WEST DIVIDE WATER CONSERVANCY DISTRICT
818 Taughenbaugh Blvd., Suite 101
Rifle, Colorado 81650

MINUTES OF BOARD OF DIRECTORS MEETING
April 20, 2023

CALL TO ORDER
The regular Board of Directors meeting was called to order at the District office at 9:00 a.m. by President Samuel B. Potter.

ROLL CALL
The following directors were present: President Samuel B. Potter, Secretary Richard L. McNeill and Treasurer Tom Jankovsky. Vice President Dan R. Harrison and Director Kelly Couey were absent. Also in attendance were Tammy Keenan, Office Manager; Wendy Ryan, Colorado River Engineering, Inc.; Edward B. Olszewski, Counsel; and Brendon Langenhuizen, Colorado River District, attended via zoom

PUBLIC COMMENT
There was no comment from the public.

MINUTES
Tom Jankovsky moved the minutes of the March 16, 2023, meeting be approved as received with a date correction; Richard L. McNeill seconded; motion carried.

FINANCE REPORT
Bills to be Paid: Richard L. McNeill moved the attached list of bills be paid; Tom Jankovsky seconded; motion carried.

Accounts Receivable: The board reviewed the current accounts receivable.

INCLUSION RESOLUTIONS
Notice was published in the Aspen Time, Rifle Citizen Telegram and the Post Independent per C.R.S. 37-45-136. Tom Jankovsky moved to adopt Resolutions 23-01 through 23-02; seconded by Richard L. McNeill; motion carried.

Roll call vote: Samuel B. Potter -- yes; Tom Jankovsky -- yes, Richard L. McNeill – yes, Resolutions duly adopted. (Copies attached)

RIVER DISTRICT REPORT
Brendon Langenhuizen discussed the ongoing concerns with the Upper Colorado River Commission (UCRC) system conservation pilot program. The program will pay water users to leave their water in the system to mitigate the impacts of depleted storage and continued drought in the Upper Colorado River Basin. The approval process was confusing, which caused some participants to drop out of the program. West Divide expressed their

concerns about the hydrology and augmentation plans in the district; Brendon will pass the concerns along to the UCRC.

The Bureau of Reclamation is reviewing operations and Lake Powell releases. The River District will prepare comments for their review. The projected inflow is near 11.5 million a.f. with 9.5 million a.f to be released.

He also discussed the current snowpack and the predicted fill of several reservoirs. A few of the reservoirs he discussed were:

Blue Mesa will be able to store and spill? this year
Flaming Gorge will be close to full
Granby and Wolford Reservoirs should fill in July
Windy Gap will not be pumping this year
Ruedi and Dillion reservoirs should fill this year as well

He also presented the highlights from the previous River District board meeting:

- Division Engineer, Heath James discussed the Crystal River and reiterated the need for an augmentation plan.

- Airborne Snow Observatories, Inc. surveyed the Roaring Fork and Frying-pan Headwaters April 11-12, 2023. The survey showed healthy snowpack. (Report attached)

- The River District will be hosting a 15-person tour of the Upper Basin.

- The tour of the Upper Colorado River was cancelled due to weather.

The River District continues working with Wendy Ryan on the Nature Based Solutions and Next Steps projects.

The Middle Colorado State of the River meeting will be May 2, 2023 at 6:00 p.m. at the Glenwood Springs Community Center.

WATER CONTRACTS
Richard L. McNeill moved approval of the following assignments; seconded by Tom Jankovsky; motion carried; assignments approved.

Kurt W. Zilm and Velma K. Zilm; assignment from **Charlotte Bea Zilm**, 3.427. a.f., Domestic, Fourmile Creek.

HOUSE4U, Inc.; assignment from **Doug and Susan Lyons**, 1.00. a.f., Domestic, Silt Interconnect.

David Epstein and JoAnn Sunshine; Fourmile Creek amending from 1.7 a.f to 1.00 a.f; Tom Jankovsky moved approval of this amended water allotment contract seconded by Richard L. McNeill; motion carried

Daric and Bret Closs; Tom Jankovsky moved approval of this water allotment contract, 1.00 a.f., domestic, General Stored Water; seconded by Richard L. McNeill; motion carried.

ROUNDTABLE REPORT
The next roundtable meeting will be Monday, April 24, 2023. The roundtable is working on a new website. The Drought Summit meeting will be May 31, 2023 at the History Colorado building in Denver, Colorado.

WATER RESOURCES' REPORT
There was no report this month.

HYDROLOGISTS' REPORT
Water Watch and Augmentation reports were provided and discussed.

ALSBURY
The outlet needs to be closed. Wendy Ryan will attempt to do this April 22, 2023. The reservoir should fill and spill even if she is not able to get to the outlet.

CHEVRON
Scheduled releases have been adjusted to accommodate demands in August and September.

CRYSTAL RIVER
Wendy Ryan is working with USFS to install monitor wells at the Janeway site. Access is tricky as a rig must cross the river and no contacted firms can get a rig across the river. Exploratory digging may be needed to determine the depths of ground water and material prior to drilling wells. Nearby domestic wells indicate ground water depths at 20 to 30 feet.

MARTIN RESERVOIRS
Tom Jankovsky moved to approve and sign the Professional Services Agreements with Metcalf Archaeological Consultants, Inc., and CTL Thompson; seconded by Richard L. McNeill; motion carried.

Environmental Consultant Steve Dahmer does not have professional liability insurance. The board discussed options to proceed.

Tom Jankovsky instructed Samuel B. Potter to make the decision on Env/Cultural based on the revised numbers that Wendy Ryan receives and will be ratified next month.

FOURMILE
A meeting with Division 5 on the Atkinson Ditch operations will be held on April 21, 2023. Wendy Ryan will drive up to check on the conditions of Fourmile creek.

WD YIELD
Transducers have been installed on Beaver and Battlement Creeks and the rest will be installed as soon as they can be accessed.

ACTIVE CALLS
Rifle Creek – Rifle Creek Cannon Ditch

ATTORNEY'S REPORT
Received written and oral report from counsel.

NEW BUSINESS
The next meeting is scheduled for Thursday May 18, 2023.

DIRECTORS' COMMENTS
The Wild and Scenic meeting will be April 27, 2023 at the Marble Firehouse at 5:00 p.m.

Richard L. McNeill expressed his opinion about the recent articles in The Grand Valley Echo.

EXECUTIVE SESSION
There was no need for executive session this month.

ADJOURN
Meeting adjourned at 11:45 a.m.

SIGNED:

Richard L. McNeill, Secretary

ATTEST:

Samuel B. Potter, President

WEST DIVIDE WATER CONSERVANCY DISTRICT

RESOLUTION 23-02

ORDER FOR INCLUSION OF CERTAIN LANDS IN THE WEST DIVIDE WATER CONSERVANCY DISTRICT

WHEREAS, **Valery and Patrick Kelly** have petitioned the Board of Directors of West Divide Water Conservancy District for inclusion of certain lands into the District boundaries;

WHEREAS, the attached Order for Inclusion outlines the proper procedures that were followed for inclusion of the certain lands described on Exhibit A of the Order.

NOW THEREFORE, the Board of Directors of the West Divide Water Conservancy District hereby resolves to execute the attached Order for Inclusion accepting said lands into its district boundaries.

READ, APPROVED, AND ADOPTED this 20th day of April, 2023.

SIGNED:

Samuel B. Potter, President

ATTEST:

Richard L. McNeill, Secretary

EXHIBIT A
Patrick and Valery Kelly
Property Description

That portion of lots 11 and 12, Section 15, Township 8 South, Range 88 West of the 6th principal meridian, more particularly described as follows:

Beginning at a point where the Easterly right-of-way line of the Old Crystal River and San Juan Railroad intersects the Westerly right-of-way line of the Ella Ditch, whence the South quarter corner of said section 15 bears South 6620'00" West, 1630.1 feet; thence North 4616'00" East, 153.20 feet along said Ella Ditch right-of-way line; thence North 3837'00" East, 76.30 feet along said Ella Ditch right-of-way line; thence North 5140'00" East 193.40 feet along said Ella Ditch right-of-way; thence North 2916'00" West, 56.90 feet along said Ella Ditch right-of-way; thence South 5558'00" West, 16.30 feet; thence North 5840'00" West, 16.30 feet; thence North 5840'00" West, 187.00 feet to said Easterly Railroad right-of-way line; thence South 1042'00" West, 166.50 feet along said Easterly Railroad right-of-way; thence South 1644'00" West, 271.10 feet along said Easterly Railroad right-of-way line to the point of beginning.

Together with easement and right-of-way for roadway purposes leading from Colorado Highway No. 133 to the above-described property which said roadway is situate and in place 25 feet in width.

Except any portion as conveyed in deed recorded January 24, 1991 in Book 638 at Page 391.

County of Pitkin, State of Colorado.

WEST DIVIDE WATER CONSERVANCY DISTRICT

RESOLUTION 23-01

ORDER FOR INCLUSION OF CERTAIN LANDS IN THE WEST DIVIDE WATER CONSERVANCY DISTRICT

WHEREAS, **Red Barn Ranch 2, LLC, James A. Gornick, and David and Abigail Jones** have petitioned the Board of Directors of West Divide Water Conservancy District for inclusion of certain lands into the District boundaries;

WHEREAS, the attached Order for Inclusion outlines the proper procedures that were followed for inclusion of the certain lands described on Exhibit A, B and C of the Order.

NOW THEREFORE, the Board of Directors of the West Divide Water Conservancy District hereby resolves to execute the attached Order for Inclusion accepting said lands into its district boundaries.

READ, APPROVED, AND ADOPTED this 20th day of April, 2023.

SIGNED:

Samuel B. Potter, President

ATTEST:

Richard L. McNeill, Secretary

EXHIBIT A
Red Barn Ranch 2, LLC
Property Description

A tract of land situated in the Southeast ¼ Northwest ¼ and the Northeast ¼ Southwest ¼ of Section 6, Township 6 South, Range 91 West of the Sixth Principal Meridian, being more particularly describes as follows:

Beginning at a point on the southerly right-of-way fence of a County Road whence the Northwest Corner of said Section 6 bears North 33°35'41" West 2,632.47 feet; thence along said right-of-way fence the following courses; South 88°01'13" East 548.55 feet; thence South 86°32'34" East 265.09 feet; thence South 68°53'42" East 85.61 feet; thence South 28°45'57" East 442.94 feet; thence South 00°27'29" East 428.64 feet to centerline of the Ware and Hinds Ditch; thence along said centerline the following courses; South 51°43'16" West 138.49 feet; thence South 76°56'13" West 134.52 feet; thence North 87°43'10" West 185.83 feet; thence South 87°48'14" West 120.88 feet; thence North 48°48'42" West 111.11 feet; thence North 44°46'12" West 91.02 feet; thence North 57°02'43" West 175.44 feet; thence North 50°58'37" West 65.75 feet; thence North 48°17'09" West 182.27 feet; North 41°50'16" West 169.04 feet; thence North 57°26'40" West 31.13 feet; thence leaving said ditch centerline on a course bearing North 07°14'07" East 461.33 feet TO THE POINT OF BEGINNING.

EXHIBIT B
JAMES A. GORNICK
Property Description

A parcel of land situated in Lot 9, Section 5, Township 6 South, Range 91 West of the Sixth Principal Meridian, County of Garfield, State of Colorado more particularly described as follows:

Beginning at a point which lies North 23°32'17" West 1435.71 feet of the Southeast corner Section 5 of said Township and Range;
Thence South 00°00'00" West 1087.66 feet to a point on the center of the Colorado River;
Thence South 69°33'39" West 276.39 feet;
Thence departing from centerline of said River North 00°00'00" East 1182.31 feet to a point on the North line of Lot 9;
Thence along said North line North 89°35'11" East 259.00 feet to the Point of Beginning.

Also known as 278 Rippy Lane, New Castle, CO 81647

EXHIBIT C
DAVID AND ABIGAIL JONES
PROPRERTY DESCRIPTION

A parcel of land situated in Lot 3, Section 4, Township 6 South, Range 91 West of the Sixth Principal Meridian, County of Garfield, State of Colorado; said parcel being more particularly describes as follows:

Commencing at the North Quarter Corner of said Section 4, the True Point of Beginning; thence S. 00°33'33" E. along the easterly line of said Lot 3 983.97 feet; thence leaving said easterly line N. 88°57'25" W. 494.40 feet to a point on the centerline of a 30.00 foot road easement; thence N. 60°00'08" W. along said centerline 68.32 feet; thence continuing along said centerline along the arc of a curve to the right having a radius of 133.43 feet and a central angle of 22°17'15", a distance of 51.90 feet (chord bears N. 48°51'31" W. 51.57 feet); thence continuing along said centerline N. 37°42'54" W. 9.86 feet; thence continuing along said centerline along the arc of a curve to the left having a radius of 160.29 feet and a central angle of 17°43'48", a distance of 49.60 feet (chord bears N. 46°34'48" W. 49.40 feet); thence continuing along said centerline N. 55°26'41" W. 17.59 feet; thence continuing along said centerline along the arc of a curve to the left having a radius of 61.00 feet and a central angle of 83°07'53", a distance of 88.51 feet (chord bears S. 84°00'22" W. 80.94 feet); thence leaving said centerline N. 00°56'14" E. 250.00 feet; thence N. 89°03'47" W. 243.27 feet; thence S. 00°56'14" W. 595.33 feet; thence S. 31°38'55" W. 126.47 feet to a point on the northerly right-of-way of County Road 214; thence N. 78°45'00" W. along said right-of-way 138.81 feet; thence continuing along said right-of-way along the arc of a curve to the left having a radius of 590.933 feet and a central angle of 11°12'00", a distance of 115.51 feet (chord bears N. 84°21'00" W. 115.33 feet); thence continuing along said right-of-way N. 89°57'00" W. 4.86 feet; thence leaving said right-of-way N. 00°37'47" E. 371.25 feet; thence West 29.78 feet to a point on the westerly line of said Lot 3; thence N. 00°40'11" W. along said westerly line 883.00 feet to a point on the northerly line of said Section 4; thence N. 89°06'51" W. along said northerly line 518.07 feet so the Southeast Corner of Section 35, Township 5 South, Range 91 West; thence continuing along said northerly line N. 89°09'23" E. 808.74 feet to the True Point of Beginning; said parcel containing 29.197 acres, more or less.

Lot 1, Hayes Exemption Plat Reception No. 397767

ASO Survey Report

Roaring Fork & Fryingpan Headwaters, CO

Survey Date: April 11-12, 2023

Airborne Snow Observatories, Inc. is a public benefit corporation with a mission to provide high-quality, timely, and accurate snow measurement, modeling, and runoff forecasts to empower the world's water managers to make the best possible use of our planet's precious water.

Historical data and reports can be found at:
data.airbornesnowobservatories.com

ROARING FORK & FRYINGPAN HEADWATERS
APRIL 11-12, 2023 SURVEY

Survey Date: April 11-12, 2023
Survey # of Water Year 2023: 1
Report Delivery Date: April 14, 2023

Full basin SWE: 589 ± 27 TAF
Estimated snowline: < 7800 feet

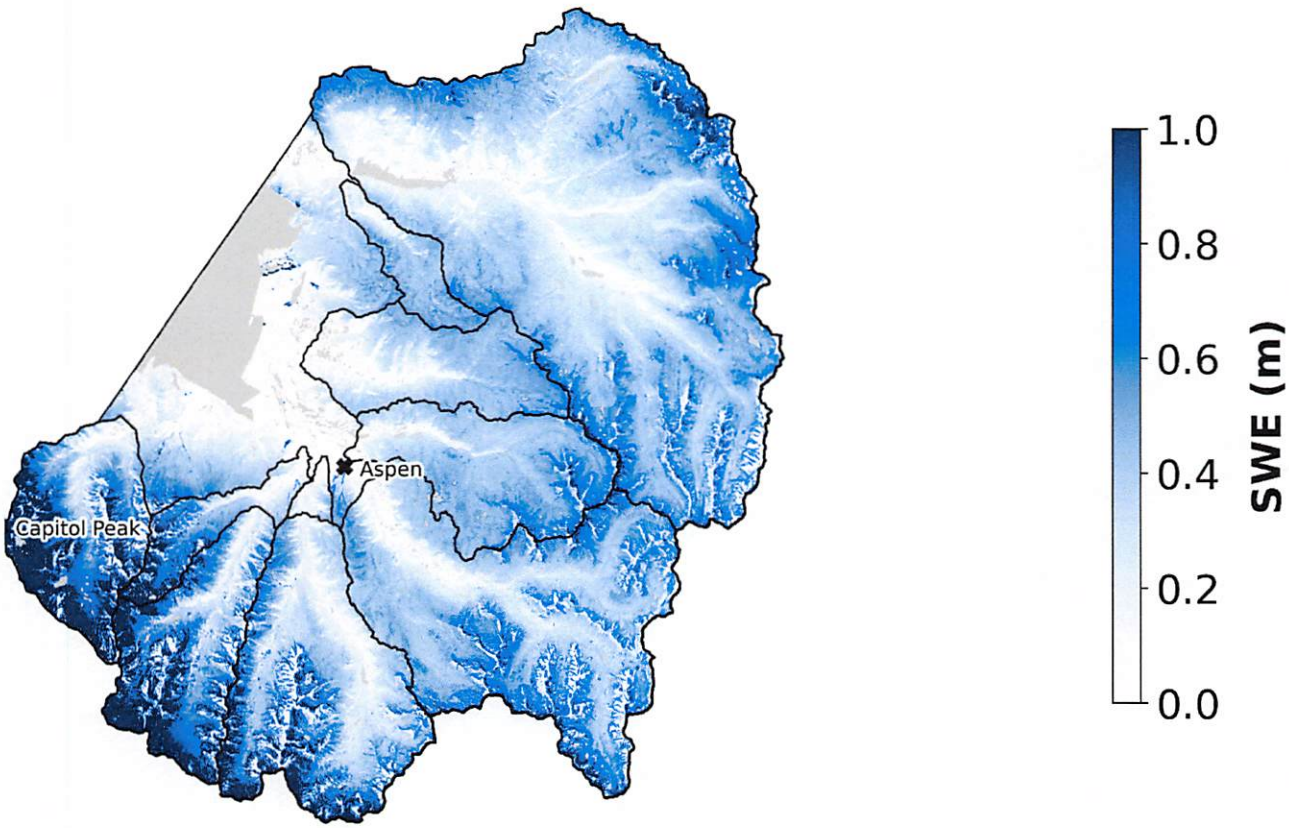
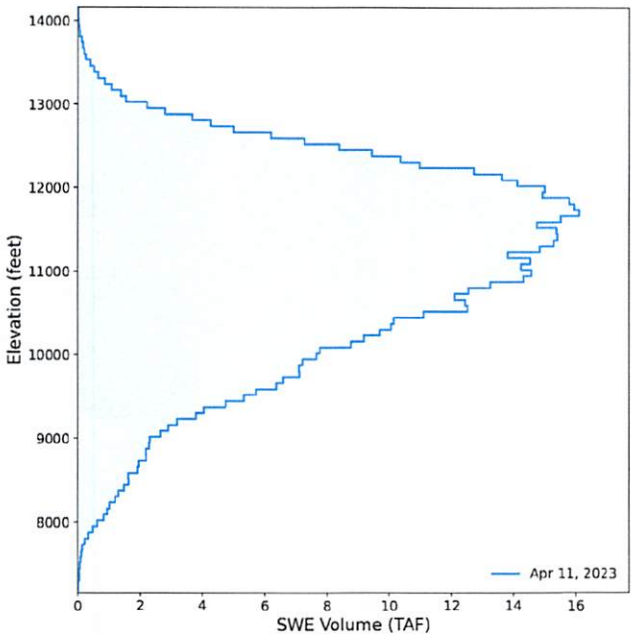


Figure 1. *Spatial distribution of SWE depth (m).*

Table 1. *Estimated SWE volume (TAF) for the full Roaring Fork & Fryingpan Headwaters as well as subbasins basin for the April 11-12 survey.*

Basin	Estimated SWE (TAF) April 11-12
Roaring Fork & Fryingpan Headwaters	589
Uncertainty Range	*562 - 616*
Castle Creek above Aspen Diversion	66
Castle Creek at Highway 82	67
Fryingpan River above Reudi	187
Hunter Creek at Aspen	39
Maroon Creek above Aspen Diversion	58
Maroon Creek at Highway 82	74
Roaring Fork near Aspen	94
Rocky Fork Creek	10
Snowmass Creek	61
Woody Creek below Collins Creek	25

2.a.



2.b.

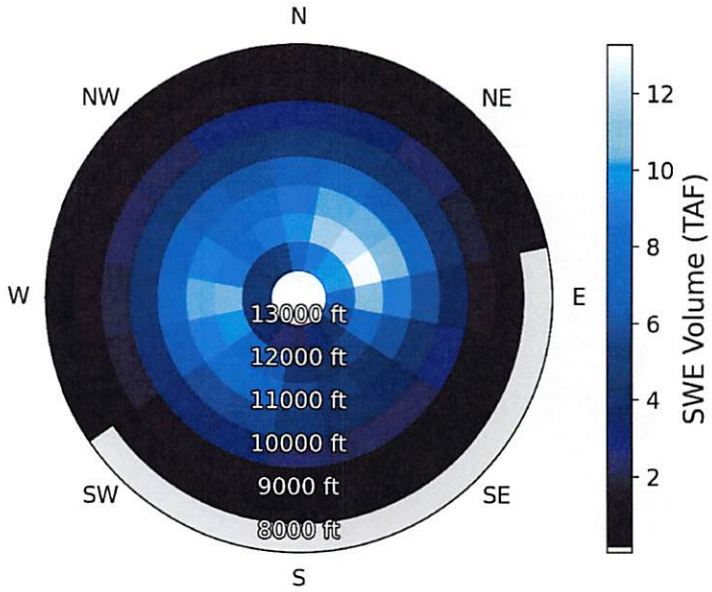


Figure 2.a. *Distribution of SWE volume (TAF) across elevations.* ***Figure 2.b.*** *Distribution of SWE volume (TAF) by aspect and elevation for the April 11-12 survey. See* ***Figure 9*** *and* ***Figure 10*** *for more descriptive plots.*

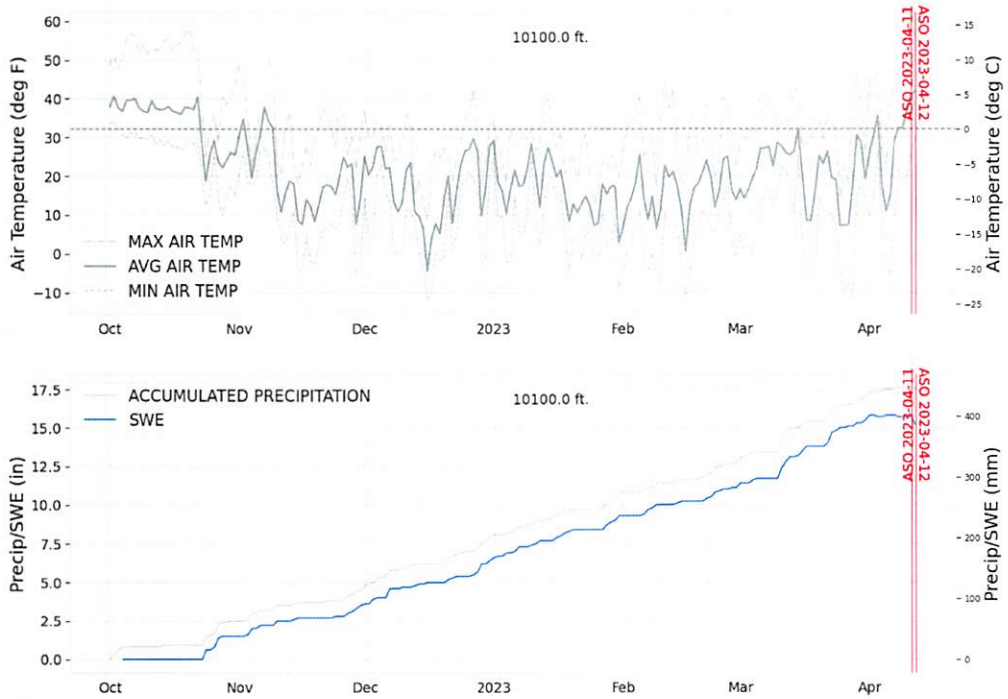


Figure 3. *Daily meteorological conditions at Chapman Tunnel (SNTL 1101) (elevation 10100 ft). Note: the raw daily data shown has been downloaded directly from CDEC and has not been quality checked. There may be noise or incorrect data present. Precipitation data will only be shown if the featured station records it, and the air temperature plot shows daily max, mean, and min values. ASO surveys are marked with red vertical lines.*

Summary of background conditions

- The snow season in the Roaring Fork and Fryingpan basins began with regular snowfall events in October and largely kept pace with the 30-year median trace.
- Beginning in mid-December, two notable storm sequences boosted the basin snowpack well above the median. Regular accumulations continued through the winter, with contributions from several of the atmospheric river events that have produced record snow totals in California and Utah.
- Late winter and early spring saw this accumulation pattern continue, with SNOTEL sites in the basin apparently peaking a few days into April.
- This SNOTEL SWE peak was accompanied by a strong dust event, depositing a continuous and extensive dust layer throughout the watershed and region. This dust layer has been steadily exposed at higher and higher elevations, and has resulted in significant melt generation and increases in streamflow.
- Prior experience and research conducted by ASO team members suggest that, barring significant additional snowfall events, this recent dust deposition and resulting melt rate enhancement has likely shortened the snowmelt season by a month or more.

Evaluation of ASO snow depth measurements

Point-to-point comparison of in-situ snow depths with ASO 3 m resolution snow depth* is shown in **Table 2.**

These depth comparisons are at stations for which we are very confident in 1) the location, and 2) the depth data that is being reported at the time of the ASO survey. Because we are directly comparing a point to a 3 m pixel in our data, we need to be certain that the station location is accurate to within 1.5 m. For reference, GPS data is usually only accurate to within 5 m, but we are often able to hone in on locations using Google Earth and other means, thereby enabling these comparisons. For these reasons, specific sites might not be included in the comparison. Please contact the ASO team to converge on accurate and precise coordinates and/or investigate data quality issues for any sites of interest.

*Note: Snow-free, planar surfaces, common between the snow-on and snow-off datasets, are used to co-register the elevation datasets throughout the basin. This relative registration process ensures that in areas without snow, we measure a snow depth of 0, and enforces snow depth accuracy throughout. At 3 m resolution, the standard deviation of snow depth distribution was 0.015 m, unbiased. At 50 m resolution, the snow depth uncertainty based on a rigorous bare surface evaluation is less than 1 cm.

Table 2. Comparison of ASO and snow pillow snow depths. Note: ASO long-term depth uncertainty is ± 8 cm.

Site	Elevation (ft)	Date	Site Depth (cm)	ASO Depth (cm)	Depth Difference (cm)
Independence Pass (542)	10598	4/11/23	132	132	0
Ivanhoe (547)	10541	4/12/23	132	131	-1
Chapman Tunnel (1101)	10100	4/12/23	109	109	0
Kiln (556)	9264	4/12/23	91	92	1
Nast (658)	8731	4/1/23	53	53	0
				Mean	1

Evaluation of snow density

Physically based model - iSnobal

- As this is the first survey of the season in the Roaring Fork and Fryingpan Headwaters, the iSnobal model is only now being updated with data from the April 11th-12th airborne survey.
- The mean spatially distributed snow density from the open-loop model on April 12th is 383 ± 63 kg/m^3.

In-situ measurements

ASO field collections

- ASO staff conducted field work in the Roaring Fork River basin coincident with this survey, on April 12th.
- The mean snow density from a 0.68 m snow pit at 9500 ft elevation near Ashcroft was 329 kg/m^3.

Sensor measurements

- To increase our confidence in the model evaluation, we expanded our density analysis to include sites in the nearby Crystal and Taylor River basins.
- The mean snow density reported on April 12th from nine locations (**) was 372 ± 33 kg/m^3, with a range of 337-442 kg/m^3. (** Chapman Tunnel, Independence Pass, Ivanhoe, Kiln, Nast Lake, Schofield Pass, North Lost Trail, McClure Pass, Upper Taylor SNOTELs.) See **Figure 4.**

- To increase our confidence in the densities provided by collocated SNOTEL sites, we have estimated snow density at reliable and accurate pillow locations using ASO 3 m depth and pillow SWE. The estimated mean bulk density from these inversions at five locations (**) was 350 ± 6 kg/m³. (**Chapman Tunnel, Independence Pass, Ivanhoe, Kiln, Nast Lake)

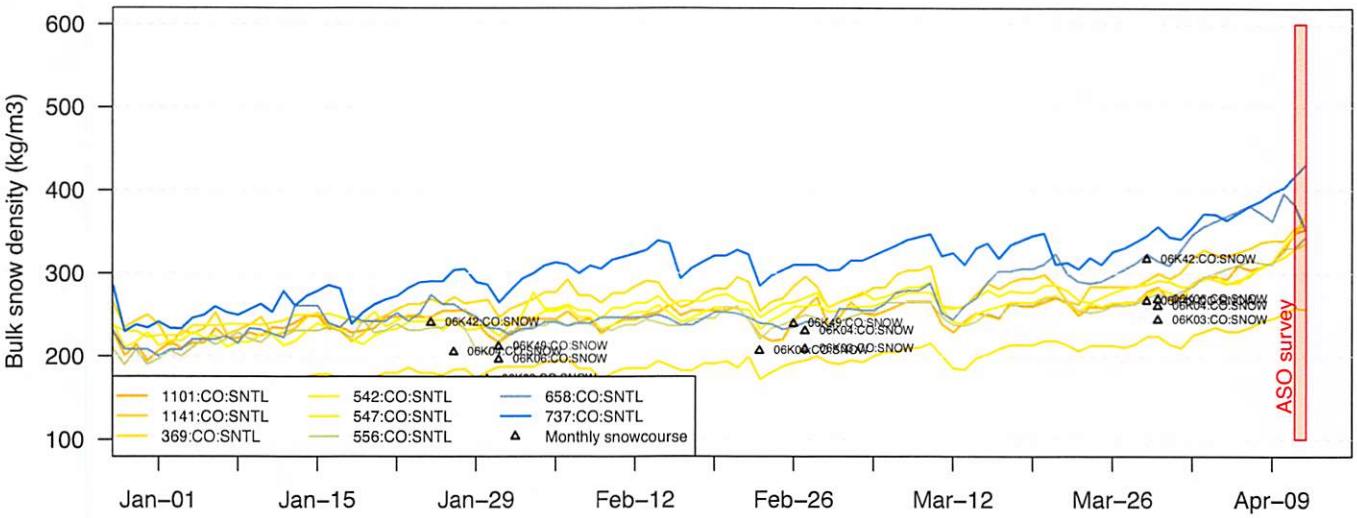


Figure 4. *Daily snow density timeseries at automated sensor locations in the Roaring Fork Basin. (Data source: CDEC)*

Snow course measurements

- The April snow course measurements were available from five locations at the time of processing. These data were collected on March 29th and March 30th and had an average bulk density of 271 ± 27 kg/m³ on the day of their collection.
- During the time between the snow course collections and the ASO survey, snow density changed due to ongoing densification of the snowpack. The densification rate has been estimated at 4.6 kg/m³/day based on in-situ sensors and climatology.
- Due to the increased uncertainty induced by measurements taken 13-14 days prior to the survey and adjusted for densification, the snow course data were given lower weight in the model evaluation and bias correction.
- After adjustments, the estimated mean bulk density at these locations on the ASO flight date is 333 ± 29 kg/m³.

Model evaluation & snow density adjustment

- The mean modeled snow density of 383 ± 63 kg/m³ is higher than the mean of the in-situ measurements of ~370 kg/m³, with notable model overestimations in deep snow (> 3.5 m) and in shallow, warm snow (< 0.9 m).

- In deep snow (> 3.5 m), the model is reporting a mean bulk density of 466 kg/m^3 which is ~9% higher than the in-situ guidance of ~425 kg/m^3 at Schofield Pass, which is known to report high densities due to sensor configuration (**Figure 6a**).
- Conversely, the model is overestimating bulk snow density in shallow snow (< 0.9 m) in a non-linear manner (**Figure 6a**).
- To address these biases in the model, deep snow (> 3.5 m) bulk density was reduced non-linearly by up to 10% (if original model density was > 400 kg/m^3). The adjustment reduced deep-snow density to a mean of 431 kg/m^3, which is much more consistent with the in-situ guidance. In addition, a non-linear relationship (with snow depth) was used to reduce bulk density in shallow snow (< 0.9 m) by up to 22% for depths of ~0.05 m and 11% for depths ~0.9m. Finally, a minor adjustment was applied to low-elevation snow (< 8500 ft) to preserve physically based dynamics of slightly higher bulk densities at lower elevations.
- The resulting mean-adjusted snow density across the basin was reduced to 367 ± 36 kg/m^3, which is more consistent with the in-situ guidance.
- After adjustment, the bias in snow density calculated using point-to-point comparisons was reduced to -0.7 kg/m^3 from +34 kg/m^3 (model open-loop).
- Using the open-loop model density, the full basin SWE was 600 TAF and after snow density adjustments were applied, the basin SWE estimate was reduced to 589 TAF. The snow density adjustments decreased the basin SWE estimate by 2%. These estimates include backfilling under clouds of 5 TAF (see discussion below for more detail).
- Given the significant density adjustment in deep snow (> 3.5 m) we have generated one scenario to sample the remaining uncertainty associated with the deep snow and mid-depth snow density adjustments. Scenario A applies half of the adjustments described (i.e. up to 5% reduction in deep snow density and up to 11% reduction in shallow snow density). The resulting full basin SWE outcome for this scenario was 594 TAF.

Table 3. *Snow density scenarios and SWE volume estimates. "The 'Adjusted Density' is used in calculating the reported SWE. The other density scenarios are computed to evaluate the density sensitivity and to help determine the uncertainty in the reported SWE values.*

Scenario	Spatial-mean density (kg/m³)	SWE (TAF)	Description
Adjusted density	**362**	**589**	**Adjusted density map & ASO depths**
Open-loop	372	600	Modeled density map and ASO depths
Scenario A	367	594	Partially adjusted densities, up to 5% reduction in deep snow density and up to 11% reduction in shallow snow + ASO depths

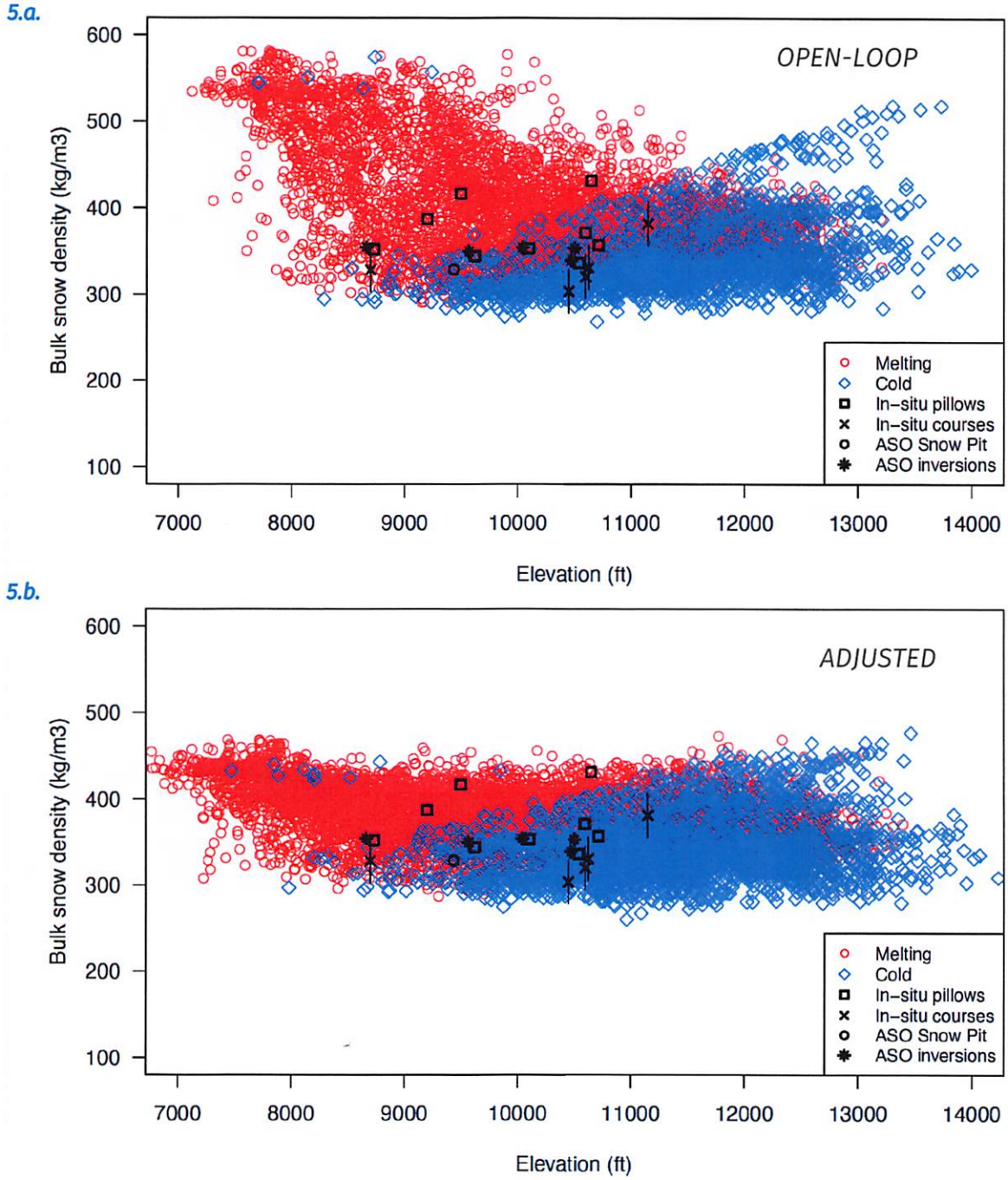


Figure 5. *Observed and modeled bulk snow density (kg/m³) by elevation (ft) for* **a.** *open-loop and* **b.** *adjusted densities. The black stars represent the density inversions described in Sensor Measurements. Red circles represent modeled densities of melting snow (cold content = 0), blue diamonds represent modeled densities of cold snow (cold content < 0).*

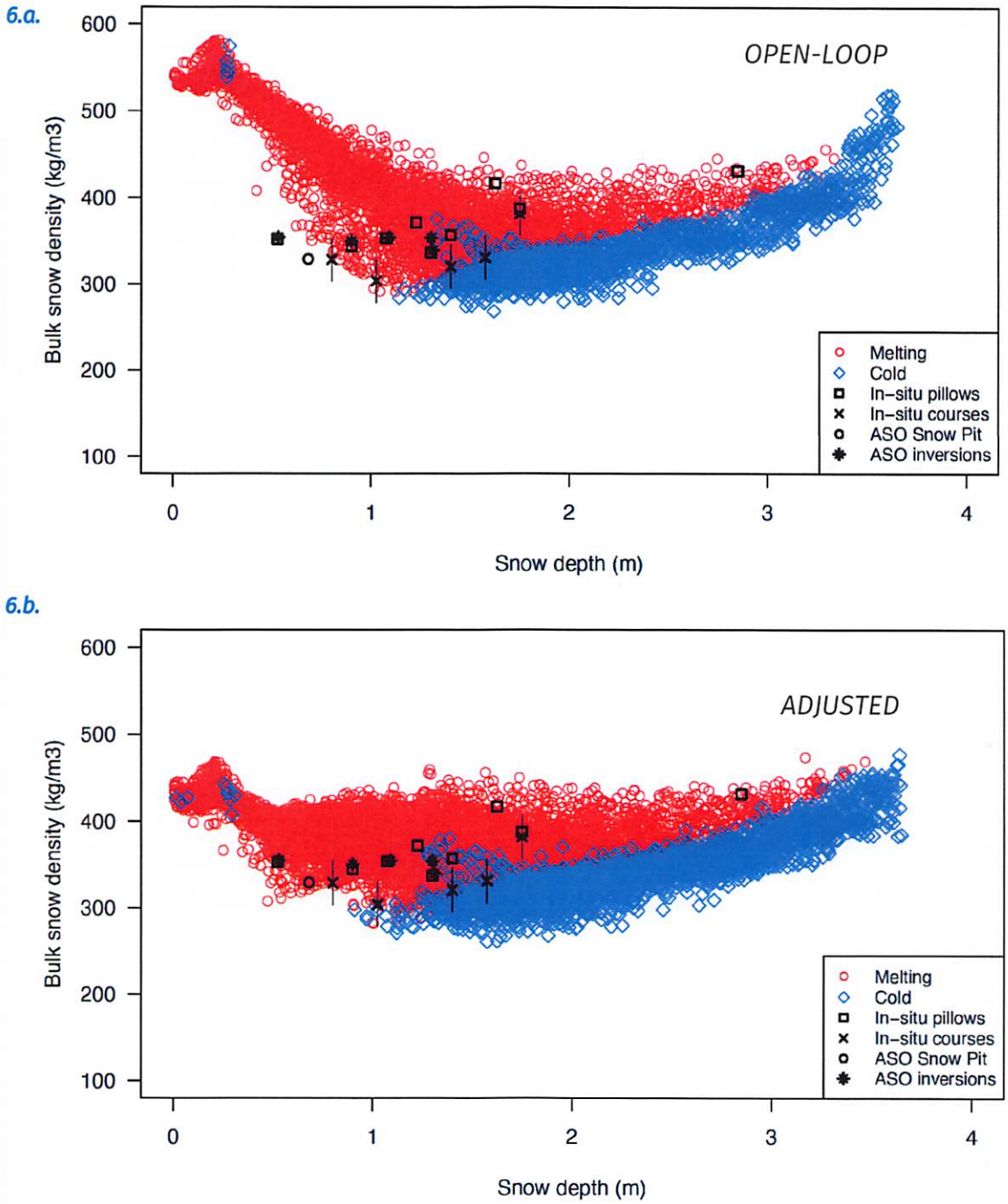
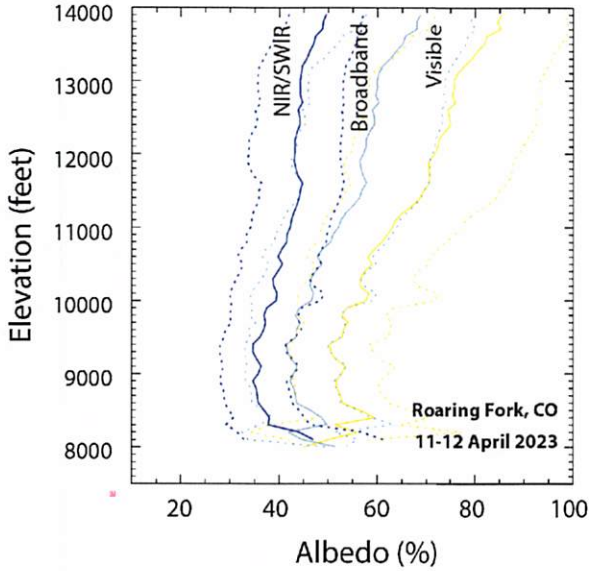


Figure 6. *Observed and modeled bulk snow density (kg/m³) by snow depth (m) for* **a.** *open-loop and* **b.** *adjusted densities. The black stars represent the density inversions described in Sensor Measurements. Red circles represent modeled densities of melting snow (cold content = 0), blue diamonds represent modeled densities of cold snow (cold content < 0).*

Snow albedo

- As described in Painter et al. (2016), in addition to the scanning lidar, ASO also carries a pair of visible to shortwave infrared imaging spectrometers from which we retrieve broadband albedo (400-2500 nm wavelength), visible albedo (400-700 nm), and near-infrared to shortwave-infrared (700-2500 nm). The latter two albedos are generated to ultimately constrain iSnobal and WRF-Hydro, as well as other physically-based models.
- Solar radiation is the primary energy source for snowmelt. The snow albedo describes the fraction of incoming solar energy that is reflected by the snow surface.
- The three wavelength bands presented in **Figure 7a** are visible, broadband, and near IR/shortwave IR, the same wavelength ranges that are used in iSnobal and WRF-Hydro Noah-MP snow albedos.
- Snow surface albedos decrease from higher elevations to lower – 85% down to 55% in the visible wavelengths, 70% down to 45% in broadband, and 50% down to 39% in the near IR/shortwave IR. These albedo traces with elevation show that the snowpack surface at the highest elevations still retains some new, clean snow atop the recent dust layer (**Figure 8**). Even in these areas however, the albedo is reduced from that expected of purely clean snow, suggesting that the slightly buried dust is beginning to absorb solar radiation. The snow albedos decrease strongly at lower elevations, as dust is progressively more exposed where the new snow above the dust layer has melted off. The albedo values below 11000 ft indicate that the snowpack is absorbing about 40% more incoming solar radiation than a clean snowpack would be - resulting in rapid melt production.
- The ASO flight team encountered challenging flight conditions during the April 11th and 12th surveys, with darkness encroaching towards the end of the 11th survey, and significant cloud obscuration on the 12th. While the geometry and active sensing mode of the lidar scanner allows snow depth retrieval over most of the survey area, an optical imager like the imaging spectrometer is more often occluded. Valid albedo retrievals were obtained during the 1st half of the flight on the 11th, and in between clouds on the 12th. While this precludes a full-basin albedo coverage, it appears that a full dynamic range of clean-to-dusty snow albedos was captured, allowing characterization of surface energy balance conditions throughout the basin as well as constraint of model parameters.

7.a.



7.b.

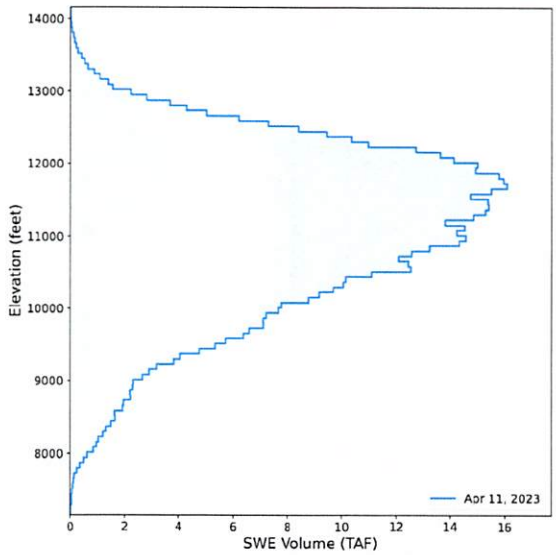


Figure 7.a. *Snow albedo (%) by elevation (ft) for April 11-12 with mean (solid lines) and ± 1 standard deviation (dotted lines) for near and shortwave infrared (blue), broadband (light blue), and visible (gold) wavelengths.* ***7.b.*** *Distribution of SWE volume (TAF) across elevations for the April 11-12 survey.*

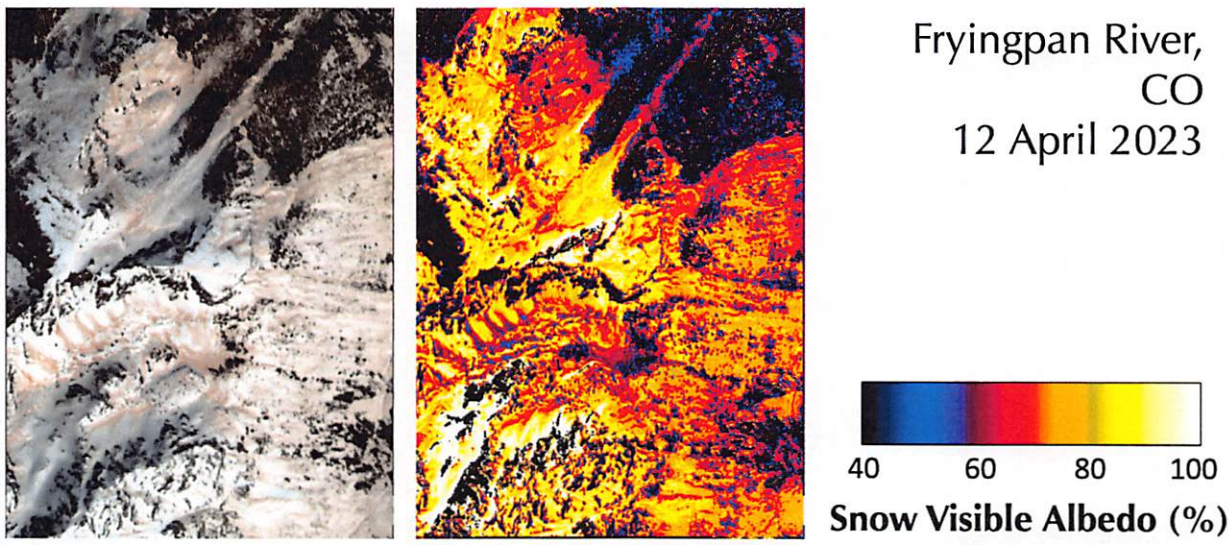


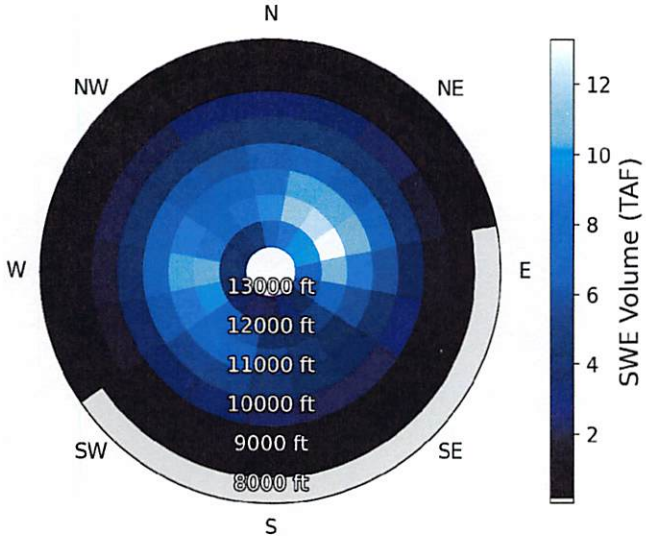
Figure 8. *True color (left) and snow albedo (right) images from the upper Fryingpan River on April 12, 2023. The strong dust-induced albedo reduction is pronounced - these conditions are representative of the snow surface state throughout the survey area.*

Additional data/ remarks

- ASO survey operations target clear sky days, however, clouds can encroach into the target area during the period of survey. The survey techniques are such that we can often get valid retrievals under the cloud, but this is not always possible.
- During the narrow survey window for the April 11th-12th Roaring Fork survey, we encountered moderate cloud cover in the northern section of the basin (during the April 12th flight). Flight line overlap and penetration through clouds enabled us to retrieve a snow depth signal in many of these clouded areas. However, remaining clouds were estimated to cover approximately 1.4% of the snow covered area (27.8 km^2). In these areas, we applied a backfill snow depth (at 3m spatial resolution) based on snow depths in the vicinity of the clouds. The backfilling replaced 5 TAF of SWE, which is included in the total basin SWE estimate on the front page of this report.
- Please refer to the text files included in the data package for SWE volume per elevation band and other summary statistics.

Additional data / remarks

9.a.



9.b.

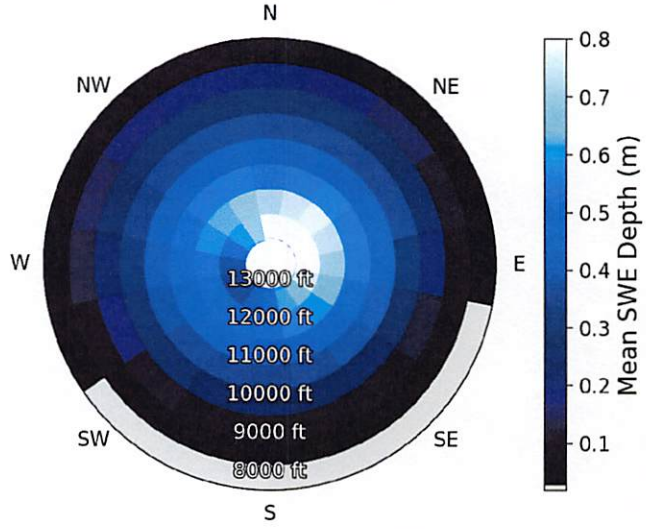
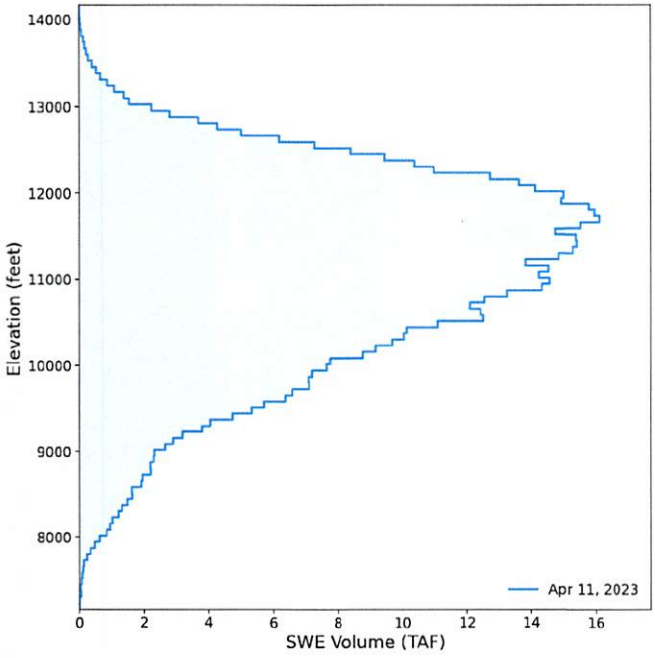


Figure 9.a. & 9.b. *SWE volume (TAF) and depth (m) by aspect and elevation for April 11-12 survey.*

10.a.



10b.

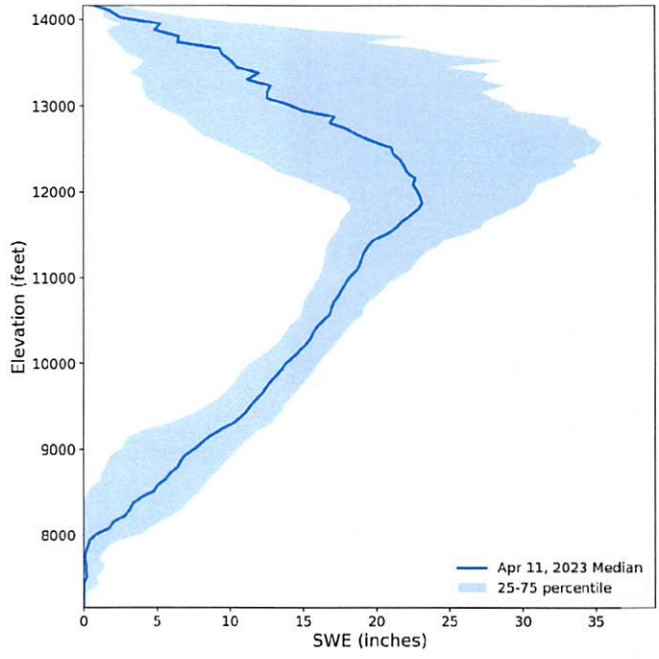


Figure 10.a. *Distribution of SWE volume (TAF) across elevations for the April 11-12 survey.* ***10.b.*** *Distribution of SWE depth (in) across elevations; solid line represents median SWE depth (in), lighter color bands represent the 25th to 75th percentile.*

West Divide Water Conservancy District-General Fund
Bills to be Paid
April 20, 2023

Num	Name	Memo	Account	Amount
5646	Bookcliff Professional Building, LLC		5395 · Rent--Office unit	996.35
5646	Bookcliff Professional Building, LLC		5394 · Rent-Prop.Taxes/Ins/Utilities	200.00
eft	Capital One, F.S.B.	Comcast	5390 · Telephone & Internet	186.64
eft	Capital One, F.S.B.	Zoom	5390 · Telephone & Internet	17.29
eft	Capital One, F.S.B.	Postage	5300 · Postage/Box Rent/Etc.	30.77
eft	Capital One, F.S.B.	Water, floor mat, paper	5100 · Office Supplies	173.46
eft	Capital One, F.S.B.	Quickbooks update	5100 · Office Supplies	549.00
5643	Couey, W. Kelly		5020 · Director Fees	287.49
5644	Harrison, Dan R.		5020 · Director Fees	334.47
DD11	Jankovsky, Tom	Direct Deposit	5020 · Director Fees	381.45
DD11	McNeill, Richard L	Direct Deposit	5020 · Director Fees	560.93
DD11	Keenan, Tamara	Direct Deposit	5221 - Salary	2,502.41
5645	Potter, Samuel		5020 · Director Fees	404.20
5647	Barnes, Pearson & Rudow, PC	March	5150 · Accounting	715.00
5648	Olszewski, Massih & Maurer, P.C.	General	5280 · Legal	376.25
eft	American Funds		2227 · Simple IRA Payable	107.93
eft	American Funds		2227 · Simple IRA Payable	359.76
eft	Electronic Federal Tax Payment Syster	84-0976632	2205-FICA/MED/FWT Payable	1,143.84
				9,327.24

GENERAL STORED WATER

Num	Name	Memo	Account	Amount
2604	Garfield County Clerk and Recorder	Memorandums	7070 · Memorandum Recording Fees	46.00
2605	Colorado River Engineering, Inc.	Task 2 Hydrology Report Edits	Martin Grant	330.00
2605	Colorado River Engineering, Inc.	Task 9 Cost estimate spreadsheet	Martin Grant	27.50
2605	Colorado River Engineering, Inc.	Task 10 Feasability Study for WSBR gra	Martin Grant	1,213.75
2605	Colorado River Engineering, Inc.	Task 11 Landowner Coordination	Martin Grant	130.00
2606	Colorado River Engineering, Inc.	General	7032 · Hydrology--General	2,952.50
2607	Olszewski, Massih & Maurer, P.C.	Inclusions	7047 · Legal--General	218.75
2607	Olszewski, Massih & Maurer, P.C.	CRWCD	7047 · Legal--General	455.00
2607	Olszewski, Massih & Maurer, P.C.	Contracts	7047 · Legal--General	35.00
2607	Olszewski, Massih & Maurer, P.C.	Crystal	7048 · Legal--Crystal River	131.25
2607	Olszewski, Massih & Maurer, P.C.	Martin Diligence	7046 · Legal--WD project Diligence	2,038.75
2607	Olszewski, Massih & Maurer, P.C.	Area A	7047 · Legal--General	630.00
				8,208.50

West Divide Water Conservancy District-General Fund
Bills to be Paid
April 20, 2023

FOURMILE CREEK

Num	Name	Memo	Account	Amount
1999	Olszewski, Massih & Maurer, P.C.	General	8050 · Legal--General	997.50
2000	Colorado River Engineering, Inc.	General	8030 · Hydrology	2,490.00
2000	Colorado River Engineering, Inc.	Seepage & evaporative losses	8033 · Hydrology -- Martin # 1 & 2	260.00
2000	Colorado River Engineering, Inc.	Water rights & Stakeholders outreach	8080 · Maintenance - Martin Reservoir	105.00
2001	Black Bear Ranch, LLC	2022 lease payment	8090 · Water Lease--Black,Paq, Zilm	1,008.23
2002	Alex Shabtai	2023 lease	8090 · Water Lease--Black,Paq, Zilm	1,043.52
				5,904.25

SILT INTERCONNECT

Num	Name	Memo	Account	Amount
547	Garfield County Clerk & Recorder	Memorandum	8000 · Memorandum Recording Fees	36.00
548	Silt Water Conservancy District	Joint Agreement	7200 · SWCD Joint Project Legal	1,966.06
				2,002.06
			GRAND TOTAL	25,442.05