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**Cc:** Deb Daniel – General Manager, Republican River Water Conservation District  
**From:** Randy L. Hendrix – Hendrix Wai Engineering, Inc.  
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**Date:** October 5, 2018  
**Subject:** Republican River Water Conservation District Water Fee Policy

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This memorandum documents our preliminary recommendations for an equitable fee structure for all types of water consumption within the Republican River Water Conservation District (RRWCD) that are considered to be part of the Computed Beneficial Consumptive Use (CBCU) in the Republican River Compact Administration (RRCA) Accounting Procedures and Reporting Requirements. The recommended fee structure is limited to the use and consumption of water within the RRCA Model Domain, in accord with the proposed Rules and Regulations Governing the Diversion and Use of Water Resources in the Republican River Compact Administration Groundwater Model Domain for Compliance with the Republican River Compact (Compact Rules). If the Compact Rules are modified in the future, then the recommended fee structure may need to be revised.

## Background

Currently, the RRWCD imposes a water use fee of \$14.50 per irrigated acre for groundwater pumping for irrigation. There currently are no similar fees for non-irrigation groundwater pumping, post Compact surface water diversions, and evaporation from certain reservoirs. Impacts from the consumptive uses with no current water use fee are included in the RRCA accounting and are included in Colorado's CBCU for the year and so have an impact on Colorado's ability to comply with the Compact.

As explained in more detail below, groundwater pumping does not result in a one-for-one depletion to streams, instead much of the water comes from storage and does not have a stream impact. Also, pumping impacts are longer term and so pumping in one year may contribute to CBCU for many years to come, but just a little bit each year. **Figure 1** shows the total Colorado groundwater pumping from 1968-2017 (the last 50 years). Pumping varies year to year, but averages 737,644 ac-ft/yr for that period. The RRCA accounting has considered groundwater CBCU only since 1995<sup>1</sup>. For this period, it averaged 27,404

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1 The RRCA accounting for the years 1995 to 2002 was completed for the limited purpose of having accounting for all years.

ac-ft/yr. Therefore, if we consider the long term average ratio of CBCU to total pumping, that ratio is 3.7% (27,404 / 737,644).

Surface water usage is counted against Colorado's CBCU in the same year at 60% of the measured diversion and counts directly against Colorado's CBCU. It should be noted that the 60% number is a system wide value, not a farm headgate delivery. This means that the 60% is counted against measured river headgate diversions. There is no separate accounting term for canal losses, it is all lumped together. The other 40% is added to the groundwater model as additional recharge. In the calculation of the groundwater CBCU this surface water recharge is present in both the pumping and the no-pumping Groundwater Model runs, so it does not directly contribute to the groundwater CBCU. However, it does, at times, prevent the stream from drying out, and to the extent that it provides additional baseflow which can be depleted by groundwater pumping, it increases the groundwater CBCU.

If we simply take the ratio of the direct groundwater contribution to CBCU and the direct surface water contribution to CBCU, the ratio is 3.7% to 60%, or about 1 to 16. If we consider the fact that surface water recharge enhances baseflow and therefore causes the model to calculate more groundwater CBCU, that ratio would be higher.

In addition, we have to consider that the CBCU for surface water use is counted in the same year as the actual use. By contrast, groundwater pumping can be delayed by many years or decades before it impacts the stream. Experience with the Groundwater Model has generally shown that the impact of pumping on CBCU in the same year is infinitesimal. Therefore, comparing the 1968-2017 average pumping to 1995-2017 average CBCU is our attempt at evaluating the time-averaged relationship between total pumping and CBCU.

It is important to not have the Glover mindset when evaluating pumping vs. CBCU. In Glover, it is assumed that 100% of the consumptive use will eventually impact the stream, so the only offset is for return flow. In the RRCA model, it is NOT assumed that 100% of the consumptive use will eventually hit the stream, but instead the RRCA model takes into account that there are changes in boundary flows and evapotranspiration that provide significant offsets, as well as allowing for the depletion of the aquifer, i.e. water coming out of storage.

Therefore, in terms of the long-term cost of compact compliance, the headgate diversion of surface water has an impact approximately 16 times greater than the metered (total) groundwater pumping. Furthermore, the surface water CBCU appears in the accounting in the same calendar year as the diversion, while groundwater pumping may not show up until years or decades later. This makes annual compact compliance more difficult and may cause the CCP to over-deliver.

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## Recommended Water Use Fees

Based on information described above in the Background Section the following Water Use Fees should be considered for the use and consumption of water within the RRCA Model Domain for Compliance with the Compact Rules. Calculations for the four different types of water uses are shown in **Table 1**.

### Groundwater Irrigation Use

This is the current fee set by the RRWCD Board of \$14.50 per irrigated acre. This fee would be the basis for the remaining fees discussed below. If this fee changes in the future by the direction of the Board, then this will result in changes to the remaining fees based on the factors that apply to the remaining 3 types of use and consumption. This is referred to in Table 1 and below as the Groundwater Irrigation Fee.

### Municipal and Commercial Use

This fee would apply to groundwater pumping by entities that use the water for non-irrigation purposes. This fee is referred to in Table 1 and below as the Groundwater Non-Irrigation Fee. This would basically apply to certain municipal and commercial well users and would apply to the annual measured pumping amount. Since the fee for Groundwater Irrigation Use is based on irrigated acres, that fee needed to be converted to an amount of pumping per acre. An application rate of 18 inches or 1.5 feet per acre was assumed as an average application rate for irrigation. The Groundwater Irrigation Fee of \$14.50 per acre was divided by 1.5 feet to arrive at a groundwater irrigation rate of \$9.67 per ac-ft ( $\$14.50 / 1.5$ ). The next step was to then compare the ratio of modeled consumption from municipal and commercial uses (50%) to modeled sprinkler consumption (83%) within the RRCA accounting. A Groundwater Non-Irrigation Fee of \$5.83 per ac-ft pumped is derived as the ratio of 50:83 multiplied by \$9.67 per ac-ft of pumping ( $\$9.67 \times 50/80$ ).

All municipal and commercial users would have to provide annual pumping records that this fee would apply. Therefore, it is recommended that the Groundwater Non-Irrigation Fee be set at \$5.83 per ac-ft pumped and would be subject to any future changes to the Groundwater Irrigation Fee.

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## Surface Water Irrigation Use

This fee would apply to surface water diversion structures that continue to irrigate land and are post Compact diversion rights. This fee is referred to as the Surface Water Irrigation (flood) Fee or Surface Water Irrigation Fee in Table 1 and below. As explained in the Background section above, the direct contributions to Colorado's CBCU from surface diversions during any year is 1:16. This ratio could be higher and has been estimated in the past to be about 1:20. Since the contributions to Colorado's CBCU is higher than the CBCU for groundwater pumping the Surface Water Irrigation Fee should reflect that difference in contribution.

As stated before in the Groundwater Non-Irrigation Fee section, the groundwater irrigation rate was calculated as \$9.67 per ac-ft of water pumped. The ratio of 1 unit of groundwater pumping to surface water diversions is 6.25% (1 / 16). Applying this percentage to the groundwater irrigation rate results in a Surface Water Irrigation Fee of \$154.72 ( $\$9.67 / 6.25\%$ ).

All surface water diversions irrigation users would need to supply not only annual diversions in ac-ft but should also provide monthly diversions to aid Colorado and the RRWCD in determining the amount of surface water diversions that will be included within the RRCA accounting. The annual use can be estimated using a rolling average of the previous 5 years. The 5-year average would then be consistent with the current RRCA compliance requirement of a 5-year average. Actual diversions numbers would be used when made available. Therefore, it is recommended that the Surface Water Irrigation Fee be set at \$154.72 per ac-ft diverted and would be subject to any future changes to the Groundwater Irrigation Fee.

## Reservoir Evaporation

This fee would apply to evaporation from reservoirs within the RRCA Model Domain for compliance with the Compact Rules. The evaporation losses applied to Colorado's CBCU include all Federal reservoirs (Bonny Reservoir) and reservoirs with a storage capacity of 15 ac-ft or more. All reservoir evaporation is charged at 100% to Colorado's CBCU in the RRCA accounting. Since the storage of water in reservoirs is usually by surface water diversion methods, the Surface Water Irrigation Fee of \$154.72 was used to determine Evaporation Fee. As stated above the consumption rate for evaporation is considered 100% and 60% for surface water diversions. The amount for the Evaporation Fee can be calculated as \$257.87 ( $\$154.72 / 60\%$ ).

If owners of the reservoirs have monthly water levels that can be associated with an area capacity table, this information on pond area can be used to determine the monthly

evaporation from the reservoir. A reservoir that has no water stored during a particular month can be considered to have no evaporation during that month. In order to assist Colorado and the RRWCD in Compact compliance, annual estimate use can be provided based on the maximum surface area of the reservoir. If that reservoir will not be filled during the year then no evaporation will be assumed as the estimate. Therefore, it is recommended that the Evaporation Fee be set at \$257.87 per ac-ft evaporated and would be subject to any future changes to the Groundwater Irrigation Fee.

## Summary

The RRWCD is seeking to implement a water use fee for the various types of use and consumption of water within the RRCA Model Domain for compliance with the Compact Rules in a manner that is fair and equitable to all water users. This memorandum documents the procedures used to determine the various types of use and consumption fees for Compact compliance. Those proposed water use fees are summarized below:

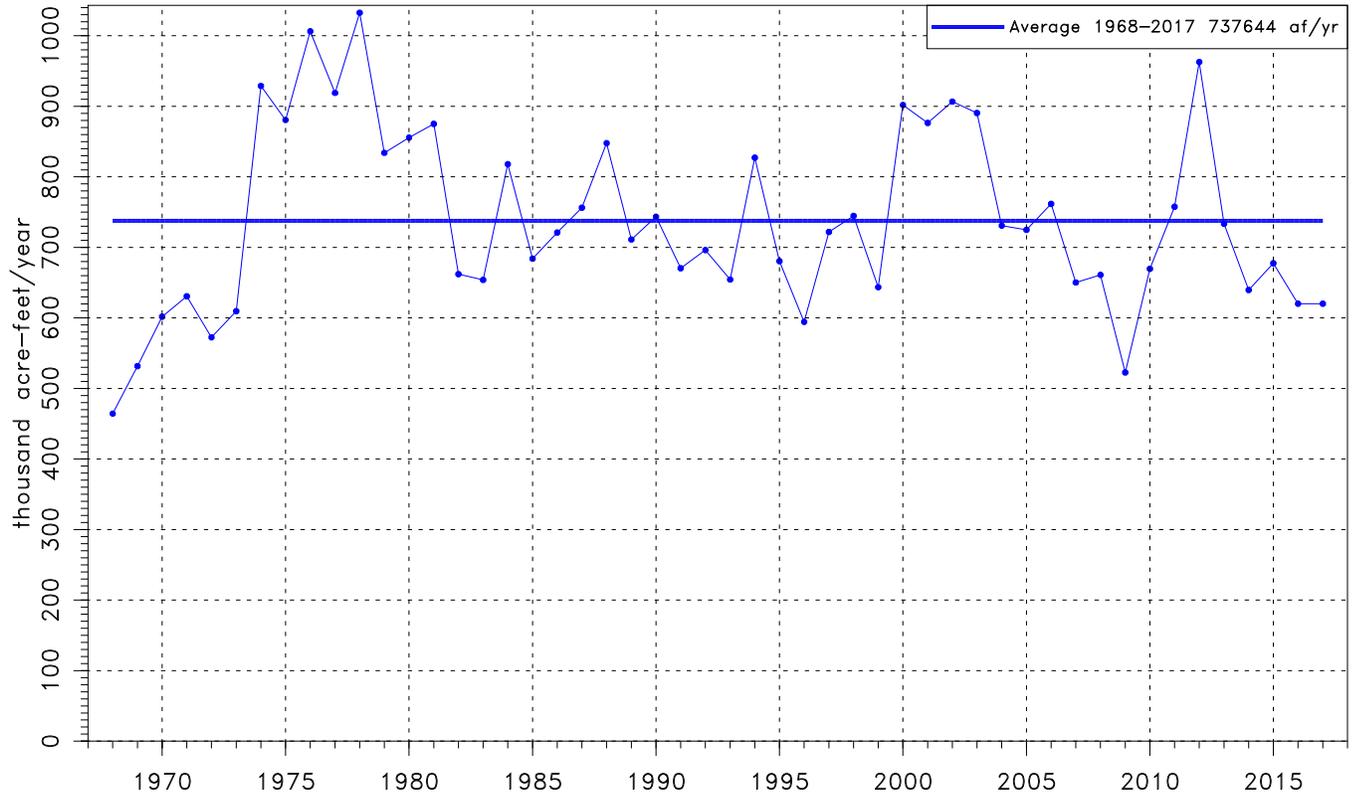
### Proposed Water Fee Structure

Description (1)	Fee Amount (2)
Groundwater Irrigation (per irrigated acre)	\$14.50
Groundwater non-irrigation (per ac-ft pumped)	\$5.83
Surface water irrigation (flood) (per ac-ft diverted)	\$154.72
Reservoir Evaporation (per ac-ft evaporated)	\$257.87

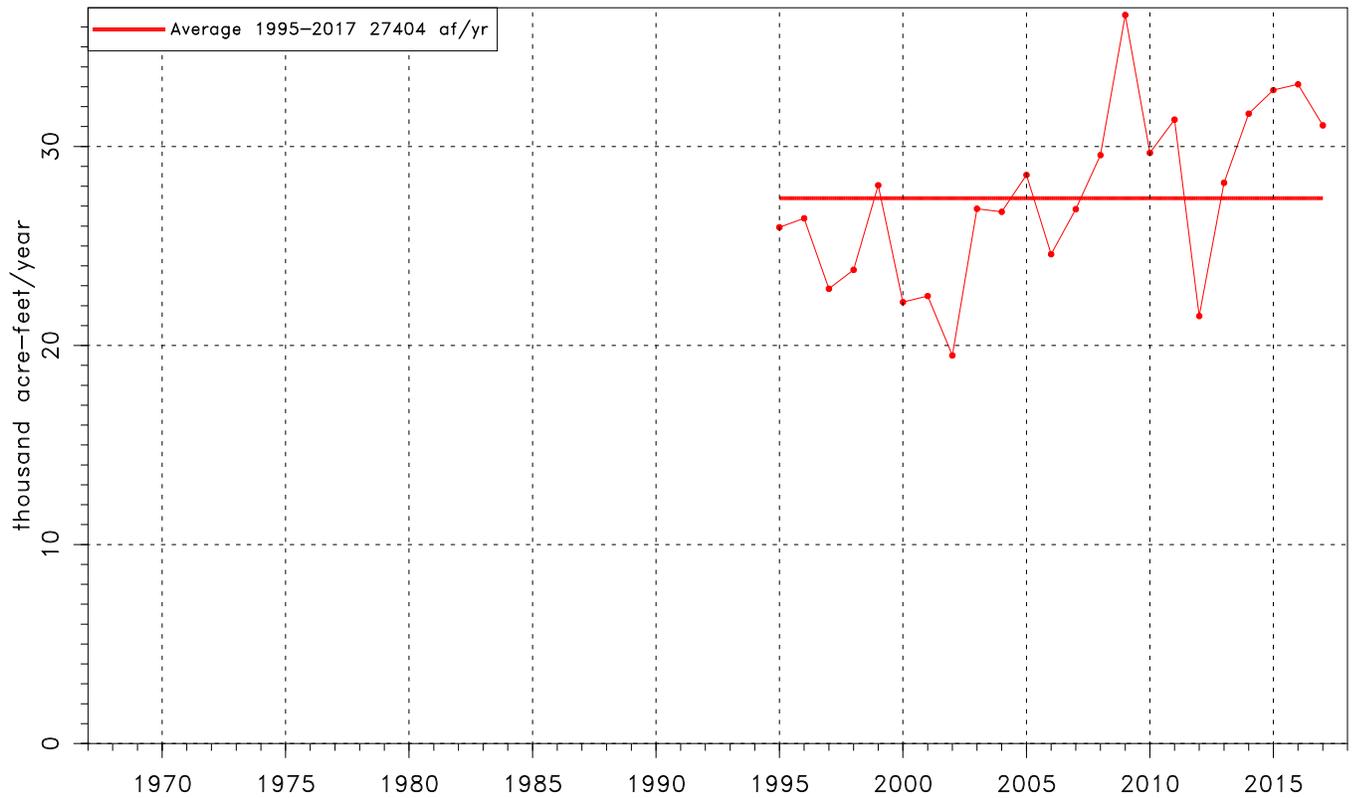
It is recommended that the RRWCD Board consider this fee structure for the various uses described.

Figure 1

# Total Colorado Groundwater Pumping



# Total Colorado Groundwater CBCU



**Table 1**  
**Water Use Fee Structure**  
**Republican River Water Conservation District**

Row	Description (1)	Amount (2)	Explanation (3)
(1)	Groundwater Irrigation Fee	\$14.50	User fee set by RRWCD per irrigated acre
(2)	Groundwater irrigation per ac-ft pumped	\$9.67	User fee of ROW 1 / 18" of pumping per irrigated acre (ROW 1 / 1.5)
(3)	Modeled sprinkler consumption	83%	Sprinklers: 80% crop consumption, 3% spray loss, and 17% groundwater returns
(4)	Non-irrigation uses (municipal/commercial)	50%	Assumed efficiency/consumption for modeling calculations
(5)	Groundwater non-irrigation Fee	\$5.83	User Fee for non-irrigation uses per ac-ft pumped (ROW 4 / ROW 3 * ROW 2)
(6)	Well pumping Compact impact ratio	6.25%	Impact ratio percentage of pumping vs surface diversion of 1:16
(7)	Surface water irrigation (flood) Fee	\$154.72	User Fee for Surface water flood irrigation per irrigated acre (ROW 2 / ROW 6)
(8)	Evaporation Compact impact ratio	60%	Compact impact ratio of surface diversions to compact impact of 1:0.6
(9)	Evaporation Fee	\$257.87	User Fee per evaporated acre used in flood irrigation (ROW 7 / ROW 8)

Notes:

- 1) Column 1 is the description of the usage of the amount in column 2
- 2) Column 2 is a number obtained through the explanation in Column 3
- 3) Column 3 is the explanation of how the value in Column 2 was obtained including the calculations used based on the rows
- 4) Highlighted Rows are the final User Fees based on the description in Column 1

**Results**  
**Proposed Water Fee Structure**

Description (1)	Fee Amount (2)
Groundwater Irrigation (per irrigated acre)	\$14.50
Groundwater non-irrigation (per ac-ft pumped)	\$5.83
Surface water irrigation (flood) (per ac-ft diverted)	\$154.72
Reservoir Evaporation (per ac-ft evaporated)	\$257.87