

## Final Technical Report Memorandum



To: Al Pfister  
From: Erin Wilson and Brenna Mefford  
Date: 3/3/2021  
Re: West Fork Water Rights Alternative Study

---

Wilson Water Group (WWG) completed a study to investigate alternative uses for the West Fork Reservoir and Canal water rights for the San Juan Water Conservancy District (District). In addition, analyses were completed to estimate water available to the Dry Gulch Reservoir water rights and to a junior storage right. The results of the study, presented in this memo, can be used by the District's Board of Directors to make an informed decision about the approach to filing diligence of the West Fork Reservoir and Canal Water Rights in June 2021.

The diligence process requires that the District meet the requirements of "Can and Will", assuring that water right development is non-speculative ("Can") and that the District has the means to develop the water rights ("Will"). This memo documents the technical analysis performed to show the future development the District's conditional storage rights are non-speculative by identifying potential demands, showing water availability, and showing a need for storage based on the timing of demands versus water availability.

To that end, this memo documents the following specific steps taken by WWG:

1. Reviewed the District's water rights portfolio and previous storage studies to understand opportunities and limitations based the original decrees, previous diligence efforts, and storage locations.
2. Performed a water use and water demand analysis to identify potential future uses for the District's water rights.
3. Determined both physical and legal water available to the District's West Fork and Dry Gulch water rights.
4. Investigated potential reservoir operations.

### 1.0 San Juan Water Conservancy District's Water Rights

The starting point for any diligence process is to understand the opportunities and limitations associated with the water rights in question. As noted in our proposal to the District, WWG felt it was important to look at the full portfolio of water rights owned by the District, to better understand the options associated with diligence of the West Fork water rights.

WWG worked with the District's attorney, Jeff Kane, to better understand the stipulations associated with the District's water rights and how they could potentially affect future development. Figure 1 shows the physical locations of the District's water rights.

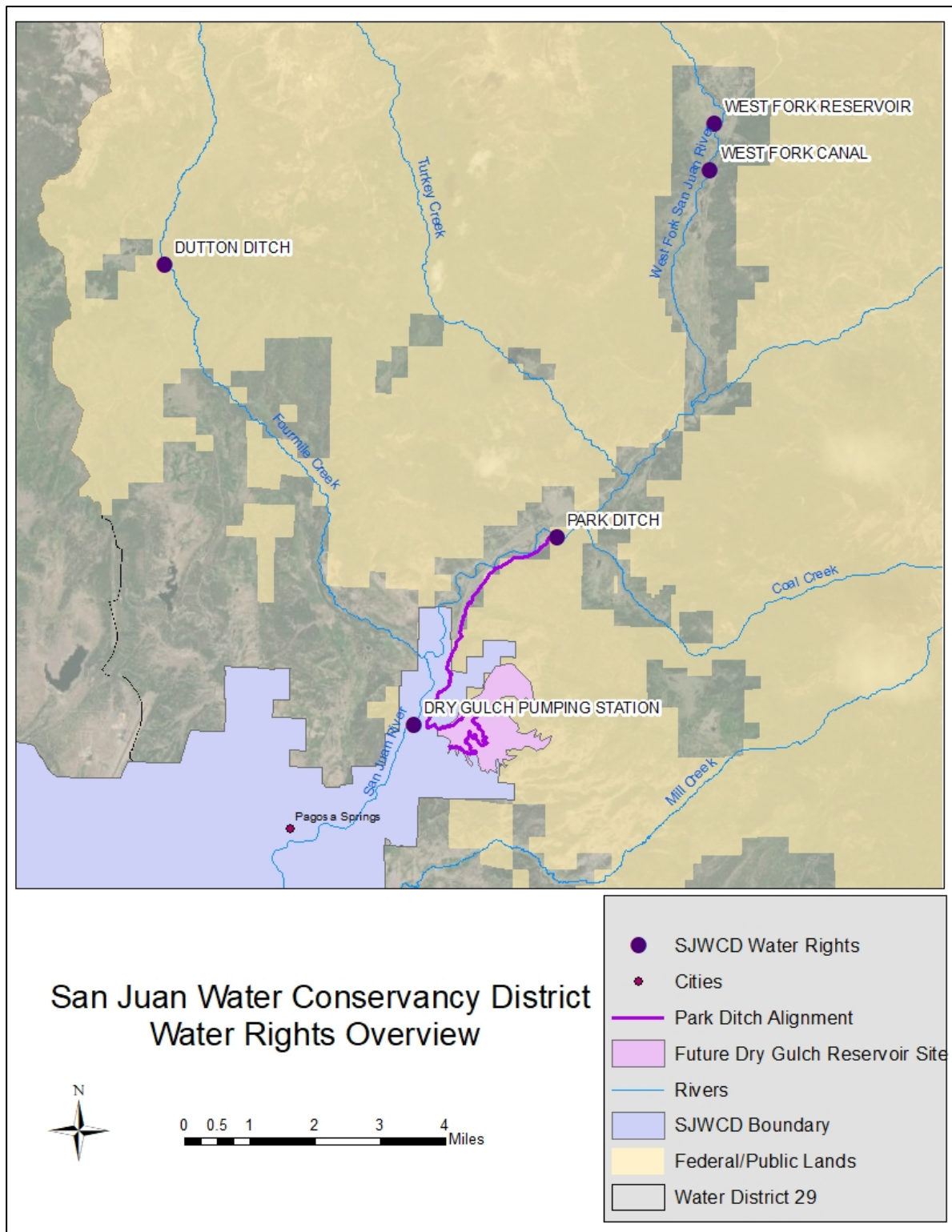


Figure 1. San Juan Water Conservancy District Map of Water Rights Locations

## 1.1 Direct Flow Water Rights

The following bullets summarize the District's direct flow water rights and associated limitations. The summary of limitations may not be exhaustive; however, stipulations that could impact future development are noted.

### *West Fork Canal (West Fork of the San Juan River)*

- 50 cfs conditional water right with appropriation date of 7/21/1967
- Decreed uses include irrigation, industrial, and municipal.
- The water right is not limited to use within the District's boundary.
- There are no volumetric limits on the amount of water that can be diverted annually or on an average annual basis.
- This right will be abandoned by the Water Court if not used or perfected at the time the Dry Gulch/San Juan River Headwaters Project facilities are constructed (per stipulation in Case No. 04CW85).
- The District must apply to change the point of diversion by June 2021 and subordinate to all water rights upstream of the original or any future points of diversion having adjudication dates prior to December 31, 2013 (per stipulation in Case No. 08CW37).
- The point of diversion must be moved downstream of Snowball Pipeline and if the new point of diversion is on Bootjack Ranch, the District must get approval of plans and ROW and pay compensation (per stipulation in Case No. 08CW37).

The stipulation subordinating the West Fork Canal water rights to upstream water rights senior to a December 31, 2013 is significant; as it essentially changes the water right appropriation date to January 1, 2014 with respect to upstream uses. An even more significant constraint on the West Fork Canal direct flow right is that it is not decreed for storage in an off-channel reservoir.

### *Dutton Ditch Second Enlargement (Stollsteimer Creek, Dutton Creek, and imported Four Mile Creek)*

- 20 cfs conditional water right with appropriation date of 7/6/1967. Note that Pagosa Area Water and Sanitation District (PAWSD) owns an additional 20 cfs of this water right.
- Decreed uses include irrigation, industrial, municipal, and domestic.
- This right will be abandoned by the Water Court if not used or perfected at the time the Dry Gulch/San Juan River Headwaters Project facilities are constructed (per stipulation in Case No. 04CW85).

A significant physical limitation to development of the Dutton Ditch Second Enlargement water right is the location; there is not reliable water supply available on these smaller tributaries except during the runoff period primarily in May and June.

### *Dry Gulch Pumping Station (San Juan River)*

- 50 cfs conditional water right with an appropriation date of 12/20/2004

- Decreed uses include municipal, irrigation, exchange, augmentation, and storage in Dry Gulch and other reservoirs owned by the District and/ PAWSD.
- This right cannot be diverted if the San Juan River at Pagosa Springs streamflow gage shows flow less than 100 cfs from March 1 to August 31 or less than 60 cfs from September 1 to February 29 (per stipulation in Case No. 04CW85). Note that these flows are identified further in this report as the “stipulated environmental flows”.
- The District may not place a call against junior water rights located upstream from the San Juan River at Pagosa Springs streamflow gage to meet the stipulated environmental flows and may not divert flows curtailed from upstream junior rights to satisfy downstream calls (per stipulation in Case No. 04CW85).

Besides the potential cost versus benefit imbalance of pumping water for potential storage at this location, the water available in many years can be significantly limited by the stipulated flow requirements at the San Juan River at Pagosa Springs streamflow gage.

#### *Park Ditch (San Juan River)*

- 1.1 cfs absolute water right associated with shares in the Park Ditch Company (various appropriation dates from 1886 to 1956)
- The District’s Park Ditch water rights are decreed for irrigation.
- Case No. 04CW85 sets the Park Ditch as a location to divert water to store in Dry Gulch Reservoir.
- The District must enter an Operating and Maintenance (O&M) agreement with the Park Ditch Company, and possibly consult with Park Ditch shareholders on re-design standards (per stipulation in Case No. 04CW85).
- The District will have to obtain a special use permit to use Park Ditch to convey water that is not for irrigation if using the current alignment of Park Ditch to convey the water (per stipulation in Case No. 04CW85).
- Water diverted at Park Ditch for storage in Dry Gulch reservoir has the following additional stipulations as stated in Case No. 04CW85:
  - Diversion cannot occur if the San Juan River at Pagosa Springs stream gage shows flow less than 100 cfs from March 1 to August 31<sup>st</sup> or less than 60 cfs from September 1 to February 29.
  - Diversion may not place a call against junior water rights located upstream from the San Juan River at Pagosa Springs gage and may not divert flows curtailed from upstream junior rights to satisfy downstream call.

Water legally available in many years can be significantly limited by the stipulated flow requirements at the San Juan River at Pagosa Springs streamflow gage.

## **1.2 Storage Water Rights**

The following bullets summarize the District’s storage water rights and associated limitations. The summary of limitations may not be exhaustive; however, stipulations that could impact future development are noted.

#### *West Fork Reservoir (West Fork of the San Juan River)*

- 24,000 acre-feet conditional water right with an appropriation date 8/23/1967
- Decreed uses include industrial, municipal, domestic, recreation, piscatorial, and irrigation.
- This right will be abandoned by the Water Court if not used or perfected when the Dry Gulch/San Juan River Headwaters Project facilities are constructed (per stipulation in Case No. 04CW85).
- The District must apply to change the point of diversion and place of storage to a location downstream of Bootjack Ranch by June 2021. (per stipulation in Case No. 11CW17)
- The storage right must subordinate to those water rights upstream of the original or any future points of diversion or storage having adjudication dates prior to December 31, 2013 (per stipulation in Case No. 11CW17).
- None of the decrees concerning the West Fork Reservoir rights require the water stored in the reservoir be used within the District boundary.
- None of the decrees concerning the West Fork Reservoir rights put a limitation on filling rate or a volumetric limitation beyond the decreed amount.

The stipulation subordinating the West Fork Reservoir storage rights to upstream water rights senior to a December 31, 2013 is significant; as it essentially changes the water right appropriation date to January 1, 2014 as to any water rights located upstream. The requirement to move the water right downstream of Bootjack Ranch to a likely off-channel reservoir site is not as limiting, because permitting an on-channel reservoir at any location on the San Juan River would be a significant challenge. The uses under the storage right may be limiting, as it does not include the authorization to release water to the San Juan River to meeting environmental or recreational needs.

#### *Dry Gulch Reservoir (1967 Right, San Juan River, and native flow))*

- 6,300 acre-feet conditional storage right with appropriation date 7/22/1967
- Decreed uses include industrial, domestic, municipal, recreation, and piscatorial.
- The storage right can be filled using native Dry Gulch runoff and/or Park Ditch, with no diversion rate limitation (Case No. 73-308D).

The 1967 Dry Gulch Reservoir storage right does not include the authorization to release water to the San Juan River to meet in-channel environmental or recreational needs.

#### *Dry Gulch Reservoir (2004 Right, San Juan River)*

- 4,700 acre-feet (first fill) and 11,000 acre-feet (refill) conditional storage right with appropriation date of 12/20/2004
- Decreed uses include municipal, irrigation, exchange, and augmentation.

- Fill and refill of the reservoir is limited to a combined diversion rate of 50 cfs from Park Ditch, Dry Gulch Pump Station, and native flows under this storage right and when used in combination with the 1967 storage water right (per stipulation in Case No. 04CW85).
- The District cannot store more than 11,000 acre-feet in any water year in conjunction with the 1967 Dry Gulch right from the San Juan River and native inflow combined and cannot store more than 93,000 acre-feet over any ten consecutive years (per stipulation in Case No. 04CW85).

The uses under the storage right do not authorize the release of water to the San Juan River to meeting environmental or recreational needs. The annual storage limit of 11,000 acre-feet per year and the ten-year volumetric limitation of 93,000 acre-feet are only restrictive if annual demands average greater than 9,300 acre-feet per year (93,000 acre-feet over ten years).

### 1.3 Previous Investigations of Storage Rights

As part of the review of the Districts water rights and previous diligence efforts, WWG reviewed the following reports that investigated water rights and storage in the basin:

- Water Rights Report on Dry Gulch Reservoir, West Fork Reservoir, East Fork Reservoir, West Fork Canal, San Juan River Canal for Southwestern Water Conservation District (May 1988) by Harris Water Engineering
- Appraisal Report to Evaluate Future Raw Water Demands and Water Supply Alternative Plans as of March 2003 by Harris Water Engineering
- The Draft San Juan Water Conservancy District Strategic Plan (2020)
- Pagosa Area Water and Sanitation District Water Conservation Plan (October 2008)
- Pagosa Area Water and Sanitation District Drought Management Plan (2018)

WWG concurs with the conclusion reached in these reports that the Dry Gulch Reservoir site is the most advantageous reservoir site in the upper San Juan basin because the location of the reservoir provides the best water supply compared to other sites located on smaller tributaries, the location does not constrict the size of the reservoir compared to the storage rights, and the District already owns the land. Therefore, the water availability analyses performed were based on development of water rights at the Dry Gulch reservoir site.

## 2.0 Water Use and Water Demand Analysis

Proving diligence on a water right requires showing there is a current or future demand for the water use. WWG investigated existing and future demands and shortages, for agricultural, municipal, industrial, and environmental uses of water in the District and connected portions of the San Juan River basin. The following describes the approach that was used to determine water demands and shortages for each sector and the results of the analysis.

### 2.1 Agricultural

Future demands for agricultural water in the San Juan basin will depend on an increase in irrigated acreage. The State of Colorado's irrigated acreage assessments, updated on an approximate 5-year basis, shows that irrigated acreage has decreased by 6 percent over the



past 25 years in the San Juan basin. The recent Technical Update to Colorado’s Water Plan also showed no increase in irrigated acreage in future 2050 demands. However, late season water supply limitations for current irrigated acreage could be met from water stored during the runoff period.

WWG used the Colorado Decision Support System (CDSS) consumptive use model to estimate the potential crop demand of current irrigated acreage and actual crop consumptive use based on irrigation diversions recorded by the Division of Water Resources over the past 30 years. The CDSS consumptive use model calculates average monthly system delivery efficiency for each ditch based on historical diversions, reflecting both ditch conveyance efficiency and farm application efficiency components. Crop shortages are increased by the appropriate efficiency factor to determine shortages at the ditch headgate.

This irrigation shortage could be met from the river or from a reservoir supply. Even though most irrigation shortages are due to physical and legal water limitations, some shortages may be due to irrigation practices, such as limiting irrigation to allow for grazing. For this analysis, it was assumed that irrigation shortages were due to water supply limitations. Figure 2 shows annual irrigation shortages in the District for the last 30 years.

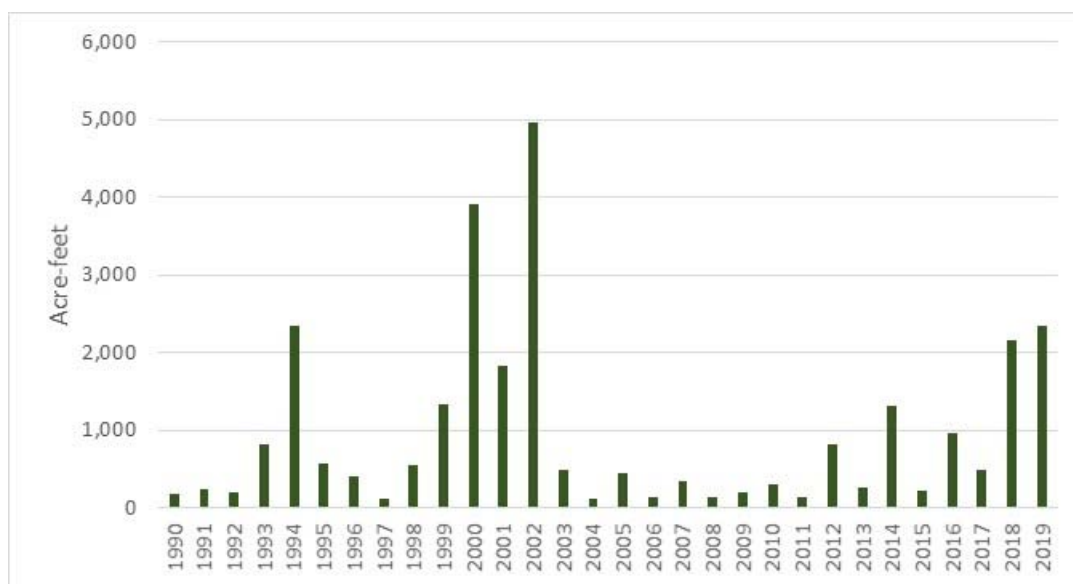


Figure 2. Annual Irrigation Shortages from 1990 to 2019 in the San Juan Basin

As shown in Figure 2, annual irrigation shortages ranged from 125 to 4,950 acre-feet over the last thirty years, with an annual average shortage of 950 acre-feet. As expected, higher shortages occur in dry years such as 2002, 2018, and 2019. Access to storage could help agricultural producers in the District reduce irrigation shortages during drought years. The estimated shortages were used as a potential demand on future District storage. Note that the irrigation rights are senior to conditional water rights in the basin; therefore, the development of conditional water rights will not increase potential agricultural demand of District storage.

## 2.2 Municipal

To determine current and future municipal demand, WWG considered available data from the Pagosa Area Water and Sanitation District (PAWSD), the Growing Water Smart Work Group, and the Colorado Water Plan Technical Update. PAWSD is the only municipal water provider in the San Juan basin and serves the town of Pagosa Springs and the surrounding area. Most of the District's service area overlaps with PAWSD's service area as shown in Figure 3.

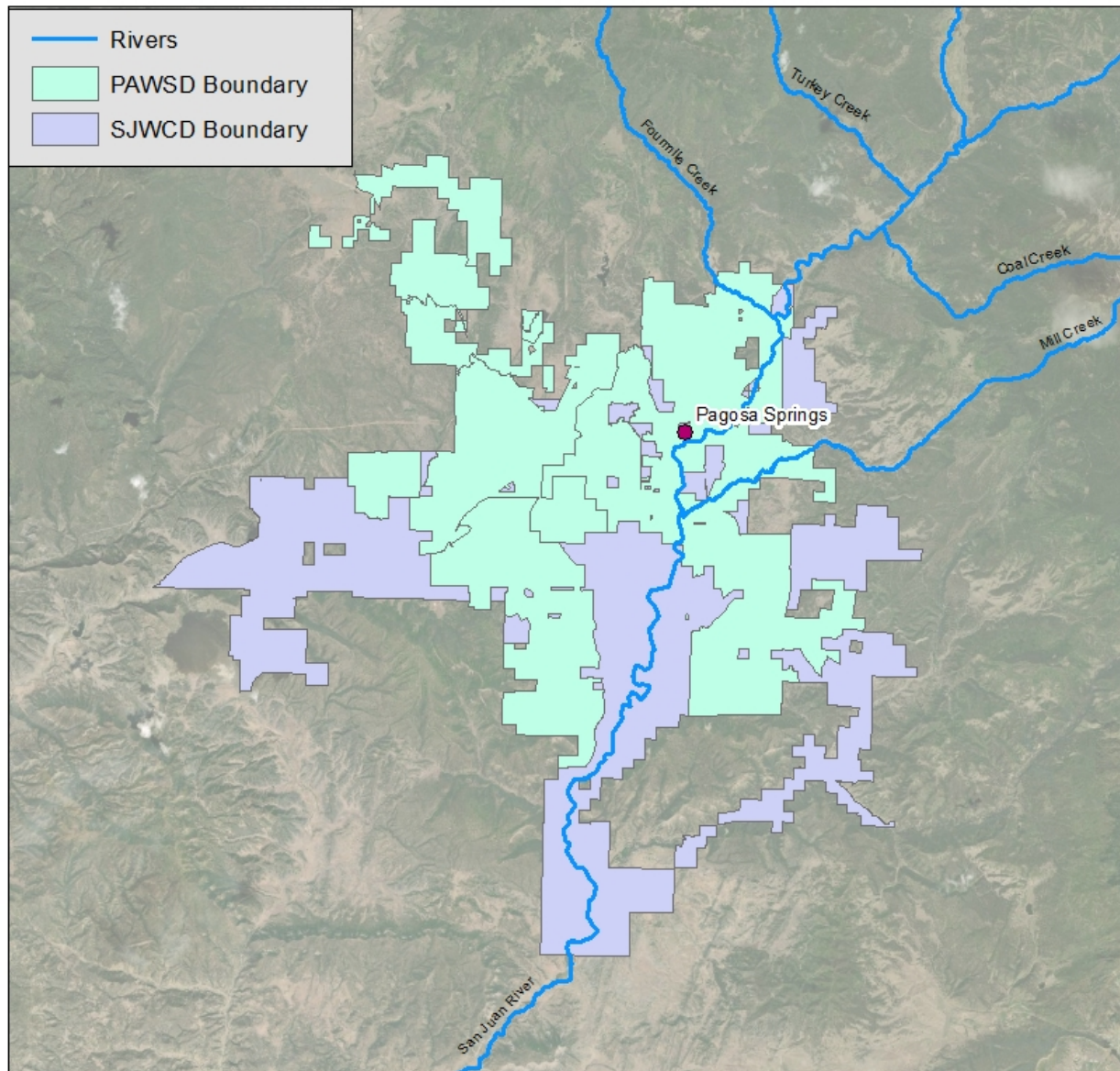


Figure 3. San Juan Water Conservancy District and Pagosa Area Water and Sanitation District boundaries

PAWSD staff indicated they typically see two percent growth each year and, for planning purposes, estimate that growth rate will continue. PAWSD's recently completed the 2018 Drought Management Plan that reported average raw and potable water produced from 2008 to 2017 to be 2,246 acre-feet. WWG believes that 2050 is a reasonable horizon to consider and



justify for diligence of the West Fork water rights. Based on a two percent annual growth rate, the average annual municipal demand in 2050 would be 4,150 acre-feet.

Population growth estimates for Archuleta County have been developed by the Growing Water Smart Work Group. Due to the large number of vacation homes in and near Pagosa Springs the Growing Water Smart Work Group looked at recent trends in population, housing units, sanitation flows, and jobs to estimate growth projections. The group estimated that population growth would most likely follow one of three scenarios:

- Low-end scenario: 1.1 to 1.3 percent average annual growth
- Likely scenario: 1.6 to 1.9 percent average annual growth
- High-end scenario: up to 2.6 percent average annual growth

PAWSD's 2018 Drought Management Plan estimates that 75 percent of the population of Archuleta County lives within the PAWSD service area or receives water from PAWSD through water filling stations. Current average gallons used per person per day (gallons per capita day, GPCD) for PAWSD was estimated using 2019 population data from the State Demographer's Office and PAWSD's reported average annual water produced. The 2019 population data was multiplied by 0.75 to estimate the GPCD only for PAWSD's service area. This resulted in a current average annual GPCD of 191; this value was used to forecast future municipal demands under low growth, likely growth, and high growth scenarios. PAWSD's current and 2050 population projections and municipal demands are shown in Table 1.

Table 1. PAWSD current and projected population and demands

	<b>Current (2019)</b>	<b>2050 – Low Growth</b>	<b>2050 - Average Growth</b>	<b>2050 - High Growth</b>
<b>Population</b>	12,401	18,589	20,786	24,741
<b>GPCD</b>	191	191	191	191
<b>Demand (ac-ft/year)</b>	2,246	2,982	3,334	3,969

The Colorado Water Plan Technical Update contains estimates for current (2015) and projected municipal use (2050). The municipal results for the Technical Update are provided on a county wide basis. WWG obtained the population and GPCD for Archuleta county from the Technical update. The population data was multiplied by 75 percent to estimate the population in the PAWSD service area. The Technical Update Scenario A "business as usual" demand for 2050 was considered appropriate to compare with the PAWSD and Growing Water Smart Group estimates. Table 4 shows the estimated current projected demands for PAWSD based on population and GPCD data from the Colorado Water Plan Technical Update.

Table 4. Estimated PAWSD current and projected population and demands from the Colorado Water Plan Technical Update

	<b>Current (2015)</b>	<b>2050 - Business as Usual</b>
<b>Population</b>	9,313	19,928
<b>GPCD</b>	220	197
<b>Demand (ac-ft/year)</b>	2,295	4,398

The Technical update estimated larger GPCD for Archuleta County, which resulted in a slightly higher demand than the estimates based on the data provided in PAWSD’s 2018 Drought Management plan. The three estimates are within 10 percent:

- PAWSD (2% Growth) = 4,150 acre-feet
- Growing Water Smart (high growth) = 3,969 acre-feet
- Technical Update = 4,398 acre-feet

The slightly higher Technical Update demand results in an increase in demand through 2050 of approximately 2,150 acre-feet. Figure 4 shows the current and 2050 projected demand using a typical municipal monthly distribution. The hatched area indicates potential demand on future District storage.

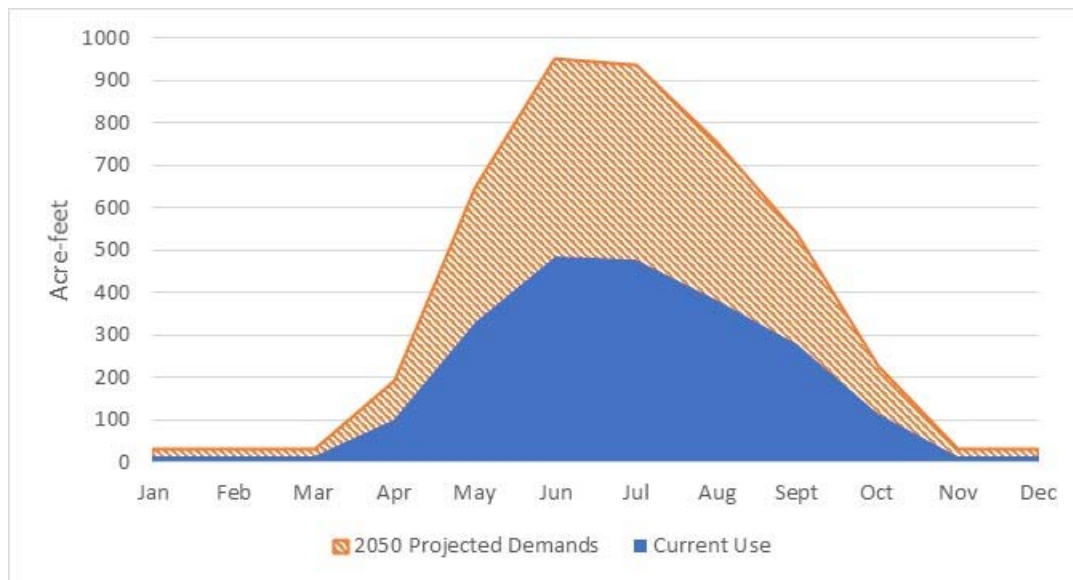


Figure 4. Monthly Current and 2050 Projected Municipal Demands

The estimates shown above were not confirmed by PAWSD and are provided only for the District’s use in understanding potential future municipal demand. Based on the 2018 Drought Management Plan and conversations with PAWSD staff, PAWSD estimates their existing supplies can meet current demands through a 2-year drought without use restrictions. PAWSD currently plans to meet future demand by using planned upgrades to water treatment plants,

continuing to fix leaks in its system, and constructing additional pump stations/pipelines that could help increase water production. In addition, per agreement with the Colorado Water Conservation Board (CWCB) Dry Gulch Reservoir is also a part of PAWSD's plan to meet future demands.

As with all future use estimates, there are assumptions and uncertainty associated with both the projected municipal use and the amount that could be met from the District's water rights. For example, as noted above, some future use may be met from decreased system water loss as leaky pipes are replaced, from other conservation measures, or from PAWSD's existing water rights. The approach taken to estimate future municipal use is a reasonable approach for diligence efforts, and the resulting demands are in-line with other published estimates.

## 2.3 Industrial

The Colorado Water Plan Technical Update shows no current or projected future industrial use in Water District 29 (the Upper San Juan River basin). A review of other planning efforts in the basin, including the Southwest Basin Implementation Plan, and discussions with PAWSD staff and the local water commissioner, WWG concluded there is no anticipated future industrial use in the District or elsewhere in the San Juan basin that could be included as a demand for diligence of the West Fork water rights.

## 2.4 Environmental and Recreational

As shown, moderate irrigation and municipal demands were identified that could be met from the West Fork water rights. Increased environmental and recreational demands may also be met by additional storage in the San Juan basin. To identify these demands, WWG reviewed available documents from the San Juan Watershed Enhancement partnership, determined how often the mainstem instream flow is met, looked for background information on the Dry Gulch environmental flow bypass stipulations, and reviewed the current work being done as part of the San Juan Stream Management Plan. The results of the Upper San Juan Integrated Water Management Plan were not yet available; therefore, environmental and recreational needs were based on the existing CWCB instream flow right and the flows stipulated in Dry Gulch Reservoir Case No. 04CW85.

The CWCB instream flow reach on the mainstem of the San Juan River begins at the confluence of the East and West Forks of the San Juan River and extends to the town of Pagosa Springs. The instream flow water right is 50 cfs from March 1 to August 31 and 30 cfs from September 1 to February 29. The San Juan at Pagosa Springs streamflow gage (USGS ID 09342500) was used to determine how often the mainstem instream flow rights is satisfied. Figure 5 shows the annual instream flow shortages over the last 30 years. The CWCB instream flow right is a very junior water right in the basin, with a 1980 appropriation date. Unlike the shortages to senior agricultural uses, as shown in Figure 5, the need for District storage to meet the environmental demands would increase if upstream conditional water rights were developed.

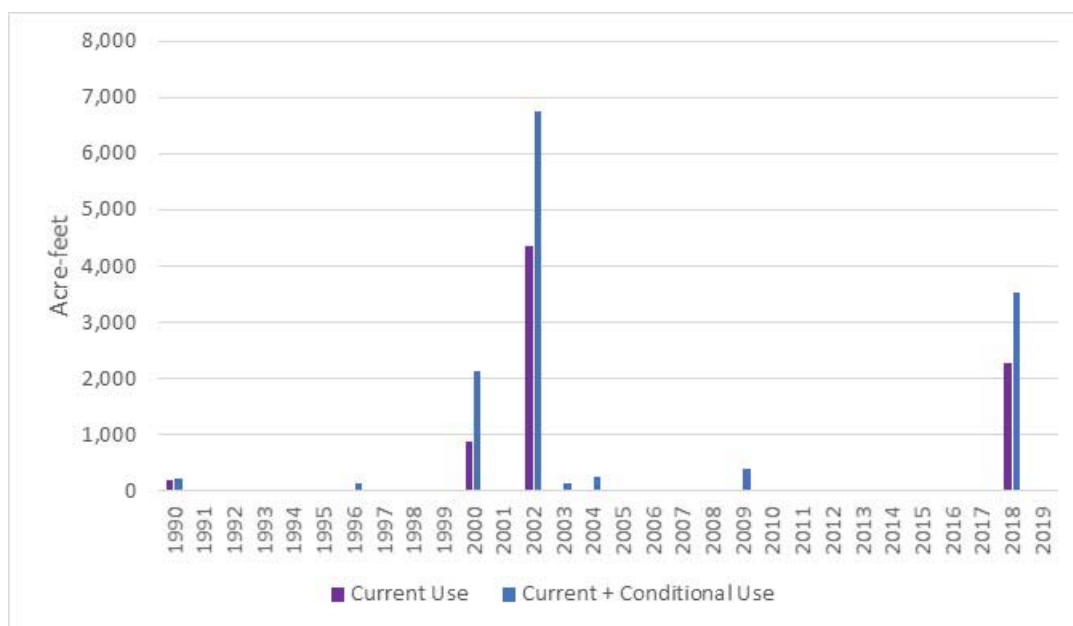


Figure 5. Annual San Juan River Instream Flow Shortages

As shown, in most years the current instream flow right is satisfied. Instream flow shortages generally occur in July and August only in dryer years with limited late season precipitation. This coincides with the period that municipal and agricultural demands are greatest and the typical high season for tourists in Pagosa Springs that like to enjoy recreation on the San Juan River.

Environmental flow bypass stipulations were added as a requirement for development of the Dry Gulch water rights during the 2004 diligence proceedings. These stipulated flows are double the current instream flow right on the mainstem of the San Juan River (100 cfs from March 1 to August 31 and 60 cfs from September 1 to February 29). Backup documentation on the basis for these flows could not be found, however these stipulated flows may be justified and necessary to meet environmental needs. Colorado Parks and Wildlife (CPW) and CWCB would need to perform an analysis to determine if they are necessary. Figure 6 shows the annual shortages on the mainstem San Juan River if the stipulated flow rates were justified. As shown, the need for District storage to meet these flow shortages would increase if upstream conditional water rights were developed.

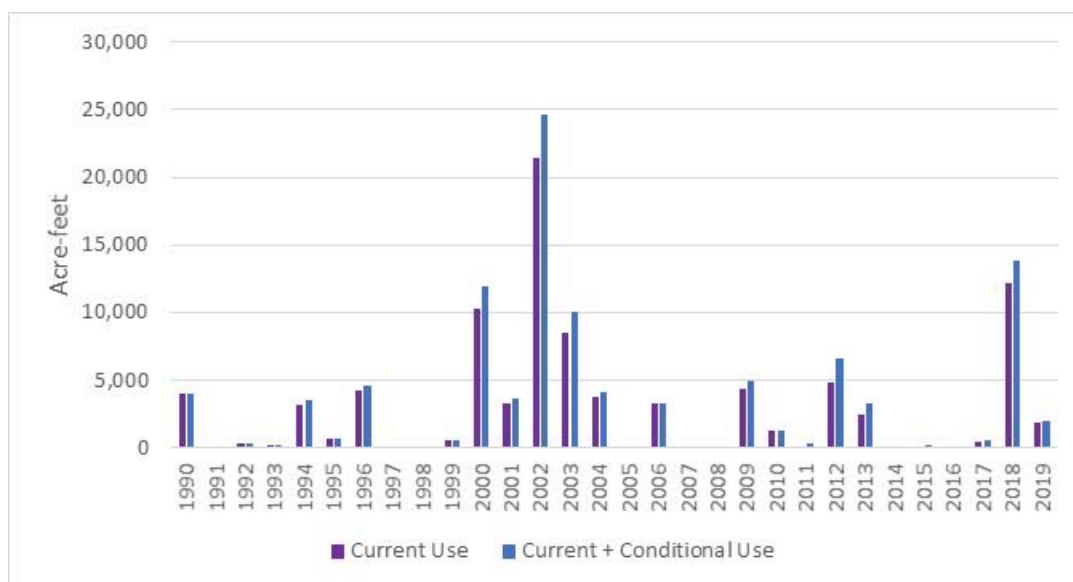


Figure 6. Annual San Juan River Environmental Stipulated Flow Shortages

The environmental stipulated flows result in an increase in shortages in late summer and winter months in both hydrologically dry and average years. As noted, at the time of writing this report, the results of the Upper San Juan Integrated Water Management Plan were not yet available. The results of the Water Management Plan may help to better understand the environmental and recreational flow needs of the mainstem San Juan.

## 2.5 Water Use and Water Demand Summary

The water use and water demand analysis indicate that the most significant need for future District storage is to satisfy projected municipal growth through 2050 and late season environmental flows on the mainstem San Juan River. Figure 6 shows the estimated 2050 annual demands and how they could fluctuate based on historical climate and streamflow conditions. The environmental demands shown in Figure 6 are the estimated stipulated environmental flow shortages.



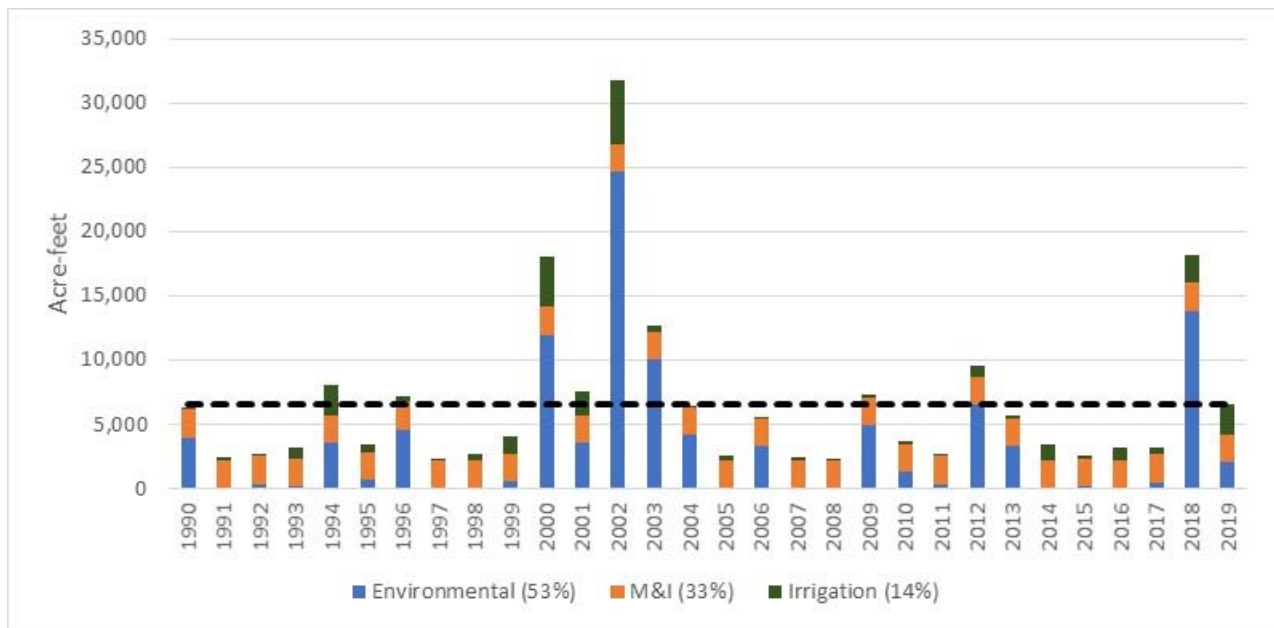


Figure 6. Maximum Annual 2050 Projected Demands

The average annual future demand ranges from around 3,000 to over 30,000 acre-feet, with an average future demand of 6,600 acre-feet.

### 3.0 Water Availability Analysis

Proving diligence on a water right requires showing there is water (physical supply) that is in priority (legal supply) to meet the future demand for the water use. WWG developed a daily point-flow model to determine water physically and legally available to the District's water rights. The point-flow model starts with historical streamflow, adds diversions for current uses that are junior to the District's water rights under the various stipulation scenarios identified, and subtracts estimates of future development under conditional water rights that are senior to the District's rights.

WWG investigated water available to the West Fork Water right if it was moved downstream to the San Juan Headwaters Project (Dry Gulch Reservoir) site. As discussed, previous engineering studies have shown that the Dry Gulch Reservoir site is the best reservoir site in the upper San Juan Basin. The current water shortages and future water demands did not result in future demands that could reasonable justify more than one new reservoir under the District's water rights. Therefore, the water availability analyses also investigated water available to store at the site under the Dry Gulch water rights and under a new junior storage right. Finally, the analyses specifically quantified water available with and without the limitations imposed on the District's water rights during previous diligence filings to provide a complete understanding and basis for moving forward with diligence.

The initial water availability analysis was performed without placing a demand on the reservoirs, assumed that each year the reservoir could divert physically and legally available water up to the maximum storage capacity or up to the annual volumetric limit. Then project

demands were superimposed on reservoir supply to understand how the reservoir would perform under varying hydrology and demands.

### 3.1 Water Available to West Fork Canal and Storage Rights

As identified in Section 1.1, the West Fork Canal water right is decreed for irrigation, municipal, and industrial use and is not decreed for storage. The water use and demand analysis concluded that increased irrigated acreage in the basin is unlikely, and that late-season shortages to existing irrigated acreage and projected municipal use could only be reliably met from water stored during the runoff period, as the West Fork Canal direct flow water right is not in priority to meet these late-season shortages. Therefore, the water availability analysis did not consider the use of the West Fork Canal direct flow right and instead concentrated on analysis of the West Fork Reservoir right.

If the West Fork Reservoir right is moved to the Dry Gulch Reservoir site and filled from the San Juan River mainstem, the new filling location would be an “alternate point” to the original location to maintain the existing water right priority. This means that water needs to be physically and legally available at both the original reservoir location on the West Fork San Juan River, and at the filling location on the mainstem San Juan River. Four separate water availability scenarios were analyzed to consider water availability at both locations, to understand limitations that are currently placed on the West Fork Reservoir storage right, and to investigate water availability if other potential stipulations were placed on the West Fork Reservoir storage right during the 2021 diligence filing.

- *Scenario 1:* Water available at the original reservoir location on the West Fork of the San Juan River, subordinated to upstream absolute and conditional water rights senior to 2013. Although the original location anticipated an on-channel reservoir, a reasonable maximum rate of diversion to storage of 50 cfs was also applied.
- *Scenario 2:* Water available at the Dry Gulch Reservoir site, assuming water is diverted via Park Ditch, subordinated to upstream rights on West Fork, East Fork and the mainstem San Juan River. A maximum diversion rate of 50 cfs was applied, assuming this stipulation imposed on filling the Dry Gulch Reservoir would likely be imposed on filling with the West Fork Reservoir storage right.
- *Scenario 3:* Scenario 2 plus the assumption that CWCB would impose stipulations that the filling right subordinates to the junior San Juan River instream flow right (1980 appropriation date).
- *Scenario 4:* Scenario 3 plus the assumption that the stipulated environmental flows imposed on Dry Gulch Reservoir would also be imposed on the relocated West Fork storage right by potential opposers in the case.

Note that while it was assumed that water would be diverted to Dry Gulch via Park Ditch, water availability at the Dry Gulch Pump Station location is essentially the same. Figure 7 shows the annual water available to the West Fork Storage rights for the four scenarios.

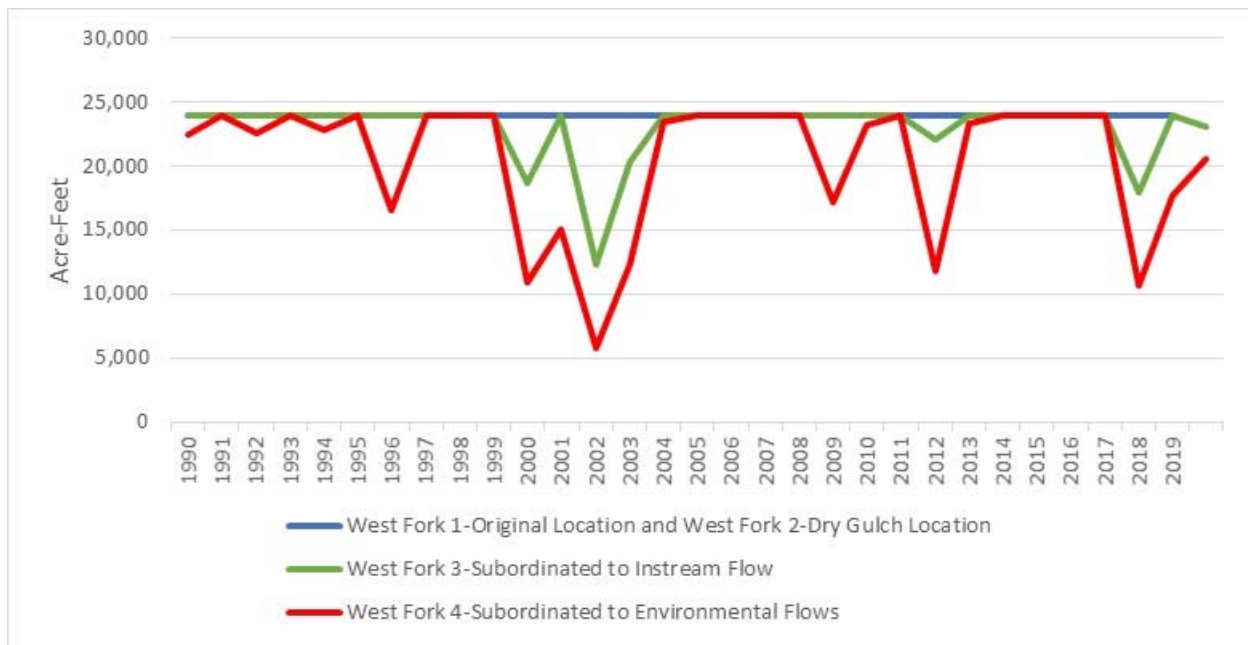


Figure 7. Annual Water Supply Available to the West Fork Storage Rights.

In all four scenarios, water is available for storage during the peak runoff period - primarily in April, May, and June. Scenario 1 (at the original reservoir location) and Scenario 2 (moved to fill from the Park Ditch) are never limited by supply, while Scenario 3 (subordinated to CWCB instream flow right) is only limited during dry years, like 2002 and 2018, when even senior agricultural water rights were unable to get a full supply. The largest impact on water availability would occur if the environmental flow stipulations imposed on the Dry Gulch water rights were applied to the West Fork rights at the Dry Gulch site (Scenario 4). As noted above, scenarios 3 and 4 are important to consider, as it is possible that at least some of the stipulations imposed on the Dry Gulch storage rights would also be imposed when changing the location of the West Fork Storage right. Also, it is important to note is that the reservoir storage right and capacity considered in the point-flow model (24,000 acre-feet) is significantly more than the average annual future demand identified in Section 2.5.

### 3.2 Water Available to Dry Gulch Storage Rights

Water available to the Dry Gulch Storage rights was estimated by considering the stipulations that have been imposed in previous diligence efforts which include the following:

- 50 cfs maximum rate for diversion to storage from all combined sources
- Maximum total annual storage limit of 11,000 acre-feet and maximum total storage over 10 years is limited to 93,000 acre-feet
- Junior water rights cannot be called out to meet the stipulated environmental flows and continue to allow diversions to storage
- Stipulated environmental flows (60 cfs from September through February, and 100 cfs from March to August) must be met at the San Juan River at Pagosa Springs streamflow gage before diversions can occur to storage
- Storage limited to the current Dry Gulch Reservoir rights (11,000 acre-feet)

Figure 8 shows the annual supply available to the Dry Gulch storage rights with consideration for the current water rights' stipulations.

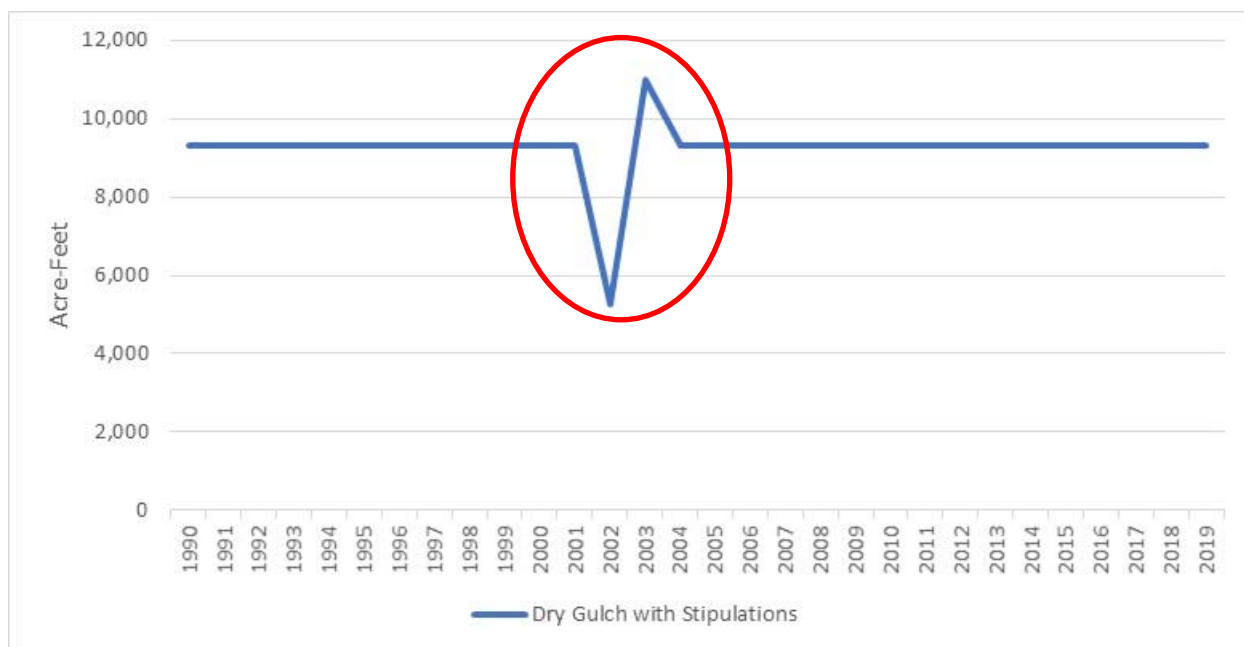


Figure 8. Annual Water Supply Available to the Dry Gulch Storage Rights.

Due to the stipulations that limit the amount of water that can be diverted on an annual or ten-year basis, only 9,300 acre-feet per year can be stored under the water right (assuming the reservoir is filled and emptied every year). Water was available to store 9,300 acre-feet every year except 2002. In 2002, there was less than 6,000 acre-feet available to store, therefore the ten-year volumetric limit was not a constraint and more than 9,300 acre-feet could be stored in 2003.

### 3.3 Water Available to a New Junior Storage Right

To provide the District with multiple options, WWG also estimated water available to a new junior storage right at the Dry Gulch reservoir site. A new junior storage water right could be advantageous because it does not need to be applied for until the District is closer to constructing storage; therefore, eliminating the cost of maintaining diligence on the right. In addition, the District could file a water rights application that includes “all-uses” on the right including in-channel environmental and recreational uses. As noted above, neither the West Fork nor Dry Gulch storage rights are decreed for in-channel uses. For this analysis two different scenarios were considered:

*Scenario 1:* Water is diverted for storage through the Park Ditch, with a maximum flow rate of 50 cfs and the reservoir size is assumed to be 11,000 acre-feet.

*Scenario 2:* Scenario 1 plus represent the same stipulated environmental flows imposed on Dry Gulch Reservoir on the junior storage right.

Figure 9 shows annual water supply available to the junior storage right under the two scenarios.

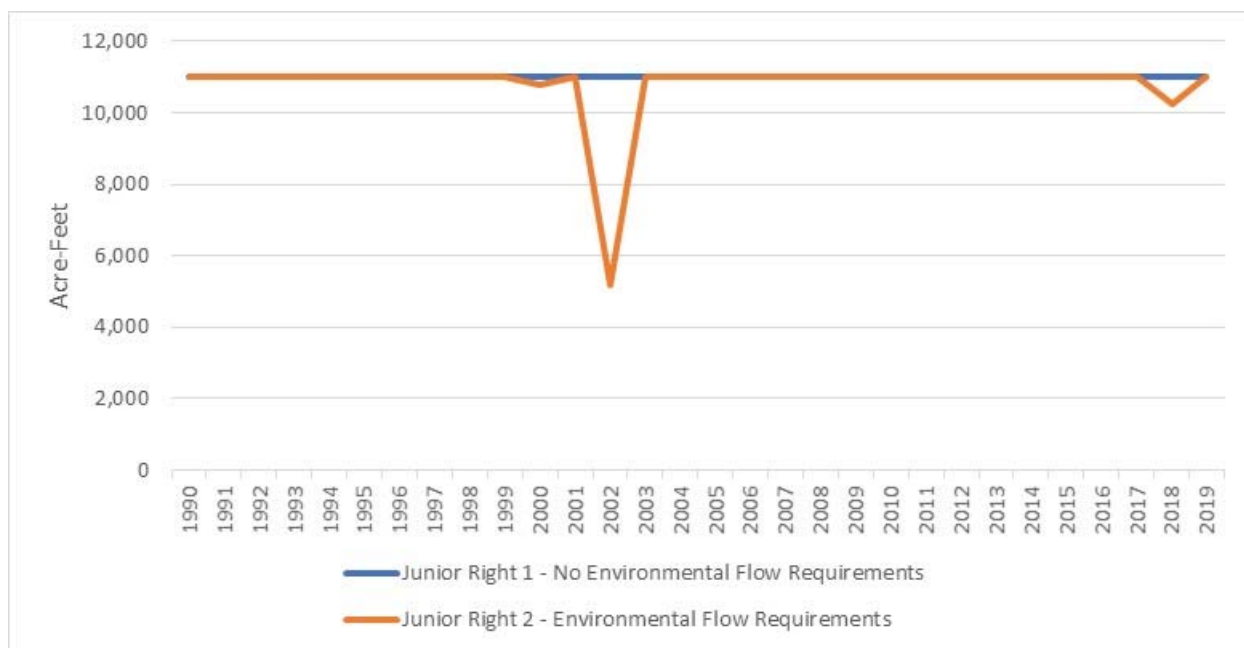


Figure 9. Annual water supply available to a junior storage right at the Dry Gulch Reservoir Site.

Without the stipulated environmental flows, water is available to meet the full 11,000 acre-feet storage right each year (Scenario 1). Even with the stipulated environmental flows the junior right can fill the reservoir every year except during the driest years (2002 and 2018). Current absolute and conditional water rights that have appropriation dates between the West Fork and Dry Gulch water rights and a new junior right do not impact the ability to store. Reservoir storage under the rights investigated will occur during the peak runoff months, primarily April through June. Except in the driest years, water is available to fully meet the storage needs during those months.

### 3.4 Storage Right Comparisons

The point-flow model was used to investigate water available to an 11,000 acre-feet capacity reservoir filled using the West Fork storage right to compare available water to the other water rights considered. The Dry Gulch storage rights stipulated environmental flow requirements were placed on both the West Fork storage right and the junior storage right; however, the 10-year volumetric limit was assumed to only apply to the Dry Gulch water rights. Figure 10 shows that a Junior right with the stipulated environmental flows and the West Fork Rights with the stipulated environmental flows have similar amounts of water available to them. If the annual and 10-year diversion limitations were applied to the West Fork or Dry Gulch rights, the water available under the three water rights would be essentially the same.



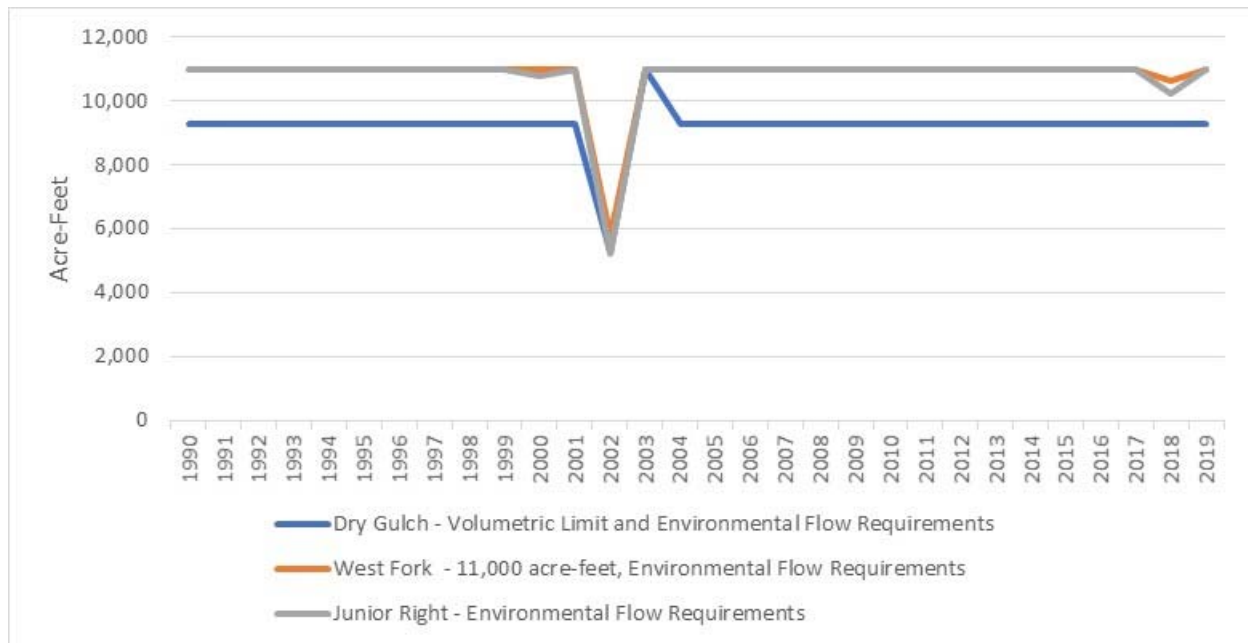


Figure 10. Comparison of Annual Supply Available to the Storage Rights.

#### 4.0 Potential Reservoir Operations

WWG modeled reservoir operations superimposing the future projected daily demands on the reservoir water availability analysis developed in the point-flow model. Water was released to meet future demands in the following order: municipal demands, agricultural demands, then environmental flow demands. As the Dry Gulch Reservoir site was previously identified as the best reservoir site, all analyses assumed storage occurred at the Dry Gulch Reservoir site. Note that studies have shown that the Dry Gulch Reservoir site could support a reservoir as large as 35,000 acre-feet; however, the reservoir modeling assumed a 24,000 acre-feet capacity reservoir when storing under the West Fork storage right, and an 11,000 acre-feet reservoir when storing under the Dry Gulch Storage rights or a junior storage right. Note that the two reservoir sizes considered were based on the District's conditional water rights and projected demands. Smaller reservoirs that could meet a portion of the demands were not considered as part of this analysis.

Figure 11 shows average monthly reservoir content using the West Fork, the Dry Gulch, and a junior water right with the stipulated environmental flows. Note that the reservoir contents based on operations and storage under the Dry Gulch water rights and the junior water right are the same; the two lines are on top of each other.

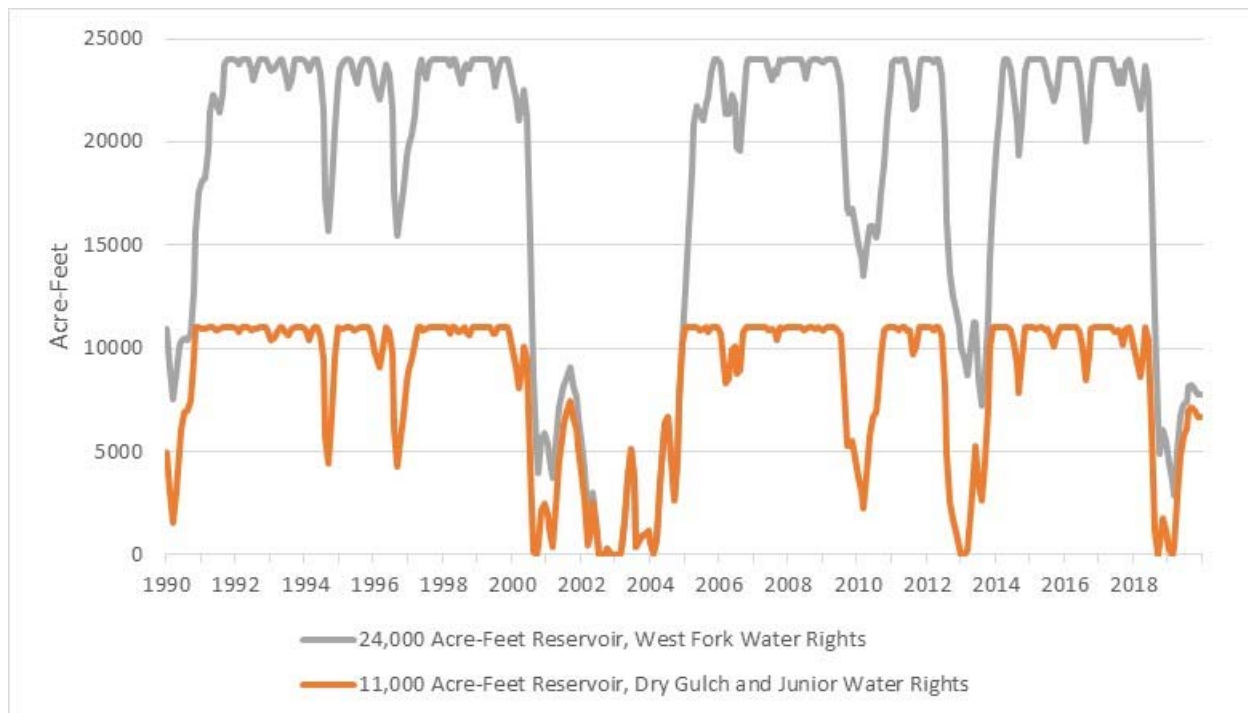


Figure 11. Average Monthly Reservoir Contents with the Stipulated Environmental Flows

Both the 11,000 acre-feet and 24,000 acre-feet reservoir stay full most months; however, the combination of increased demands and decreased flows during early 2000 drought draws down both modeled reservoirs. As shown in Figure 11, the 11,000 acre-feet reservoir can fully meet demands in 24 of the 30 years modeled (all years except 2000 through 2004, 2012, and 2018). The larger 24,000 acre-feet reservoir can meet demands in all but 3 years, from 2002 through 2004. Evaporation losses for the reservoir are estimated to be almost double between the two modeled reservoir capacities, as can be clearly seen in the monthly fluctuations.

A 24,000 acre-feet reservoir instead of a 11,000 acre-feet reservoir is only warranted in the driest years. The option to operate a 11,000 acre-feet reservoir to meet the stipulated environmental flow demands only in wet and average years was simulated as an alternative operation scenario. In dry years, water was simulated to be release only to meet the current instream flow demands. Figure 12 compares the monthly reservoir contents from a reservoir that always releases to meet the stipulated environmental flows and a reservoir that in dry years only releases to meet the current instream flow demands. The storage and releases are essentially the same regardless of whether the West Fork, the Dry Gulch, or a junior water right is used to fill the reservoir.

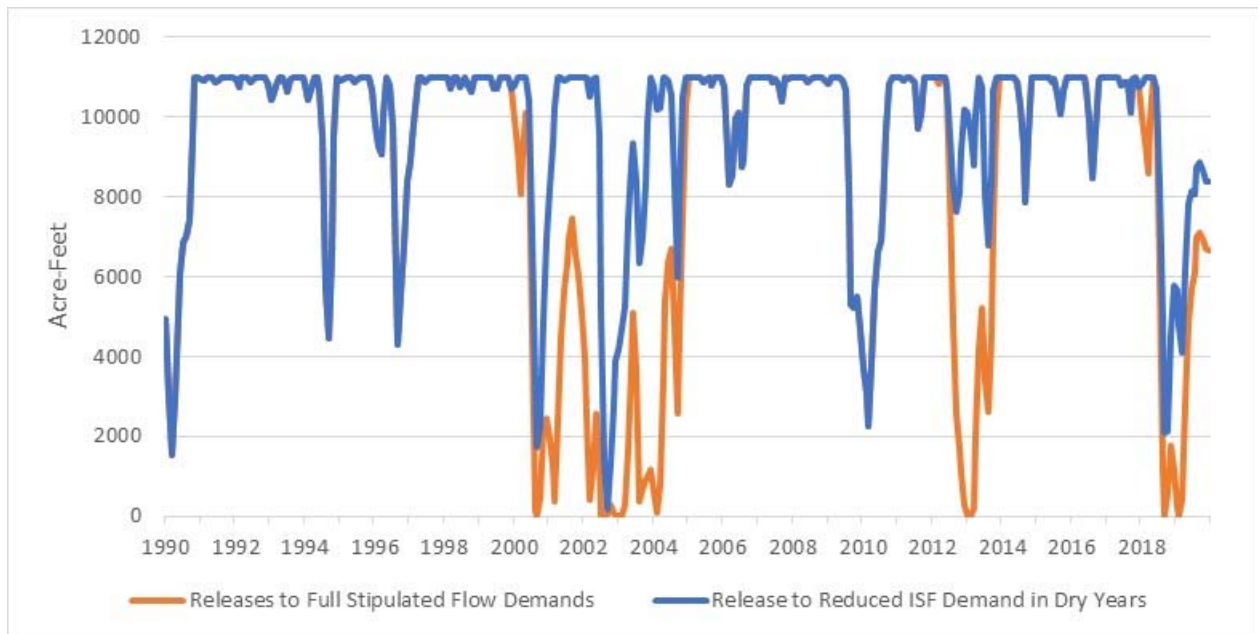


Figure 12. Average Monthly Reservoir Contents with releases to meet the full stipulated flow requirements in all years compared to releases to meet only the current instream flow demands in dry years.

As shown in Figure 12, the 11,000 acre-feet capacity reservoir is more reliable if the reservoir does not release to the stipulated environmental flows during dry years. Note that even though streamflow demands on the reservoir are relaxed, storage still cannot occur unless the stipulated environmental flows are met.

## 5.0 Analysis Summary

The following summarizes observations from the demand and water availability analyses as they apply to diligence of the West Fork water rights.

- The West Fork Canal direct flow water right is decreed for irrigation, municipal, and industrial uses only and not for storage. WWG did not identify a projected demand for the decreed direct flow use of this water right.
- The stipulations attached to the West Fork storage right is not as limiting as the stipulations attached the Dry Gulch storage rights. However, the terms and conditions that may be imposed during diligence and change of location proceedings are unknown.
- If the location of the West Fork storage right is moved to the Dry Gulch Reservoir site as an alternate point of storage, the District may be required to measure water available at the original West Fork reservoir location. This could involve funding and maintaining a streamflow gage or a diversion and return structure.
- The West Fork Storage rights priority stipulated to upstream junior rights provides limited benefit compared to the Dry Gulch storage right priorities (1967/2004) or to a new Junior storage right priority.

- Current Dry Gulch water rights may be sufficient to cover future demands; however, they are not decreed to release for in-channel environmental and recreational demands.
- Current information indicates projected demands for municipal, environmental, recreational, and irrigation uses through 2050 could be met most years with an 11,000 acre-feet reservoir at the Dry Gulch reservoir site.
  - Current Dry Gulch water rights may be sufficient to cover future demands; however, they are not decreed to release for in-channel environmental and recreational demands.
- WWG did not analyze the ability for PAWSD to meet their future demands with existing sources. Applying for a new junior water right in the future would provide the District time to work with PAWSD to refine future municipal demands and potential storage requirements.
- Environmental flow stipulations for Dry Gulch water rights affect the ability to fill the reservoir in dryer years; however, the reservoir may also be used to release to environmental demands.
- The existing environmental flow stipulations are somewhat arbitrary (double the instream flow); there may be an opportunity for the District to work with stakeholders to develop technically based environmental and recreation flows that benefit both the river and improve project operations for municipal use.
- Applying for a new junior water right for the Dry Gulch reservoir location would not impact legal water availability compared to the current District's storage rights, and a new filing could include in-channel environmental and recreational flows as a decreed use.
- Applying for a new junior water right in the future would provide the District time to work with CPW and CWCB to determine if increased environmental flows are justified and to develop agreements for reservoir use.