind; Kevin Lusk (klusk@csu.org); Lain Leoniak; Mike Sullivan - DNR; Alan Martellaro - DNR; James Heath - DNR; Bill Paddock; David W. Robbins; Davis, Alexandra; Connor, Michael; Kalsoum Abbasi
Subject: Re: Letter and attachment re: State Line Delivery Pilot Project Reservoir Release
Attachments: Ltr from FRWC to Kevin Rein re State Line Reservoir Release Pilot Project 08-27-2020.pdf; Attachment to K Rein Letter - State Line Delivery Pilot Project Reservoir Release 8-25-2020.pdf; Reservoir Release Admin Protocol - Final 2020-08-26.pdf

Dear Pat,

For the purpose of conducting the Reservoir Release, the SEO will regard the attachments to your August 27 e-mail, including the submittal letter and the August 25, 2020 Project Description, as the formal request for the SEO to cooperate on the Reservoir Release. For convenience, I have attached those two documents to this e-mail. I have also attached the final Administrative Protocol, dated August 28, 2020, as evidence of the SEO's acceptance of that request and to document the terms by which the Reservoir Release will be administered.

Sincerely,

Kevin

Kevin G. Rein, PE
State Engineer, Director



COLORADO
Division of Water Resources
Department of Natural Resources

Office: 303.866.3581 ext. 8239 | Mobile: [303.358.3022](tel:303.358.3022)
1313 Sherman Street, Room 818, Denver, CO 80203
kevin.rein@state.co.us | www.water.state.co.us

On Thu, Aug 27, 2020 at 11:15 AM Williams, Pat E. <Pat.Williams@denverwater.org> wrote:

Good morning, hope all is well.

See letter and attachment from the Front Range Water Council.

Have a great day.

Patricia (Pat) Williams | CEO/Manager's Office | Executive Assistant
Denver Water | t: 303-628-6462 | f: (303-628-6509 | c: 303-921-8512

1600 West 12th Ave | Denver, CO 80204-3412
pat.williams@denverwater.org | <http://www.denverwater.org>

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