Water Supply Reserve Account – Grant and Loan Program
Water Activity Summary Sheet
September 21-22, 2016
Agenda Item 19(b)

Applicant & Fiscal Agent:	Center for Snow and Avalanche Studies
Water Activity Name:	Colorado Dust-on-Snow Project
Water Activity Purpose:	Study/Monitoring
County:	Multiple counties in the Rio Grande, Colorado, Southwest and Gunnison Basins
Drainage Basin:	Rio Grande, Colorado, Southwest, and Gunnison
Water Source:	Snow
Amount Requested/Source of Funds:	$2,500 Rio Grande Basin Account $2,500 Colorado Basin Account $2,500 Southwest Basin Account $2,500 Gunnison Basin Account $10,000 Total Basin Account Requests $140,000 Statewide Account $150,000 Total Grant Request
Matching Funds:	Basin Account Match ($10,000) = 6.7% of total grant request; Applicant Match (refer to *Funding Summary/Matching Funds* section)

Staff Recommendation:

Staff recommends approval of up to $2,500 from the Rio Grande Basin Account; $2,500 from the Colorado Basin Account; $2,500 from the Gunnison Basin Account; $2,500 from the Southwest Basin Account; and $140,000 from the Statewide Account to help fund the Study titled: Colorado Dust-on-Snow Project.

Water Activity Summary: The Center for Snow and Avalanche Studies is an independent not-for-profit organization that operates the Colorado Dust-on-Snow (CODOS) program. Dust on snowpack events advance snowmelt timing, enhance runoff intensity, and decrease snowmelt yields. CODOS is the only organization monitoring dust-on-snow in Colorado in a comprehensive, applied manner on behalf of the water community, providing forecasts of dust-on-snow impacts on snowmelt runoff behavior throughout the state in the form of timely and actionable updates and alerts. If approved, expenditures of grant monies will be provided to:

- Conduct dust-on-snow field campaigns to track the severity and extent of dust events throughout the snow accumulation and ablation period for WY2017, 2018, and 2019;
- Provide timely and applicable updates and alerts to forecasters and the water community;
- Operate long-term snow system study sites in Colorado's San Juan Mountains;

- Manage dust-on-snow and methodological data collection, management, validation, and reporting. Ensuring correct operation of instruments, and maintain data, metadata, and sensor status files;
- Maintain project webpages and data files, graphs, and relevant information;
- Initiate website upgrades to improve access, and support data, graphics, and interpretation platforms;
- Develop visualization and interpretive tools on project webpages for easy dissemination of information, and;
- Provide educational outreach for K-12 schools in Southwest Colorado.

Discussion: This grant is consistent with the next steps for implementation identified by the roundtables, the IBCC, and the CWCB, as well as in Colorado's Water Plan.

Issues/Additional Needs: No issues or additional needs have been identified.

Threshold and Evaluation Criteria:
The application meets all four Threshold Criteria.

Tier 1-3 Evaluation Criteria:
This activity has undergone review and evaluation and staff has determined that it satisfies the Evaluation Criteria. Please refer to WSRF Application for applicant's detailed response.

Funding Summary/Matching Funds:

Funding Source	Cash	In-kind	Total
WSRF Rio Grande Basin Account	$2,500	n/a	$2,500
WSRF Colorado Basin Account	$2,500	n/a	$2,500
WSRF Southwest Basin Account	$2,500	n/a	$2,500
WSRF Gunnison Basin Account	$2,500	n/a	$2,500
Total Basin Account Requests	$10,000	n/a	$10,000
USGS	$0	$21,000	$21,000
USBOR	$37,500	$0	$37,500
City of Grand Junction	$7,500	$0	$7,500
Colorado River Water Conservation District	$60,000	$0	$60,000
Denver Water	$18,000	$0	$18,000
CWCB	$75,000	$0	$75,000
Dolores Water Conservancy District	$3,000	$0	$3,000
Rio Grande Water Conservancy District	$15,000	$0	$15,000
Southwestern Water Conservation District	$15,000	$0	$15,000
Tri-County Water Conservancy District	$7,500	$0	$7,500
Upper Gunnison River Water Conservancy District	$22,500	$0	$22,500
Subtotal Matching Funds	$261,000	$21,000	$282,000
WSRA Statewide Account	$140,000	n/a	$140,000
Total Project Costs	**$411,000**	**$21,000**	**$432,000**

CWCB Project Manager: Joe Busto

All products, data and information developed as a result of this grant must be provided to the CWCB in hard copy and electronic format as part of the project documentation. This information will in turn be made widely available to Basin Roundtables and the general public and will help promote the development of a common technical platform. In accordance with the revised WSRA Criteria and Guidelines, staff would like to highlight additional reporting and final deliverable requirements. The specific requirements are provided below.

Reporting: The applicant shall provide the CWCB a progress report every 6 months, beginning from the date of the executed contract. The progress report shall describe the completion or partial completion of the tasks identified in the scope of work including a description of any major issues that have occurred and any corrective action taken to address these issues.

Final Deliverable: At completion of the project, the applicant shall provide the CWCB a final report that summarizes the project and documents how the project was completed. This report may contain photographs, summaries of meetings and engineering reports/designs.

Engineering: All engineering work (as defined in the Engineers Practice Act (§12-25-102(10) C.R.S.)) performed under this grant shall be performed by or under the responsible charge of professional engineer licensed by the State of Colorado to practice Engineering.

THE COLORADO BASIN ROUNDTABLE
C/O P.O. BOX 1120
GLENWOOD SPRINGS, COLORADO
81602

July 27, 2016

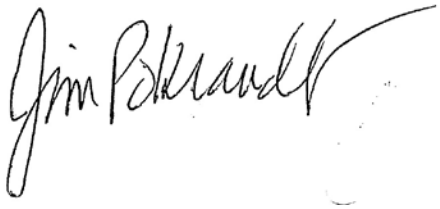
Craig Godbout
Colorado Water Conservation Board
Water Supply Planning Section
1313 Sherman Street
Denver, CO
(303) 866-3441, ext 3210 (office)
(970) 218-9407 (cell)
craig.godbout@state.co.us

Dear Craig:

The Colorado Basin Roundtable voted unanimously at its July 25, 2016 meeting to support Center for Snow and Avalanche Studies (CSAS) Basinwide and a Statewide request for Water Supply Reserve Account funding. The Basin request is for $2,500. It would join Basin requests from the Rio Grande, Southwest and Gunnison Roundtables. The Statewide request is for $140,000. This funding package would be allocated over three years.

CSAS has been instrumental in identifying dust-on-snow as a crucial factor in water supply management and it has built up almost a decade of important data. This data is of keen interest on both sides of the Continental Divide. This grant request will allow CSAS to not only sustain itself in a time of yo-yo funding but allow it to be more efficient in acquiring regional data and quicker in publishing it for the benefit of water users.

The information CSAS provides addresses the ag sustainability theme through the importance of learning how dust can retime traditional runoff with negative impacts to existing decrees and storage. Additional leverage points would be environmental flows for endangered fish and seasonal adjustment to recreational uses.



Jim Pokrandt
Chair, Colorado Basin Roundtable

The Gunnison Basin Roundtable
501 Palmer Street
Delta, CO 81416

August 3, 2016

Mr. Craig Godbout
Water Supply Management Section
COLORADO WATER CONSERVATION BOARD
1313 Sherman St., Room 718
Denver, CO 80203

Re: WSRF Grant Request from Center for Snow and Avalanche Studies

Dear Mr. Godbout:

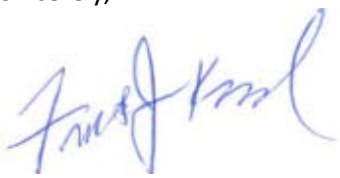
This letter is presented to advise you that the grant application submitted by the Center for Snow and Avalanche Studies for $2,500 from Basin Account funds from the Water Supply Reserve Fund received a favorable recommendation from the GBRT Project Screening Committee. This grant request would help fund the ongoing dust-on-snow research in Colorado. The request was approved by a unanimous vote of the Gunnison Basin Roundtable during our meeting on August 1, 2016.

This water activity meets the provisions of Section 37-75-104(2), Colorado Revised Statutes. The requirements/language from the statute is provided in Part 3 of the Criteria and Guidelines.

The primary purpose of this project is continued research of impacts from dust on Colorado's snowpack and how it affects both nonconsumptive and agricultural water supplies. This research will help water managers and irrigators make informed decisions that are affected by the timing and volume of snowmelt runoff.

Thank you for your help in processing this WSRF grant request.

Sincerely,



Frank J. Kugel
Vice Chair

cc: Hugh Sanburg (e-mail)
Tom Alvey (e-mail)

Conejos Water Conservancy District
P. O. Box 550
Manassa, CO 81141
Cwcd1971@hotmail.com
Phone 719-843-5261 fax 5452

June 18, 2016

Colorado Water Conservation Board
1313 Sherman St #721
Denver, Colorado 80203

Dear Colorado Water Conservation Board,

This letter is in support of the Center for Snow and Avalanche Studies (CSAS) and to confirm that the Rio Grande Basin Roundtable Members passed in full agreement a resolution on June 15, 2016 to provide $2,500 of Basin funds towards a $150,000 Water Supply Reserve Account (WSRA) Grant to support CSAS's Colorado Dust-on-Snow (CODOS) program. Funding CSAS through WSRA funds makes sense since Statewide funds are for projects that have a Statewide benefit, and the CODOS program most certainly qualifies.

The CODOS program is the only organization monitoring dust-on-snow in the state of Colorado in a comprehensive, applied manner and delivers timely and actionable dust-on-snow alerts to the water community. The Senator Beck Basin at Red Mountain Pass is the CODOS program "sentry site" for dust-on-snow deposition with ten additional sites monitored throughout the State. The information CSAS provides improves understanding of the effect of air-borne pollutants on the timing and rate of snowmelt, crucial for water agencies in forecasting, modeling and managing snowmelt water supplies. The CODOS program objectives meet 8 of 14 goals outlines on the Rio Grande Basin Water Plan and addresses dust-induced hydrologic complexities and uncertainties as described in the Colorado Water Plan. The best way to understand dust-on-snow severity and extent is by direct field observations. This grant will fund field monitoring efforts and development of interpretative tools on the CODOS website.

CSAS is applying for a WSRA grant with support from multiple roundtables; Rio Grande, Gunnison, and Colorado. CSAS is submitting a $150,000 total grant request and approaching the three roundtables seeking a contribution of $2,500 each, $7,500 total, to meet the required minimum roundtable match of 5%. Rio Grande Basin Roundtable Members understand that the total WSRA grant request is dependent on Colorado and Gunnison roundtables passage of a resolution to each contribute $2,500 in matching funds. If either the Colorado or Gunnison roundtable agree to a lesser matching amount, then the total WSRA grant request will reflect this change, totaling a roundtable

contribution equal to 5%. The Rio Grande Basin Roundtable Members agree with a total grant request that reflects a 5% total roundtable match.

We are proud to support such a worthy and beneficial project not only for the Rio Grande Basin but the State as a whole. We are hopeful that Center for Snow and Avalanche Studies will be awarded funding to enable practical, useful decision making tools for streamflow forecasting.

Sincerely,

Nathan Coombs

Nathan Coombs
Rio Grande Basin Roundtable
C/O
San Luis Valley WCD
623 Fourth Street
Alamosa, CO 81102

SOUTHWEST BASINS ROUNDTABLE
Michael Preston, Chair
c/o Dolores Water Conservancy District
P.O. Box 1150
Cortez, Colorado 81321
970-565-7562

July 25, 2016

Mr. Craig Godbout
Water Supply Management Section
Colorado Water Conservation Board
1580 Logan Street, Suite 600
Denver, Colorado 80203

SUBJECT: Colorado Dust on Snow Project, Requested by Center for Snow and Avalanche Studies, $2,500 from Basin Account

Dear Mr. Godbout:

The Southwest Basin Roundtable approved funding of $2,500 from the Basin Account for the Colorado Dust on Snow Project, Requested by Center for Snow and Avalanche Studies. The application was considered in detail and approved at the July 13, 2016 meeting of the Southwest Basin Roundtable. There was a quorum of Roundtable members present.

The proposed project contributes to better run-off forecasting and is intended to refine run-off management with benefits to all water uses that rely on snowpack as their primary source of water supply.

The completed Grant Application will be forwarded directly to you by the applicant. Please contact the applicant directly or me at 970-565-7562, mpreston@frontier.net, if you have questions or wish to discuss this application in more detail.

Sincerely,

Michael Preston
Southwest Basin Roundtable Chair

COLORADO WATER CONSERVATION BOARD

WATER SUPPLY RESERVE ACCOUNT APPLICATION FORM

Today's Date: July 26, 2016

Colorado Dust-on-Snow Project

Name of Water Activity/Project

Center for Snow and Avalanche Studies

Name of Applicant

Rio Grande, Southwest, Gunnison, and Colorado Basin Roundtables. $2,500 contribution from each Roundtable. $10,000 total Roundtable contribution

Amount from Statewide Account: $140,000

Amount from Basin Account(s): $10,000

Total WSRA Funds Requested: $150,000

Approving Basin Roundtable(s)
(If multiple basins specify amounts in parentheses.)

FEIN: 04-3737768

Application Content

Required Exhibits

A. Statement of Work, Budget, and Schedule
B. Project Map
C. As Needed (i.e. letters of support, photos, maps, etc.)

Appendices – Reference Material

1. Program Information
2. Insurance Requirements
3. WSRA Standard Contract Information (Required for Projects Over $100,000)
4. W-9 Form (Required for All Projects Prior to Contracting)

Instructions

To receive funding from the Water Supply Reserve Account (WSRA), a proposed water activity must be approved by the local Basin Roundtable **AND** the Colorado Water Conservation Board (CWCB). The process for Basin Roundtable consideration and approval is outlined in materials in Appendix 1.

Once approved by the local Basin Roundtable, the applicant should submit this application **with a detailed statement of work including budget and schedule as Exhibit A** to CWCB staff by the application deadline.

WSRA applications are due with the roundtable letter of support 60 calendar days prior to the bi-monthly Board meeting at which it will be considered. Board meetings are held in January, March, May, July, September, and November. Meeting details, including scheduled dates, agendas, etc. are posted on the CWCB website at: http://cwcb.state.co.us Applications to the WSRA Basin Account are considered at every board meeting, while applications to the WSRA Statewide Account are only considered at the March and September board meetings.

When completing this application, the applicant should refer to the WSRA Criteria and Guidelines available at: http://cwcb.state.co.us/LoansGrants/water-supply-reserve-account-grants/Documents/WSRACriteriaGuidelines.pdf. In addition, the applicant should also refer to the Supplemental Scoring Matrix applied to Evaluation Criteria Tiers 1-3 for Statewide Account requests.

The application, statement of work, budget, and schedule **must be submitted in electronic format** (Microsoft Word or text-enabled PDF are preferred) and can be emailed or mailed on a disk to:

Craig Godbout - WSRA Application
Colorado Water Conservation Board
1313 Sherman St., Room 721
Denver, CO 80203
Craig.godbout@state.co.us

If you have questions or need additional assistance, please contact Craig Godbout at: 303-866-3441 x3210 or craig.godbout@state.co.us.

Part I. - Description of the Applicant (Project Sponsor or Owner);

1.

Applicant Name(s):	Center for Snow and Avalanche Studies. With support from Rio Grande, Southwest, Gunnison, and Colorado Basin Roundtables			
Mailing address:	PO Box 190 Silverton, CO 81433			
FEIN #:	04-3737768			
Primary Contact:	Jeff Derry	Position/Title:	Executive Director	
Email:	jderry@snowstudies.org			
Phone Numbers:	Cell: 970-231-6595	Office:	970-387-5080	
Alternate Contact:	Amy Dickinson	Position/Title:	Web Services	
Email:	amymdickinson@gmail.com			
Phone Numbers:	Cell: 970-551-0059	Office:	970-387-5080	

2. Eligible entities for WSRA funds include the following. What type of entity is the Applicant?

	Public (Government) – municipalities, enterprises, counties, and State of Colorado agencies. Federal agencies are encouraged to work with local entities and the local entity should be the grant recipient. Federal agencies are eligible, but only if they can make a compelling case for why a local partner cannot be the grant recipient.
	Public (Districts) – authorities, Title 32/special districts, (conservancy, conservation, and irrigation districts), and water activity enterprises.
	Private Incorporated – mutual ditch companies, homeowners associations, corporations.
	Private individuals, partnerships, and sole proprietors are eligible for funding from the Basin Accounts but not for funding from the Statewide Account.
X	Non-governmental organizations – broadly defined as any organization that is not part of the government.

3. Provide a brief description of your organization

The Center for Snow & Avalanche Studies (CSAS) is an independent, not-for-profit 501(c)(3) organization. Our Senator Beck Basin Study Area (SBB) at Red Mountain Pass serve the mountain science community and regional resource managers by hosting and conducting interdisciplinary research and sustaining integrative 24/7/365 monitoring that captures weather, snowpack, radiation, soils, plant community and hydrologic signals of regional climate trends.

SBB is a high elevation headwater catchment of Red Mountain Creek and Uncompahgre River. The Uncompahgre River is a major tributary to the Gunnison River, itself a major tributary to the Colorado River providing water to seven states in the western United States. SBB also immediately adjoins headwater catchments of the Animas River, a major tributary of the San Juan River, and headwaters of the San Miguel River, a major tributary to the Dolores River, all of which are also tributaries to the Colorado River. SBB is 13 miles to the west of the Rio Grande watershed.

CSAS's SBB is the home of the Colorado Dust-on-Snow Program (CODOS) "sentry site" for dust-on-snow deposition for the Colorado Mountains. Ten additional sites are monitored throughout the winter season including: Park Cone, Spring Creek Pass, Wolf Creek Pass, Hoosier Pass, Grizzly Peak, Berthoud Summit, Willow Creek Pass, Rabbit Ears Pass, McClure Pass, and Grand Mesa. The Program monitors and forecasts, on behalf of the water management community, dust-on-snow conditions and impacts on Colorado snowmelt runoff behavior throughout the State, and has been doing so since spring 2006.

Presently, Jeff Derry is the Executive Director of CSAS and CODOS Program Manager. Jeff is the only full-time employee, assisted by two less than part-time employees, a Field Assistant and Web Administrator. The Web Administrator maintains the CSAS and CODOS websites. The Field Assistant accompanies the Director on CODOS field work where the budget allows. CSAS has 9 people on the Board of Directors.

4. If the Contracting Entity is different then the Applicant (Project Sponsor or Owner) please describe the Contracting Entity here.

Not Applicable

5. Successful applicants will have to execute a contract with the CWCB prior to beginning work on the portion of the project funded by the WSRA grant. In order to expedite the contracting process the CWCB has established a standard contract with provisions the applicant must adhere to. A link to this standard contract is included in Appendix 3. Please review this contract and check the appropriate box.

[X] The Applicant will be able to contract with the CWCB using the Standard Contract

[ ] The Applicant has reviewed the standard contract and has some questions/issues/concerns. Please be aware that any deviation from the standard contract could result in a significant delay between grant approval and the funds being available.

6. The Tax Payer Bill of Rights (TABOR) may limit the amount of grant money an entity can receive. Please describe any relevant TABOR issues that may affect the applicant.

None

Part II. - Description of the Water Activity/Project

1. What is the primary purpose of this grant application? (Please check only one)

	Nonconsumptive (Environmental or Recreational)	
	Agricultural	
	Municipal/Industrial	
	Needs Assessment	
	Education	
X	Other Explain:	To provide partial funding for the CODOS Project. CODOS Project provides operational dust-on-snow and hydrologic information to CWCB, two municipalities, six WCDs, Bureau of Reclamation, and CBRFC throughout the snowmelt season

2. If you feel this project addresses multiple purposes please explain.

This Project provides a statewide benefit by providing the water community information as to the timing and rate of snowmelt that directly leads to improved management and efficient allocation of all water supplies in Colorado, both consumptive and non-consumptive. Understanding the effect of air borne pollutants on the timing and rate of snowmelt is crucial for water agencies in forecasting, modeling and managing snowmelt water supplies, supporting:

- *Preservation of historical flows and sustainability of Colorado's water resources.*
- *Optimal, efficient water management.*
- *Water maintenance and allocation that has multiple benefits for agriculture, municipal, industrial, and environmental and recreational water needs.*
- *Adaptive management to optimize multiple benefits.*
- *Sustaining river flows throughout the year.*

*The **proposed project addresses most goals outlined in individual Basin Implementation Plans,** and contributes to meeting these specific goals and IPP's, as an example:*

- *Addressing multiple purposes including municipal, industrial, environmental, recreation, agricultural, risk management, and compliance needs.*
- *Pursue a high success rate for identified and unique IPPs to meet identified gaps and to address all water needs and values.*
- *Implement efficiency measures to maximize beneficial use and production.*
- *Implement IPP's that work towards meeting agricultural water supply shortages.*
- *Minimize statewide and basin-wide acres transferred.*
- *Maintain the condition and natural function of streams, lakes, wetlands and riparian areas.*
- *Support hydropower operations*
- *Protect existing water uses, and water supply options for all existing and new uses and values.*

3. Is this project primarily a study or implementation of a water activity/project? (Please check only one)

	Study	X	Implementation

4. To catalog measurable results achieved with WSRA funds can you provide any of the following numbers?

	New Storage Created (acre-feet)
	New Annual Water Supplies Developed, Consumptive or Nonconsumptive (acre-feet)
	Existing Storage Preserved or Enhanced (acre-feet)
	Length of Stream Restored or Protected (linear feet)
	Length of Pipe/Canal Built or Improved (linear feet)
	Efficiency Savings (acre-feet/year OR dollars/year – **circle one**)
	Area of Restored or Preserved Habitat (acres)
X	Other -- Explain: Statewide dust-on-snow information collection and analysis of impacts on timing/rate of snowmelt, reporting results.

4. To help us map WSRA projects please include a map (Exhibit B) and provide the general coordinates below:

Latitude: 37° 54′ 24.89088″N Longitude: -107° 42′ 40.75924″W

5. Please provide an overview/summary of the proposed water activity (no more than one page). Include a description of the overall water activity and specifically what the WSRA funding will be used for. A full **Statement of Work** with a detailed budget and schedule is required as **Exhibit A** of this application.

The world's mountains provide a crucial water source for one-sixth of the world's population and in the Western United States (U.S.) 70– 80% of the annual discharge originates from snowmelt in the mountain watershed. Mountain environments are recognized as a sensitive bellwether of global and regional change, hence the importance of CSAS's high elevation Senator Beck Basin mountain system monitoring, and intensive snowpack processes information gathering campaigns. In addition, studies have shown (see Colorado Water Plan and reference list below) that dust events, because of the reduction of snow surface albedo, can advance snowmelt timing, enhance snowmelt runoff intensity, and decrease snowmelt yields. Dust-on-snow events can result in peak runoff three weeks earlier than normal. This shift is independent of climate change. Dust deposition has increased more than 200% in Colorado since the 1990's with no signs of abating (J. Brahney, A.P. Ballantyne, C. Sievers, J.C. Neff. Increasing Ca2+ deposition in the western US: the role of mineral aerosols. Aeolian Research (2013), http://dx.doi.org/10.1016/j.aeolia.2013.04.003). These dust-on-snow events affect Colorado's present and future water supply by ***decreasing flows by 5%*** *on average (see Colorado Water Plan, Chap. 4).*

The CODOS program is the only organization monitoring dust-on-snow in the state of Colorado in a comprehensive, applied manner and delivers timely and actionable dust-on-snow alerts to the water community. Dust-on-snow events are rigorously monitored and sampled at Senator Beck Basin throughout the winter, building a long-term record of dust loading with USGS collaboration. Each of the other ten sample locations throughout the State are visited at least three times (hopefully more with proposed funding) during winter/spring until the snowcover is gone. Data and observations from these site visits, and from Senator Beck Basin, are presented in frequent CODOS Update and Alert products. These iterative products describe current dust-in-snow conditions, by major watershed, and predict the likely influence of dust-in-snow on near-term snowmelt timing and rates. CODOS analyses includes association of dust-on-snow, snowpack, and weather conditions to hydrograph patterns observed since 2006 at 19 headwater stream gauges monitored in most major mountain watersheds. As the season unfolds, plausible and probable patterns in spring dust-enhanced snowmelt behaviors are identified, using prior year hydrographs, by watershed. The ***CODOS Project objective*** *is to continue, expand, and improve the efficiency of these efforts to better serve the water community.*

Airborne and satellite data can only inform researchers, water managers, and forecasters (i.e. Colorado Basin River Forecast Center) if dust is present on top of the snowpack at the specific moment the data was collected, with a high financial cost. These datasets cannot provide knowledge as to the 1) presence of dust within the snowpack 2) when dust may emerge at the surface, and 3) when different dust layers merge together, decreasing albedo further. The best way to understand dust-on-snow severity and extent is by direct field observations. This grant will fund field activities and assist in the development of interpretative tools on the CODOS website. Specifically, the proposed CODOS Project will execute 4 main tasks:

Task 1 – Monitor Statewide Dust-on-Snow Conditions: *Monitor and collect dust-on-snow information at SBB and at least 10 other locations throughout Colorado during the winter and spring. The WSRA funding request will primarily fund a field assistant, support travel to CODOS sites, and purchase minimal materials and supplies.*

Task 2 – Frequent and Timely Dust-on-Snow Updates and Reporting: *Collation of field observations and timely creation of dust-on-snow updates and alerts to the water community. Creation of season summary reports. WSRA funding request will primarily go towards wages for the Director to do this task. Funds will also enable educational outreach to middle schools in the San Juan Region.*

Task 3- Data Management, Quality Control, and Reporting: *Continue dust-on-snow and meteorological data collection, management, validation, and reporting. Support sensor re-calibration. Maintain data, metadata, and sensor status files. Keep files current in near-real time on project webpages.*

Task 4 – Near-Real Time Data Availability, Graphics, Communications, and Interpretation Tools: *This task includes website upgrades intended to improve access, visualization, interaction, and interpretation of dust-on-snow and related information. Upgrades will include the ability to download near-real time data files to be used in forecasting and hydrologic modeling, the creation of near-real time dust-on-snow and meteorological data graphics, and the construction of an interactive webpage that allows the water community to post, share, and view dust-on-snow conditions throughout the Colorado Mountains. The WSRA funding request will be used to fund a Web Administrator, or appropriate third party, to develop, launch, and maintain webpage upgrades.*

Part III. – Threshold and Evaluation Criteria

1. Describe how the water activity meets these **Threshold Criteria.** (Detailed in Part 3 of the Water Supply Reserve Account Criteria and Guidelines.)

   a) The water activity is consistent with Section 37-75-102 Colorado Revised Statutes.[1]

Yes, this project would be compliant with Section 37-75-102 C.R.S. and support existing Colorado water law rights and responsibilities and assist in the maximum use and benefit of Colorado water within the state's boundaries for all currently recognized uses. This project provides the information and tools to improve water management forecasting, effectively increasing water supplies. No direct use of water rights will be involved.

   b) The water activity underwent an evaluation and approval process and was approved by the Basin Roundtable (BRT) and the application includes a description of the results of the BRTs evaluation and approval of the activity. At a minimum, the description must include the level of agreement reached by the roundtable, including any minority opinion(s) if there was not general agreement for the activity. The description must also include reasons why general agreement was not reached (if it was not), including who opposed the activity and why they opposed it. Note- If this information is included in the letter from the roundtable chair simply reference that letter.

The Rio Grande Basin Roundtable passed a resolution on June 15, 2016, the Southwest Roundtable passed a resolution on July 13 (a letter is forthcoming), and the Colorado Roundtable passed a resolution on July 25 (a letter is forthcoming), to each provide $2,500 in matching funds towards the total $150,000 grant. The decision was reached in full agreement with no opposition from any Members. Please see attached Rio Grande Basin letter.

This proposal will be presented to the Gunnison Roundtable on August 1. If the match amount of $2,500 is approved by the roundtable, the Gunnison Roundtable Chair, Hugh Sanburg, will provide a letter with a description of the evaluation and the approval process.

[1] 37-75-102. Water rights - protections. (1) It is the policy of the General Assembly that the current system of allocating water within Colorado shall not be superseded, abrogated, or otherwise impaired by this article. Nothing in this article shall be interpreted to repeal or in any manner amend the existing water rights adjudication system. The General Assembly affirms the state constitution's recognition of water rights as a private usufructuary property right, and this article is not intended to restrict the ability of the holder of a water right to use or to dispose of that water right in any manner permitted under Colorado law. (2) The General Assembly affirms the protections for contractual and property rights recognized by the contract and takings protections under the state constitution and related statutes. This article shall not be implemented in any way that would diminish, impair, or cause injury to any property or contractual right created by intergovernmental agreements, contracts, stipulations among parties to water cases, terms and conditions in water decrees, or any other similar document related to the allocation or use of water. This article shall not be construed to supersede, abrogate, or cause injury to vested water rights or decreed conditional water rights. The General Assembly affirms that this article does not impair, limit, or otherwise affect the rights of persons or entities to enter into agreements, contracts, or memoranda of understanding with other persons or entities relating to the appropriation, movement, or use of water under other provisions of law.

c) The water activity meets the provisions of Section 37-75-104(2), Colorado Revised Statutes.[2] The Basin Roundtable Chairs shall include in their approval letters for particular WSRA grant applications a description of how the water activity will assist in meeting the water supply needs identified in the basin roundtable's consumptive and/or non-consumptive needs assessments.

The CODOS Program meets the provisions outlined in Section 37-75-104(2) Colorado Revised Statutes. The Program will assist in meeting water supply needs by seeking to provide crucial information related to the timing and rate of snowmelt to hydrologic modelers, forecasters, and water managers, thereby effectively increasing water availability to downstream users and improves the ability to meet all local water supply gaps identified by local Basins and identified by the Statewide Water Supply Initiative.

d) Matching Requirement: For requests from the **Statewide Fund**, the applicants will be required to demonstrate a **25 percent** (or greater) match of the total grant request from the other sources, including by not limited to Basin Funds. A minimum match of 5% of the total grant amount shall be from Basin funds. A minimum match of 5% of the total grant amount must come from the applicant or 3rd party sources. Sources of matching funds include but are not limited to Basin Funds, in-kind services, funding from other sources, and/or direct cash match. Past expenditures directly related to the project may be considered as matching funds if the expenditures occurred within 9 months of the date the contract or purchase order between the applicant and the State of Colorado is executed. Please describe the source(s) of matching funds. (NOTE: These matching funds should also be reflected in your Detailed Budget in **Exhibit A** of this application)

This project has a total cost of $432,000 over 3 years, and includes in-kind match. The grant's matching requirements will be met by considering other project funders throughout the State, including the Colorado River Water Conservation District, Dolores Water Conservancy District, Rio Grande Water Conservation District, Southwestern Water Conservation District, Tri-County Water Conservancy District, Upper Gunnison River Water Conservancy District, and CWCB. Contributions from federal agencies and municipalities include Bureau of Reclamation, Denver Water, and City of Grand Junction. The USGS continues to provide valuable in-kind lab services. Other in-kind services in the form of a Memorandum of Understanding to operate the Senator Beck Study Basin is provided by the Grand Mesa Uncompahgre and Gunnison National Forests.

Please see budget tables in Exhibit A.

[2] 37-75-104 (2)(c). Using data and information from the Statewide Water Supply Initiative and other appropriate sources and in cooperation with the on-going Statewide Water Supply Initiative, develop a basin-wide consumptive and nonconsumptive water supply needs assessment, conduct an analysis of available unappropriated waters within the basin, and propose projects or methods, both structural and nonstructural, for meeting those needs and utilizing those unappropriated waters where appropriate. Basin Roundtables shall actively seek the input and advice of affected local governments, water providers, and other interested stakeholders and persons in establishing its needs assessment, and shall propose projects or methods for meeting those needs. Recommendations from this assessment shall be forwarded to the Interbasin Compact Committee and other basin roundtables for analysis and consideration after the General Assembly has approved the Interbasin Compact Charter.

2. For Applications that include a request for funds from the **Statewide Account**, describe how the water activity/project meets all applicable **Evaluation Criteria.** (Detailed in Part 3 of the Water Supply Reserve Account Criteria and Guidelines and repeated below.) Projects will be assessed on how well they meet the Evaluation Criteria. **Please attach additional pages as necessary.**

Evaluation Criteria – the following criteria will be utilized to further evaluate the merits of the water activity proposed for funding from the Statewide Account. In evaluation of proposed water activities, preference will be given to projects that meet one or more criteria from each of the three "tiers" or categories. Each "tier" is grouped in level of importance. For instance, projects that meet Tier 1 criteria will outweigh projects that only meet Tier 3 criteria. The applicant should also refer to the Supplemental Scoring Matrix applied to Evaluation Criteria Tiers 1-3 for Statewide Account requests. WSRA grant requests for projects that may qualify for loans through the CWCB loan program will receive preference in the Statewide Evaluation Criteria if the grant request is part of a CWCB loan/WSRA grant package. For these CWCB loan/WSRA grant packages, the applicant must have a CWCB loan/WSRA grant ratio of 1:1 or higher. Preference will be given to those with a higher loan/grant ratio.

Tier 1: Promoting Collaboration/Cooperation and Meeting Water Management Goals and Identified Water Needs

a. The water activity addresses multiple needs or issues, including consumptive and/or non-consumptive needs, or the needs and issues of multiple interests or multiple basins. This can be demonstrated by obtaining letters of support from other basin roundtables (in addition to an approval letter from the sponsoring basin).
b. The number and types of entities represented in the application and the degree to which the activity will promote cooperation and collaboration among traditional consumptive water interests and/or non-consumptive interests, and if applicable, the degree to which the water activity is effective in addressing intrabasin or interbasin needs or issues.
c. The water activity helps implement projects and processes identified as helping meet Colorado's future water needs, and/or addresses the gap areas between available water supply and future need as identified in SWSI or a roundtable's basin-wide water needs assessment.

*Dust-on-snow is a problem presenting addition complexities and uncertainties into managing water supplies as described in the **Colorado Water Plan**. The dust that becomes airborne in the source region of the Southern Colorado Plateau and is blown into, and deposited on the Colorado Mountain snowpack, effecting the timing/rate and even overall yields of snowmelt, knows no boundaries. Hence, the CODOS Project assists multiple interests and basins deal with the uncertainty and complexities as it relates to dust-enhanced snowmelt, benefiting both consumptive and non-consumptive needs. The number and types of entities that support, financially, or depend on CODOS products represented in this application reflect the degree to which the Project has and will continue to foster understanding and collaboration among Colorado water users and effectively assist in addressing intra/inter-basin needs.*

The CODOS effort is supported by many statewide sponsors with a vital interest in what we do. The CODOS Project receives financial support by six water conservation/conservancy districts, Bureau of Reclamation, two municipalities, CWCB, Rio Grande Roundtable, Southwest Roundtable, Colorado Roundtable, the Grand Mesa Uncompahgre and Gunnison National Forests, and many private individual supporters. Other stakeholders include Colorado Basin River Forecast Center, NOAA, NASA, USGS, Universities, Grand Mesa Uncompahgre and Gunnison National Forests, and State and Regional Water agencies.

For this grant request, matching funds are sought from four roundtables, Rio Grande, Gunnison, Southwest, and Colorado. Support at the $2,500 level from Gunnison Roundtable is pending.

Collecting data that helps researchers understand mountain physics, and providing information related to the timing and rate of snowmelt and resultant streamflow implications provides the tools for water managers, forecasters, and hydrologic modelers to more effectively and efficiently manage water resources to assist meeting identified gaps both in individual basins, the state as a whole, and assist in meeting downstream compacts.

The Project has already developed transformative research and applied scientific techniques (and refining tools and methodologies is ongoing) aimed at understanding and predicting snowmelt from a mountain snowpack that is impacted by air-borne pollutants. Air-borne pollutants pose a major threat, as identified in the Colorado Water Plan, to Colorado's water resources. Dust deposition has increased more than 200% in Colorado since the 1990's, incorporating, and refining these tools are essential to meeting Colorado's current and future water needs.

Tier 2: Facilitating Water Activity Implementation

d. Funding from this Account will reduce the uncertainty that the water activity will be implemented. For this criterion the applicant should discuss how receiving funding from the Account will make a significant difference in the implementation of the water activity (i.e., how will receiving funding enable the water activity to move forward or the inability obtaining funding elsewhere).
e. The amount of matching funds provided by the applicant via direct contributions, demonstrable in-kind contributions, and/or other sources demonstrates a significant & appropriate commitment to the project.

Many stakeholders depend on CODOS Project information (NWS, Colorado Basin River Forecast Center, USGS, Universities) but lack a mechanism within their respective internal structure to fund outside organizations (i.e. CSAS), nonetheless, Project information is relied upon for operational purposes by the NWS, Colorado Basin River Forecast Center, water managers, and Bureau of Reclamation. Support in the form of in-kind commitments for the Project are evident in the collaborations with USGS (lab services, satellite imagery) and Grand Mesa Uncompahgre and Gunnison National Forests (USFS Special Use Permit).

We have commitments for continued contributions from many different entities. The continued financial support by conservation/conservancy districts, state, municipalities, and federal agencies demonstrates long-term, ongoing commitments to continuing the CODOS Project. That said, funding amounts from these organizations are intended to be long-term, sustainable commitments, where collectively they establish a financial "base" that help cover only the basic expenses. Requested funding will allow the critical component of field work to take place more than a few times a year with field staff that will allow the activity to take place safely and efficiently. And will also fund dust-on-snow data support, interpretation, and communication platform development, allowing clear dissemination and comprehension of collected information.

Pursuit of alternate funding besides that mentioned above is on-going, for example CSAS is strategizing, discussing and applying for funding from 7-Basin States, municipalities, and the outdoor industry.

Tier 3: The Water Activity Addresses Other Issues of Statewide Value and Maximizes Benefits

f. The water activity helps sustain agriculture & open space, or meets environmental or recreational needs.
g. The water activity assists in the administration of compact-entitled waters or addresses problems related to compact entitled waters and compact compliance and the degree to which the activity promotes maximum utilization of state waters.
h. The water activity assists in the recovery of threatened and endangered wildlife species or Colorado State species of concern.
i. The water activity provides a high level of benefit to Colorado in relationship to the amount of funds requested.
j. The water activity is complimentary to or assists in the implementation of other CWCB programs.

Continued: Explanation of how the water activity/project meets all applicable **Evaluation Criteria**.

Please attach additional pages as necessary.

Dust-on-snow information leading to more accurate streamflow forecasts, refined input data for models, and the increased efficient management of water resources would benefit and sustain agriculture, improve the efficient allocation of water for recreational needs, and inform flow regimes for environmental purposes. To the extent that improved efficiencies in water management leads to improved flow regimes for environmental purposes do Project efforts assist in the recovery of threatened and endangered wildlife.

Project contributes to the alleviation of difficulties related to compact entitled waters and compliance as well as promotes the maximum utilization of state waters. Informed snowmelt and streamflow decision making scenarios by definition maximizes utilization of state waters. One example, because of limited storage capabilities within the Upper Rio Grande and because of terms of the interstate compact, Colorado has a limited capability to store water during high flow years for eventual delivery to downstream states during low flow years. Errors in the April 1st water supply forecast can translate into millions of dollars lost annually due to reduced agricultural productivity on irrigated lands and create compact difficulties. The CODOS Project provides actionable information that reduces errors in the April 1st water supply forecast.

As an independent, 501(c)(3) not-for-profit organization with strong leadership, CSAS has been proactive and nimble, generating both transformative research and applied science in unique collaborations, and making a big impact on a minimal budget.

The activity assists in the implementation of ongoing CWCB programs such as the Rio Grande Forecasting Project. The CODOS program objectives meet 8 of 14 goals outlines on the Rio Grande Basin Water Plan, 6 of the 7 general themes outlined in the Southwest Basin Implementation Plan, and addresses dust-induced hydrologic complexities and uncertainties as described in the Colorado Water Plan.

Part IV. – Required Supporting Material

1. **Water Rights, Availability, and Sustainability** – This information is needed to assess the viability of the water project or activity. Please provide a description of the water supply source to be utilized, or the water body to be affected by, the water activity. This should include a description of applicable water rights, and water rights issues, and the name/location of water bodies affected by the water activity.

NOT APPLICABLE

2. Please provide a brief narrative of any related studies or permitting issues.

All activities using Senator Beck Basin as a field venue (dust-on-snow monitoring, research projects, climate stations, etc.) is made possible under our USFS Special Use Permit. No additional permitting is required at the other CODOS field locations.

A significant number of research and technical studies have guided the CODOS Project. A comprehensive list can be found on the CSAS website, http://www.snowstudies.org/pubs1.html, and CODOS website http://www.codos.org/#lit. A brief list of dust-on-snow related studies is below:

Colorado Water Conservation Board: Colorado's Water Plan, Chapter 4 (https://www.colorado.gov/cowaterplan).

Axson, J. L., H. Shen, A. L. Bondy, C. C. Landry, J. Welz, J. M. Creamean, A. P. Ault (2016), Transported Mineral Dust Deposition Case Study at a Hydrologically Sensitive Mountain Site: Size and Composition Shifts in Ambient Aerosol and Snowpack, Aerosol and Air Quality Res., 16: 555-567, doi:10.4209/aaqr.2015.05.0346

Landry, C. C., K. A. Buck, M. S. Raleigh, and M. P. Clark (2014), Mountain system monitoring at Senator Beck Basin, San Juan Mountains, Colorado: A new integrative data source to develop and evaluate models of snow and hydrologic processes, Water Resour. Res., 50, doi:10.1002/2013WR013711.

Bryant, A. B., T. H. Painter, J. S. Deems, and S. M. Bender (2013), Impact of dust radiative forcing in snow on accuracy of operational runoff prediction in the Upper Colorado River Basin, Geophys. Res. Lett., 40, doi: 10.1002/grl.50773, 2013.

J. Brahney, A.P. Ballantyne, C. Sievers, J.C. Neff. Increasing Ca2+ deposition in the western US: the role of mineral aerosols. Aeolian Research (2013), http://dx.doi.org/10.1016/j.aeolia.2013.04.003

Clow, D.W.,M.W. Williams, P.F. Schuster. Increasing aeolian dust deposition to snowpacks in the Rocky Mountains inferred from snowpack, wet deposition, and aerosol chemistry. Aeolian Research (2016), TBD

Deems, J. S., T.H. Painter, J.J. Barsugli, J. Belnap, and B. Udall (2013), Combined impacts of current and future dust deposition and regional warming on Colorado River Basin snow dynamics and hydrology, Hydrol. Earth Syst. Sci., 17, 4401-4413, doi:10.5194/hess-17-4401-2013.

Painter, T. H., A. C. Bryant, and S. M. Skiles (2012), Radiative forcing by light absorbing impurities in snow from MODIS surface reflectance data, Geophys. Res. Lett., 39, L17502, doi:10.1029/2012GL052457.

Skiles, S. M., T. H. Painter, J. S. Deems, A. C. Bryant, and C. Landry (2012), Dust radiative forcing in snow of the Upper Colorado River Basin: Part II. Interannual variability in radiative forcing and snowmelt rates, Water Resour. Res., doi:10.1029/2012WR011986.

Painter, T. H., S. M. Skiles, J. S. Deems, A. C. Bryant, and C. Landry (2012), Dust radiative forcing in snow of the Upper Colorado River Basin: Part I. A 6 year record of energy balance, radiation, and dust concentrations, Water Resour. Res., doi:10.1029/2012WR011985.

Painter, T. H., J. Deems, J. Belnap, A. Hamlet, C. C. Landry, and B. Udall (2010), Response of Colorado River runoff to dust radiative forcing in snow, Proceedings of the National Academy of Sciences, published ahead of print September 20, 2010,doi:10.1073/pnas.0913139107.

Lawrence, C. R., T. H. Painter, C. C. Landry, and J. C. Neff (2010), Contemporary geochemical composition and flux of aeolian dust to the San Juan Mountains, Colorado, United States, Journal of Geophysical Research, 115, G03007, doi:10.1029/2009JG001077.

Steltzer, H., C. Landry, T. H. Painter, J. Anderson, and E. Ayres. 2009.Biological consequences of earlier snowmelt from desert dust deposition in alpine landscapes. Proceedings of the National Academy of Sciences. 106: 11629-11634, doi_10.1073_pnas.0900758106.

Neff, J.C., A.P. Ballantyne, G.L. Farmer, N.M. Mahowald, J.L. Conroy, C.C. Landry, J.T. Overpeck, T.H. Painter, C.R. Lawrence and R.L. Reynolds. 2008. Increasing eolian dust deposition in the western United States linked to human activity, Nature Geoscience, Vol. 1, No. 3, pp. 189-195, March 2008, doi: 10.1038/ngeo136

Painter, T. H., A. P. Barrett, C. C. Landry, J. C. Neff, M. P. Cassidy, C. R. Lawrence, K. P. Thatcher, L. Farmer. (2007) Impact of disturbed desert soils on duration of mountain snow cover. Geophysical Research Letters. V34, 12, L12502, 10.1029/2007GL030208.

3. Statement of Work, Detailed Budget, and Project Schedule

The statement of work will form the basis for the contract between the Applicant and the State of Colorado. In short, the Applicant is agreeing to undertake the work for the compensation outlined in the statement of work and budget, and in return, the State of Colorado is receiving the deliverables/products specified. **Please note that costs incurred prior to execution of a contract or purchase order are not subject to reimbursement**. All WSRA funds are disbursed on a reimbursement basis after review invoices and appropriate backup material.

Please provide a detailed statement of work using the template in Exhibit A. Additional sections or modifications may be included as necessary. Please define all acronyms and include page numbers.

REPORTING AND FINAL DELIVERABLE

Reporting: The applicant shall provide the CWCB a progress report every 6 months, beginning from the date of the executed contract. The progress report shall describe the completion or partial completion of the tasks identified in the statement of work including a description of any major issues that have occurred and any corrective action taken to address these issues.

Final Deliverable: At completion of the project, the applicant shall provide the CWCB a final report that summarizes the project and documents how the project was completed. This report may contain photographs, summaries of meetings and engineering reports/designs.

PAYMENT

Payment will be made based on actual expenditures and invoicing by the applicant. Invoices from any other entity (i.e. subcontractors) cannot be processed by the State. The request for payment must include a description of the work accomplished by major task, and estimate of the percent completion for individual tasks and the entire water activity in relation to the percentage of budget spent, identification of any major issues and proposed or implemented corrective actions. The last 10 percent of the entire water activity budget will be withheld until final project/water activity documentation is completed. All products, data and information developed as a result of this grant must be provided to the CWCB in hard copy and electronic format as part of the project documentation. This information will in turn be made widely available to Basin Roundtables and the general public and help promote the development of a common technical platform.

The above statements are true to the best of my knowledge:

Signature of Applicant: 

Print Applicant's Name: Jeff Derry, Center for Snow and Avalanche Studies

Project Title: Colorado Dust-on-Snow Project

Date: June 29, 2016

Return an electronic version (hardcopy may also be submitted) of this application to:

Craig Godbout – WSRA Application
Colorado Water Conservation Board
1313 Sherman St., Room 721
Denver, CO 80203
303-866-3441, ext. 3210 (office)
303-547-8061 (cell)
craig.godbout@state.co.us

Exhibit A

Statement of Work
Date: July 26, 2016

WATER ACTIVITY NAME - Colorado Dust-on-Snow Project

GRANT RECIPIENT – Center for Snow and Avalanche Studies

FUNDING SOURCE – Rio Grande, Colorado, Southwest, and Gunnison Basin Roundtables, WSRA Statewide grant

INTRODUCTION AND BACKGROUND

The Center for Snow & Avalanche Studies (CSAS) is an independent, not-for-profit 501(c)(3) organization that operates the Colorado dust-on-snow (CODOS) program. Dust events on the snowpack can advance snowmelt timing, enhance runoff intensity, and decrease snowmelt yields. CODOS is the only organization monitoring dust-on-snow in Colorado in a comprehensive, applied manner on behalf of the water management community, providing forecasts of dust-on-snow impacts on snowmelt runoff behavior throughout the State in the form of timely and actionable updates and alerts. These iterative products describe current dust-in-snow conditions, by major watershed, and predict the likely influence of dust-on-snow on near-term snowmelt timing and rates. Analyses includes association of dust-on-snow, snowpack, and weather conditions to hydrograph patterns observed since 2006 at 19 headwater stream gauges monitored in most major watersheds. As the season unfolds, plausible and probable patterns in spring dust-enhanced snowmelt behaviors are identified, using prior year hydrographs.

CSAS's Senator Beck Basin is home to the CODOS "sentry site" for dust-on-snow deposition for the Colorado Mountains. Ten additional sites are monitored throughout the winter season including: Park Cone, Spring Creek Pass, Wolf Creek Pass, Hoosier Pass, Grizzly Peak, Berthoud Summit, Willow Creek Pass, Rabbit Ears Pass, McClure Pass, and Grand Mesa.

OBJECTIVES

The Center for Snow and Avalanche Studies enables the interdisciplinary investigation of the mountain and alpine snow system's behavior and role in human/environment relationships. The best way to understand dust-on-snow severity and extent is by direct field observations. This grant will fund field activities and assist in the development of interpretative tools on the CODOS website. The **CODOS Project objective** is to continue to collect (continuing an essential dataset) and disseminate dust-on-snow information, and to expand and improve efficiency on these efforts, to better serve the water community. Specifically, the CODOS Program will:

- Conduct Statewide dust-on-snow field campaigns to track the severity and extent of dust events throughout the snow accumulation and ablation period for WY2017, WY2018, and WY2019.
- Provide timely and applicable updates and alerts to forecasters and the water community
- Operate long-term snow system study sites in Colorado's San Juan Mountains.

- Manage dust-on-snow and meteorological data collection, management, validation, and reporting. Ensure correct operation of instruments. Maintain data, metadata, and sensor status files.
- Maintain project webpages with data files, graphics, and relevant information.
- Initiate website upgrades to improve access, and support data, graphics, and interpretation platforms.
- Develop visualization and interpretative tools on project webpages for easy dissemination of information.
- Provide educational outreach for K-12 schools in Southwest Colorado.

TASKS

The CODOS Project will execute four main tasks: **Task 1** - *Monitor Statewide Dust-on-Snow Conditions*, **Task 2** – *Frequent and Timely Dust-on-Snow Updates and Reports*, **Task 3**- *Data Management, Quality Control, and Reporting*, **Task 4** – *Near-Real Time Data Availability, Graphics, and Interpretation tools*

TASK 1 – Monitor Statewide Dust-on-Snow Conditions

Description of Task: Collect dust-on-snow information at SBB and at least 10 other locations throughout Colorado during the winter and spring, including: Park Cone, Spring Creek Pass, Wolf Creek Pass, Hoosier Pass, Grizzly Peak, Berthoud Summit, Willow Creek Pass, Rabbit Ears Pass, McClure Pass, and Grand Mesa.

Method/Procedure: Timely statewide visits, via motorized vehicle, to CODOS sites to collect snowpack information. These profiles of the snowpack allow the documentation of the severity and spatial extent of dust events. A field assistant will accompany Director on trip, and, when appropriate will visit some sites solo to optimize human resources. Field trips will occur at least 3 times a year.

Deliverable: Field data documentation including snow profile forms, pictures of dust-on-snow profiles and surrounding landscapes. Collection of snow samples and delivered to USGS project partners for mass loading and chemical analysis.

TASK 2 – Frequent and Timely Dust-on-Snow Updates and Reporting

Description of Task: Collation of field observations and timely creation of dust-on-snow updates and alerts to water community. Season summary and funder progress reports.

Method/Procedure: Field data formatted and summarized, data includes the collection of USGS streamflow data, NRCS SNOTEL data, and NWS weather forecasts. Creation of dust-on-snow analysis documents.

Deliverable: These timely, actionable, iterative updates and alerts describe current dust-in-snow conditions, by major watershed, and predict the likely influence of dust-on-snow on near-term snowmelt timing and rates. Analyses includes association of dust-on-snow, snowpack, and weather conditions to hydrograph patterns observed since 2006 at 19 headwater stream gauges monitored in most major

watersheds. Project reports to CWCB and other funders. Consultations and presentations to supporters, funders, general public, university and K-12 students.

TASK 3 –Data Management, Quality Control, and Reporting

Description of Task: Dust-on-snow and meteorological measurements, data collection, management, validation, and reporting. Maintenance and calibration of instrumentation.

Method/Procedure: Maintain instrumentation, communication, data collection server, storage and archive servers. Data QA/QC. Maintain dust-on-snow data files.

Deliverable: Access, via the CSAS and CODOS webpages, to serially complete near-real time and archived meteorological and dust-on-snow data files.

TASK 4 –Near-Real Time Data Availability, Graphics, and Interpretation Tools

Description of Task: Website upgrades to improve data access, visualization, interaction, interpretation, and dissemination of dust-on-snow and related information.

Method/Procedure: Web Administrator, or appropriate third party, creates platforms, tools and webpage content.

Deliverable: Ability to download near-real time data files to be used in forecasting and hydrologic modeling, the creation of near-real time dust-on-snow and meteorological data graphics, and the construction of an interactive webpage that allows the water community to post, share, and view dust-on-snow conditions throughout the Colorado Mountains.

REPORTING AND FINAL DELIVERABLE

Reporting: CSAS will provide the CWCB a progress report every 6 months, beginning from the date of the executed contract. The progress report shall describe the completion or partial completion of the tasks identified in the statement of work including a description of any major issues that have occurred and any corrective action taken to address these issues.

Final Deliverable: At completion of the project, CSAS will provide the CWCB a final report that summarizes the project and documents how the project was completed. This report may contain photographs, summaries of meetings and engineering reports/designs.

BUDGET

Table 1. CODOS Project budget by task. Totals are given for annual costs as well as for 3 year, life-of-project costs. Labor (under WSRA Funds) is for a part-time field assistant (560 hours at $25/hr) and part-time web administrator (520 hours at $25/hr), remaining labor is for Director (480 hours at $25/hr). Travel costs include accommodation, per diem, and vehicle rental as well as mileage for personal vehicle reimbursement at $0.575/mile. Matching funds, totaling $87,000 in WY2016 (see table 2), provide a level of stable, base support to assist with administrative, Director's salary, logistical, and data collection costs.

Total Costs					
	WSRA Funds Labor	WSRA Funds Materials, Travel, Expenses	Matching Funds	USGS In-Kind Contributions	Total Cost by Task
Task 1 - Collect Statewide Dust-on-Snow Information	$14,000	$7,000	$35,000	$7,000	$63,000
Task 2 - Updates, Alerts, Summary Reports	$5,000		$29,000		$34,000
Task 3 - Data Management and Reporting	$7,000	$4,000	$13,000		$24,000
Task 4 - Data Availability, Visualization, Interpretation Tools	$13,000		$10,000		$23,000
Annual Totals	**$39,000**	**$11,000**	**$87,000**	**$7,000**	
Total Annual Project Cost					**$144,000**
Three Year Totals	**$117,000**	**$33,000**	**$261,000**	**$21,000**	
Total 3 Year Project Cost					**$432,000**
Total Request	**$150,000**				

Table 2. Detailed funding history for CODOS efforts since WY2007.

CODOS Funding Summary										
	WY '07	WY '08	WY '09	WY '10	WY '11	WY '12	WY '13	WY '14	WY '15	WY '16
Animas-La Plata Water Conservancy District			500	600	600	400	500			
Bureau of Rec., Western Colorado Area Office			5,000	8,000	7,500					
Bureau of Rec., Lower Colorado Region				7,000	10,000	10,000	10,000	10,000	10,000	10,000
Bureau of Rec., Eastern Colorado Area Office					2,500		2,500	2,500	2,500	2,500
City of Grand Junction					2,500	2,500	2,500	2,500	2,500	2,500
Colorado River Water Conservation District	8,000	8,000	8,000	10,000	10,000	10,000	15,000	15,000	20,000	20,000
Colorado Water Conservation Board				28,034	15,000		50,000	50,000	40,000	25,000
Denver Water	2,500	2,500	2,500	5,000	5,000	5,000	6,000	6,000	6,000	6,000
Dolores Water Conservancy District				600	600	750	750	1,000	1,000	1,000
Northern Colorado Water Conservancy District			1,500	2,500	2,000					
Rio Grande Water Conservation District		3,000	4,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Southwestern Water Conservation District	5,000	5,000	4,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Tri-County Water Conservancy District	1,000	1,000	1,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Upper Gunnison River Water Conservancy District		5,000	7,500	7,500	7,500	7,500	7,500	5,000	7,500	7,500
Western Water Assessment – Univ. of Colorado			20,072							
Water Year Total	16,500	24,500	54,572	81,734	75,700	48,650	107,250	104,500	102,000	87,000

SCHEDULE

Table 3. Although project activities are ongoing, the intensive data collection and reporting period is winter/spring. Proposed project duration is three years, encompassing water year (WY) 2017, 2018, and 2019. Development of visualization and interpretation tools is an iterative process but estimated to be mostly completed after the second year of the funding period.

Task	Description	Target Start Date	Finish Date
1	Collect Statewide Dust-on-Snow Information for WY2017, WY2018, and WY2019	NTP	7/31/2019
2	Updates, Summary Reports	NTP	7/31/2019
3	Data Collation, Management Reporting	NTP	7/31/2019
4	Data Availability, Visualization, Interpretation Tools	NTP	7/31/2018

NTP = Notice to Proceed

PAYMENT

Payment will be made based on actual expenditures and invoicing by the applicant. Invoices from any other entity (i.e. subcontractors) cannot be processed by the State. The request for payment must include a description of the work accomplished by major task, and estimate of the percent completion for individual tasks and the entire water activity in relation to the percentage of budget spent, identification of any major issues and proposed or implemented corrective actions. The last 5 percent of the entire water activity budget will be withheld until final project/water activity documentation is completed. All products, data and information developed as a result of this grant must be provided to the CWCB in hard copy and electronic format as part of the project documentation. This information will in turn be made widely available to Basin Roundtables and the general public and help promote the development of a common technical platform.

Exhibit B

Project Map

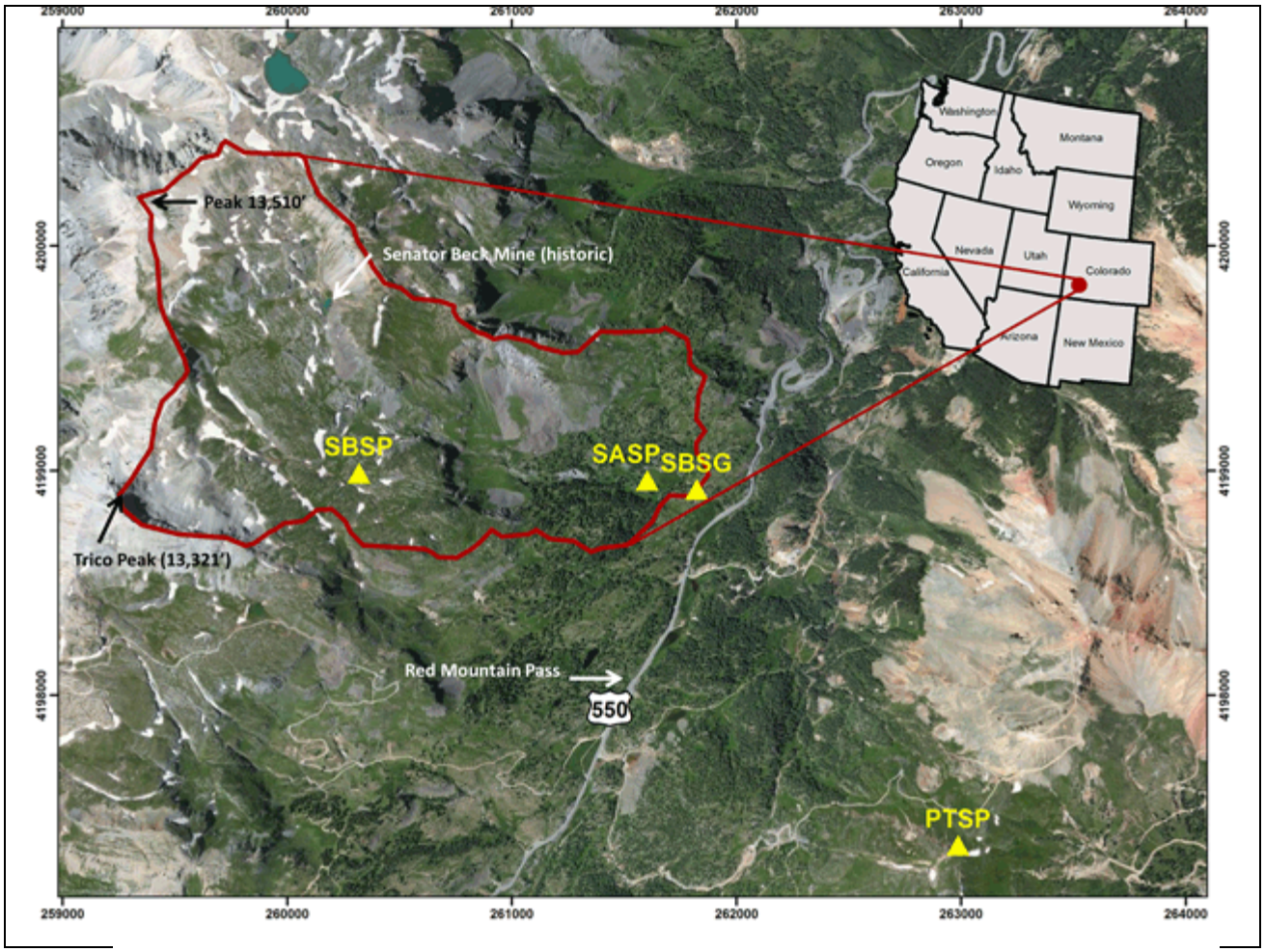


Figure 1. Senator Beck Basin Study Area is located at 37°54'24.8"N x 107°43'34.6"W in the Ouray Ranger District of the Uncompahgre National Forest in the western San Juan Mountains of southwestern Colorado. A Special Use Permit was granted to the Center for Snow and Avalanche Studies in October 2003. Under that permit, CSAS received permission to develop and use two study plots and develop a stream gauging station within the 719 acre (290 ha) Senator Beck Basin.

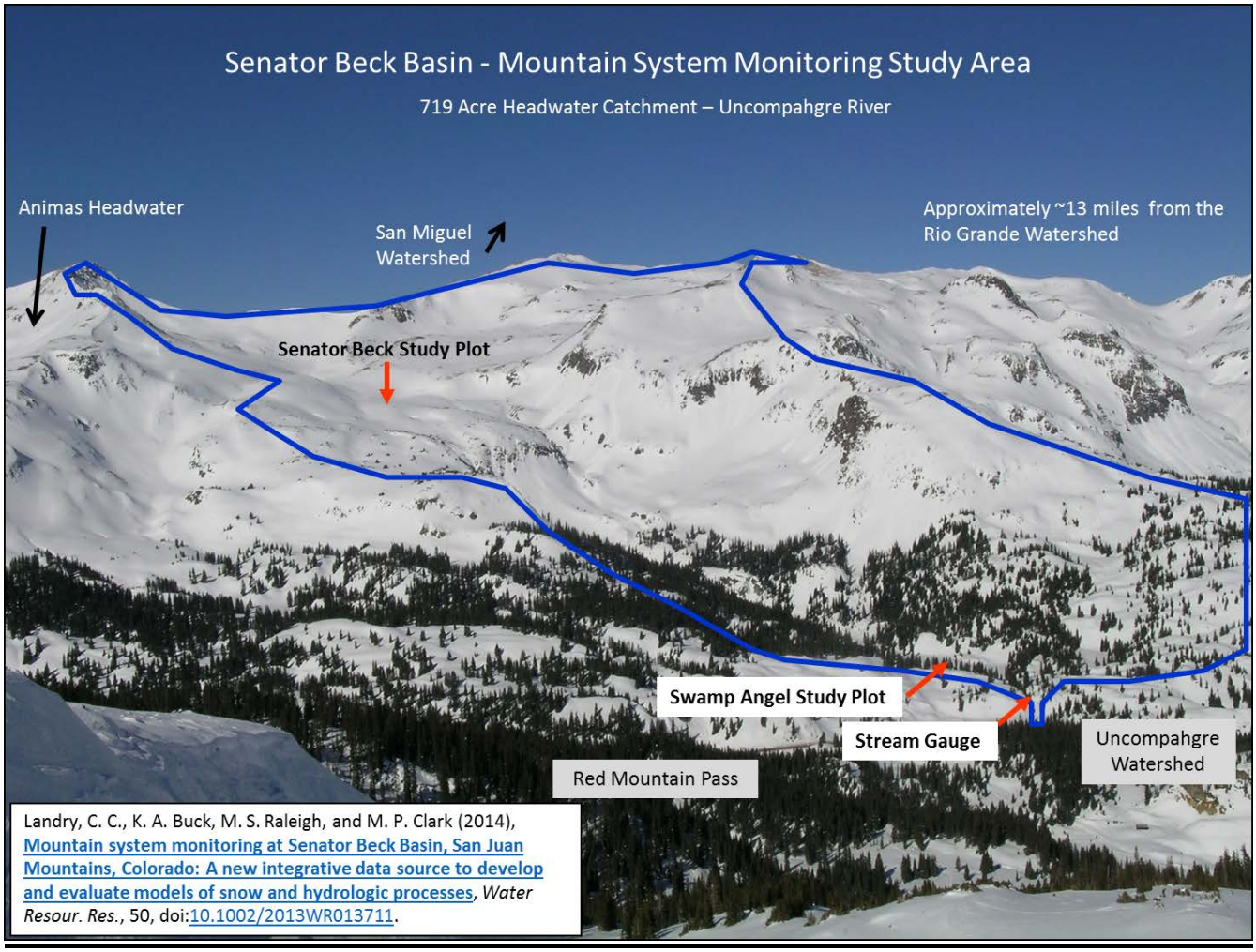


Figure 2. Senator Beck Basin is in the Uncompahgre Watershed and immediately adjacent to the Animas and San Miguel Watersheds. It is 13 miles to the west of the Rio Grande Watershed. Intensive snow data collection, including dust-on-snow, takes place at the Swamp Angel Study Plot (SASP) and Senator Beck Study Plots (SBSP).

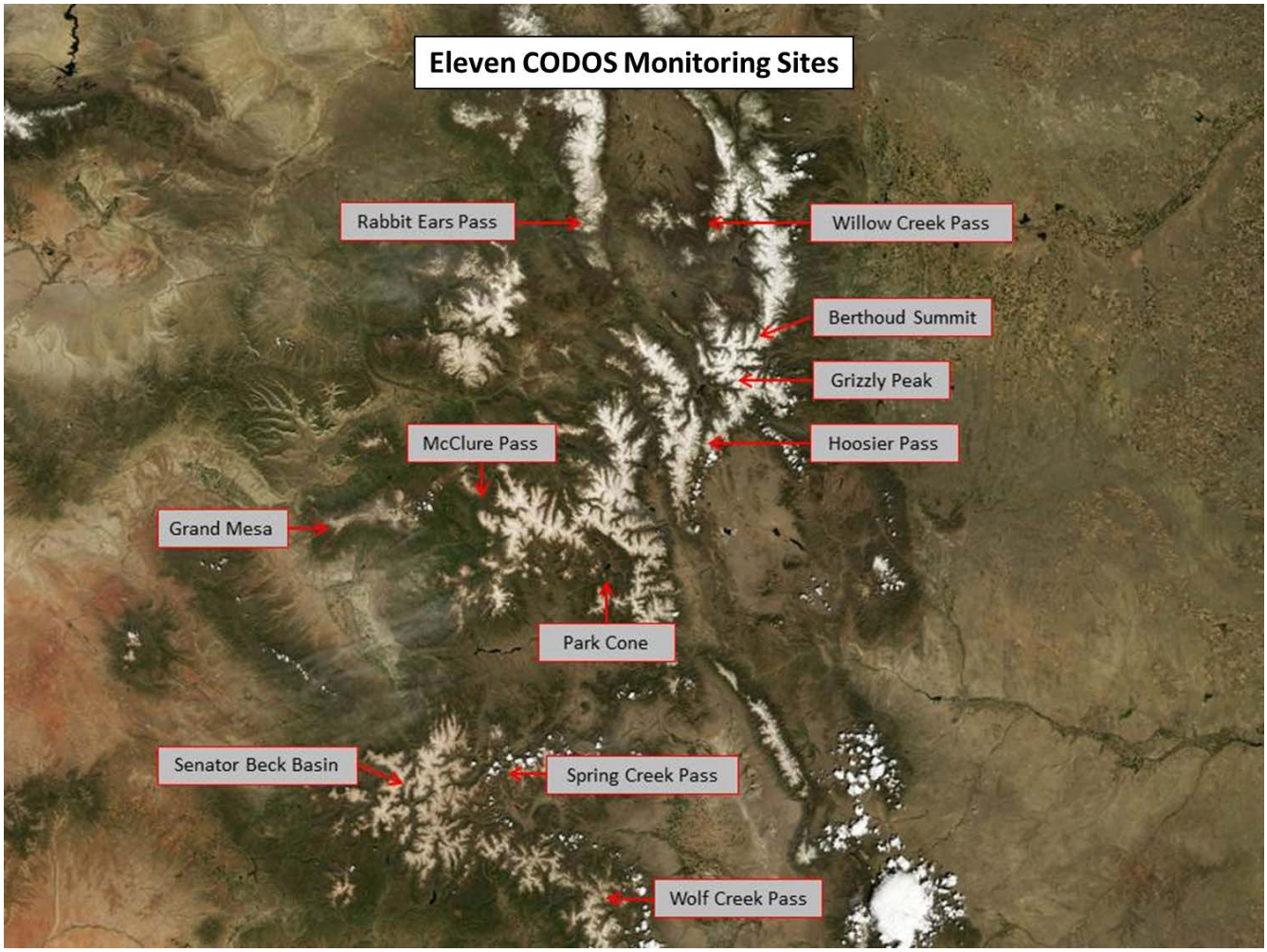


Figure 3. Map of the CODOS sample locations throughout Colorado. Most sites are located at the summit of mountain passes near SNOTEL stations to compliment both datasets.