Exhibit A – Statement of Work

Statement Of Work	
Prepared Date:	**April 17, 2025**
Name of Grantee:	**Dolores Watersheds Collaborative**
Name of Water Project:	**Developing and Implementing Hydrologically-Informed Forest Treatments in Semi-arid Southwestern Colorado**

Water Project Overview: Please provide brief description of the proposed water activity (no more than 200 words). Please define all acronyms.

Southwestern Colorado is experiencing decreased snowpack and increased wildfire, leading the Colorado Water Plan to identify wildfire mitigation as a key action to support thriving watersheds. Likewise the Southwest Basin Implementation Plan recognizes that forest health projects are needed to increase source water protection. As over 70% of our water originates as snow in forested mountains, there is an urgent need to adjust forest management strategies to incorporate interdisciplinary knowledge including hydrology, forestry, and ecology. To address these community needs, we propose generating hydrologically-informed forest treatments in the Dolores watershed, leveraging three years of existing local data to generate high resolution, localized ecohydrologic models of the upper and lower Dolores watershed above McPhee Reservoir. The models will be applied to collaboratively develop and implement hydrologically-informed treatments via funding from COSWAP, install infrastructure necessary to assess the ecohydrologic impacts of these treatments, complete the first year of monitoring, develop protocols for future monitoring and conduct outreach. We will also use existing local datasets to develop a higher elevation forest hydrologic model, which can help improve predictions of snowmelt amount and timing. *This proposal represents one of the first efforts to apply locally-informed modeling to design and implement forest treatments that delay snowmelt to enhance soil moisture, fuels moisture, and summer low flows.*

Project Objectives: ALL

1. Assimilate existing local forest hydrologic data to develop a locally-trained SnowPALM model for mid-elevation sites. Produce a peer-reviewed publication on SW Colorado ponderosa management implications for delaying snowmelt and conserving soil moisture in fire-prone watersheds.
2. Collaborate with Mountain Studies Institute, USDA-ARS, San Juan Forest and diverse stakeholders to apply the trained SnowPALM model to develop and implement hydrologically-informed treatment scenarios for comparison with current standard practices and no-treatment options.
3. Establish new snowtography stations and forest structure/diversity plots in the experimental and control treatment areas to quantify impacts of hydrologically-informed forest treatments on snow accumulation, retention, soil moisture and forest metrics.
4. Conduct the first year of post-treatment hydrological and forest structure & diversity measurements to assess effectiveness and document protocols for future ongoing assessment.
5. Assimilate local data to develop local SnowPALM model for upper-elevation sites. Produce a peer-reviewed publication on SW Colorado forest-snow relations and their implications for improved water resources planning.
6. Pending results, inform future ponderosa pine management to delay snowmelt, conserve soil moisture, enhance fuel moisture, reduce fire risk and improve watershed resilience.
7. Implement outreach and education regarding the objectives and results.

Tasks
Task 1: Hire and train Postdoc to assimilate local data to develop a locally-trained SnowPALM model for mid-elevation ponderosa sites. JOEL
Description of Task:
Landscape-scale, stand-replacing fires have the potential to push western US forest ecosystems beyond tipping points causing lasting changes in vegetation structure and watershed hydrology (Batllori et al., 2020). Reduced soil infiltration and associated flooding and erosion following high-severity fires pose major threats to the function of reservoirs and other water-resources infrastructure. Recognizing these threats, forest treatments have become a priority across the West. These treatments can reduce evaporative losses from canopy interception and transpiration, thereby increasing soil moisture and potentially streamflow and altering the timing of snowmelt and of soil moisture depletion (Belmonte et al., 2022; Chase et al., 2016; Sankey & Tatum, 2022). Forest thinning has been found to increase soil moisture, specifically prolonging spring dry-down periods (Dwivedi et al., 2023b; O'Donnell et al., 2021; Sankey & Tatum, 2022; Simonin et al., 2007). However, forest thinning can alternatively increase exposure of the snowpack and soil moisture to solar radiation and wind, potentially decreasing snowmelt volumes and advancing snowmelt timing, which can enhance fire risk and strain water demands during summer months (Biederman et al., 2014; Dwivedi et al., 2024; Westerling et al., 2006). In order to define where, when and how forest management can enhance beneficial hydrologic conditions, we established in 2021 and 2022 a pair of ecohydrologic monitoring stations employing the Snowtography method (Payton et al., 2021) to track how forest management impacts snow and soil moisture dynamics in SW Colorado ponderosa pine forests. Here, we propose to leverage the multi-year data from these existing sites to train a high-precision forest hydrology model with the goals of A) drawing generalizable inferences about forest management conditions optimal for hydrologic benefits, and B) developing and implementing forest treatments to address stakeholder-driven hydrologic objectives (Task 4).
Method/Procedure:
We will recruit and hire a postdoc with strong quantitative and programming skills to develop (i.e. parameterize) a version of the SnowPALM forest hydrology model for SW Colorado ponderosa pine forest. This work will follow steps established in recent work by USDA-ARS and its partners for Arizona ponderosa including 1) Process and prepare 3-4 years of existing data at two Snowtography stations (Payton et al., 2021) in the Dolores and Mancos watersheds where we have been monitoring snow and soil moisture effects of prescribed fire and mechanical thinning; 2) Develop daily values of snow depth, snow water equivalent (SWE), and snowmelt volumes at each of 90 Snowtography measurement points according to workflows developed in Dwivedi et al., 2023a; 3) Apply these daily time series to train the process-based SnowPALM model to accurately predict snowpack dynamics, sublimation losses, and the amount and timing of snowmelt as demonstrated for AZ in Dwivedi et al., 2024; 4) produce a paper for peer-reviewed publication using the trained SnowPALM model to assess how forest management could reduce sublimation losses and/or delay snowmelt timing to enhance summer soil moisture and enhance wildfire resistance and resilience. We will continue to collect and assimilate data from the existing Snowtography sites to refine model representation of 1) the wide range of interannual variability in winter weather and 2) ongoing changes in forest community and structure in years following management.

Deliverables:
1. Post doc hired 2. Local data leveraged to train SnowPALM model specific to southwestern CO ponderosa pine 3. Peer-reviewed publication assessing forest-snowpack-snowmelt relationships for SW CO ponderosa pine 4. Additional winter of measurements from existing ponderosa and spruce-fir Snowtography stations.

Tasks
Task 2: Postdoc assimilates local data to develop locally-trained SnowPalm model for upper elevation forested sites. JOEL
Description of Task:
As over 70% of the water in the Rockies originates as snow in forested mountains, there is an urgent need to adjust forest management strategies that protect vital water sources (Li et al., 2017). While mid-elevation ponderosa forests are a management priority for reduced risk of severe fire, associated erosion and sedimentation, protection of life and safety and forest products, upper-elevation forests generate a larger portion of streamflow for downstream water supplies. While management activity tends to be less in high-elevation forests, water resource managers need improved streamflow prediction under changing climate and increasingly common wildfire or pathogens, which can alter water supplies (Manning et. al., 2022). Research has shown that forest canopy (and canopy removal) can have very different impacts on snow hydrology in high/cold forest than in low/warm forest; specifically, snow tends to ablate earlier under forest canopy in warmer ponderosa forests, while canopy can delay snowmelt in colder mixed conifer or spruce-fir forests (Lundquist et al., 2013; Dwivedi et al., 2023a, 2024). Data are lacking for daily-scale assessment of snow water resources in high-elevation forests, because SNOTEL stations monitor unforested clearings and remote sensing products such as Airborne Snow Observatory are expensive, temporally sparse, and are sometimes not ideally suited to measure snow beneath trees. We therefore established a Snowtography station for ecohydrologic monitoring in a high-elevation spruce-fir forest in the upper Dolores Watershed in 2022. Here, we propose to leverage the multi-year data from 52 measurement locations at this site to train a high-precision forest hydrology model with the goals of identifying conditions of forest cover and spatial arrangement optimal for reduced sublimation, enhanced soil moisture percolation, and streamflow production.
Method/Procedure:
Initial procedures will be similar to Task 1, with the postdoc assimilating existing snowpack data to train a SnowPALM model version for SW Colorado spruce-fir forest. The model will then be used differently, however, with a focus on water resources production. A peer-reviewed publication will be prepared assessing forest-snow-snowmelt relationships for SW Colorado upper-elevation forest and comparing/contrasting with the processes identified for ponderosa forest in Task 1. Depending upon stakeholder interest and engagement, this publication could be extended to include HYDRUS 1-D hydrologic modeling of water in the soil profile to assess deep percolation of water towards the stream (Dwivedi et al., 2023b). Alternatively, we could build machine learning models to scale the SnowPALM predictions across the spruce-fir portion of the Dolores Watershed (Biederman et al, in review) and then evaluate the value added for historical (back-cast) streamflow prediction as compared to standard procedures.

Deliverable:

1. Local data leveraged to train SnowPALM model specific to southwestern CO upper elevation spruce-fir, producing maps of snowpack and snowmelt.
2. Water managers can use these to to improve streamflow forecasting models
3. Peer reviewed publication assessing forest-snow-snowmelt relationships for SW CO upper elevation forest and implications for improved water supply forecasting.

Tasks

Task 3: Establish control and standard prescription snowtography and forest ecology plots. Establish structure/diversity plots.

Description of Task:

In order to understand how effective the hydrologically-informed treatments are in achieving the outlined objectives, it will be important to set up viable, local controls. We propose to set up two snowtography control sites that include: a no-treatment site; and a treatment site that represents ponderosa treatment standard best-practices implemented in the Dolores watershed by the San Juan National Forest (SJNF). This will allow us to collect baseline forest-snow data, forest structure and diversity data, and establish a monitoring site for later comparisons with implemented hydrologically-informed forest treatments. We will work closely with local stakeholders, and particularly SJNF staff, to select these sites and permit their installation.

Task 3 Actions:

1. Permitting of site installation
2. Coordination and collaboration with Snowtography Technical Team, Stakeholders and SJNF on site selection
3. Installation
4. Documentation of forest structure/diversity

Method/Procedure:

We will begin this process by working with Mountain Studies Institute (MSI), USDA-ARA SW Watershed Research Center, SJNF and other stakeholders to identify sites where hydrologically-informed treatments will be implemented. Control sites will be close by to provide representative climates, soils, forest types, and topography.

Once the standard treatment and control units are identified, we will develop proposed installation site maps and submit a permit under MSI's existing master research permit with the SJNF. Once the permit is approved, we will install the control Snowtography stations to begin measuring the control and standard treatment units following the established methods we outlined in the Snowtography Handbook (Payton et al., 2021). We anticipate this process to take three 10-hour days for the staff listed. Additionally, the collaborative has an extensive network of volunteers that will assist with the installation. Leveraging our volunteers has been very successful in our previous five sites in the San Juan Mountains for providing in-kind match, expediting the installation process, and ensuring we use CWCB funds as efficiently as possible.

These sites use remote automated cameras (game cameras) to measure daily snow depths at transects and/or grids of measurement locations to quantify changes in snow accumulation, retention, and ablation. Sites will be visited twice a month to sample for snow water equivalent (SWE) at a representative number of stakes. Using the daily snow depth data from the game cameras, a regression will be built with the SWE data to extrapolate the SWE data to daily values, enabling quantification of daily snowmelt.

To track the fate of snowmelt (and rain) water in the soil, we will install four soil water measurement profiles at each site; these will be strategically placed to capture the snow and energy environments typically resulting from forest management including an open area, an under canopy area, a shaded cool edge of a forest gap, and a sunny warm edge. We will install both volumetric water content and soil matric potential soil moisture sensors at 10, 30 and 100 cm depths, allowing us to quantify both tree-available water and hydraulic gradients driving water percolation beneath the root zone and towards streamflow or aquifer recharge. Specifically, volumetric water content allows us to quantify saturation levels, while soil matric potential better measures water available to plants, an important parameter when considering wildfire risk and source water protection. During sensor installation, we will classify soil textures and hydraulic properties to better understand and control for any variation between sites.

The vegetation monitoring component of the snowtography-informed treatments is built upon an existing monitoring program designed to quantify the effectiveness of vegetation and fuels treatments within the landscape of the Dolores Watersheds Collaborative (DWC). DWC stakeholders collaboratively developed a set of resilience metrics/desired conditions for the ponderosa pine forests where a majority of treatments, including the hydrologically-informed treatments are occurring. Monitoring is plot-based and multi-faceted, including: variable radius plots to quantify overstory metrics (height, diameter at breast height (DBH), circumference at breast height (CBH), stand density, insect and disease presence); line intersect methods to quantify shrub density and canopy closure; quadrats for ground cover estimates; quadrats for photoload estimates of surface fuels (RMRS-GTR-190); nested fixed radius plots to document the density of *Quercus gambelii* and the density of tree species seedling and saplings; and the collection of tree cores from a subset of trees to represent targeted size classes along with documentation of large tree characteristics defined in RMRS-GTR-109 for trees with a DBH of 16in or greater.

To support the development of the localized model for snowtography-informed treatments, we propose establishing plots within the proposed treatment unit boundaries, within adjacent units that will be treated utilizing traditional overstory management techniques, and within adjacent units designed as controls. Data collected will be incorporated into the treatment design model and will inform the effectiveness of outcomes of the treatments within the process adopted by DWC and the SJNF.

MSI staff is currently working with Dolores District timber program staff to determine the placement of plots and controls to align with timber operations. We are targeting a plot density of 1 per 5 ac within the hydrologically-informed treatment units and 1 per 15 ac in adjacent traditional units. Sampling will occur pre- treatment, one growing season post- treatment, and 3-5 years post-treatment.

A semi hyper-spectral drone with high resolution capabilities (<5 cm) will also be flown over the control sites. This will allow us to develop a structure from the motion model of the sites that can be utilized to develop a canopy model that includes canopy cover, tree height, and a digital elevation model. This data is imperative to have as it quantifies the changes in forest structure, providing a method to compare different areas within a snowtography site as well as building a crosswalk for different scientific disciplines to understand each other. Foresters tend to think about forests in terms of basal area, or diameter breast height, while water resource scientists evaluate forests based on canopy cover, gap size, and leaf area index.

We are also partnering with Dr. Bill Smith at University of Arizona to fly the existing snowtography sites with drone-based LiDAR during a snow-off period. This will allow us to build an up-to-date digital elevation model and detailed canopy structure model. Additionally, we will fly the LiDAR drone once a year, during peak SWE. This will allow us to have a full snow depth model across the entire site. These data will be used to calibrate the SnowPALM model outlined in Task 1.

Deliverables:
1. Implementation of Snowtography stations and forest structure/diversity plots in no treatment and standard prescription units as well as a report with maps of the sites, including installed infrastructure, canopy cover and forest structure, and soil characteristics. 2. A report summarizing forest structure and diversity metrics.

Tasks
Task 4: Collaboratively develop hydrologically-informed treatments including stakeholder roundtables.
Description of Task:

Landscape-scale forest restoration is underway in many locations across the US Southwest, including multiple projects focused on ponderosa forests in SW Colorado including the Pine Prescribed Fire EA, Lone Pine Vegetation Management EA, a forthcoming Haycamp Mesa Vegetation Management EA and the Salter Vegetation Management EA where this project is located.

Forest thinning potentially increases soil moisture by reducing snow sublimation losses from reduced canopy interception and decreased transpiration (Dwivedi et al., 2023a). Alternatively, too intense of a treatment can increase soil and snowpack exposure to solar radiation and wind, potentially decreasing snowmelt volumes and/or advancing snowmelt timing— both of which can exacerbate tree stress and fire risk (Biederman et al., 2014b; Dwivedi et al., 2023b, 2024, Westerling et al., 2006). With snowpack and meltwater dynamics co-regulated by weather, topography, forest cover fraction and the spatial arrangement of remaining trees, the balance of these counteracting effects—and how forest thinning changes them—remain a critical knowledge gap in the scientific basis of forest management.

Over the past two decades, hydrologic research has made significant progress in documenting the impacts for canopy cover amount and its spatial arrangement on forest hydrology (Veatch et al., 2009; Biederman et al., 2014a, Dwivedi et al., 2023a). While there have been expanded measurements (Payton et al., 2021, Broxton et al., 2020; Belmonte et al., 2022), advances in process-based modeling (Broxton et al., 2015; Dwivedi et al., 2024), and development of efficient upscaling methods with machine learning (Biederman et al., in review), the science of forest hydrologic response to management has, in this century, been largely confined to observation and modeling of existing treatments. *The proposed project represents one of the first efforts to develop, implement, and evaluate hydrologically-informed treatments using local forest hydrology data and targeting outcomes developed in collaboration with local stakeholders.*

In addition to meeting the needs of our stakeholders, this project addresses challenges and advances goals and objectives of the SW Basin Implementation Plan including but not limited to 1) projects that build resilient watersheds and healthy forests impacted by drought, fire, and climate change; 2) efforts to enhance and maintain watershed health by protecting and/or restoring watersheds to ensure sustainable water supply, water quality, critical infrastructure, and/or environmental and recreational areas; and 3) supporting dialogue and fostering cooperation, collaboration and conflict resolution among diverse water users.

The project is located in the SJNF House Creek priority watershed, a tributary to McPhee Reservoir and the House Ck boat ramp and campground, and situated proximate to the popular Boggy Draw recreation area. The project also lies within the boundaries of a current CWCB-sponsored Wildfire Ready Watershed Planning process focused on protecting water resources and infrastructure from post-fire hydrologic hazards, and forest treatments are approved under the Salter Vegetation Management EA (see map).

Method/Procedure:
Here we will collaboratively develop, implement and evaluate the effectiveness of experimental treatments to meet the hydrologic objectives of local stakeholders as follows: 1. Dolores Watersheds Collaborative has more than thirteen years of collaborative engagement in forest management and watershed health in the upper Dolores and Mancos watersheds. Our strong working network, which includes project partners Mountain Studies Institute, USDA-ARS SW Watershed Research Center, San Juan National Forest and Dolores Water Conservancy District, was awarded a $950,000 COSWAP grant for hydrologically-informed and standard fuels treatments. Through Forest Hydrology Technical Team meetings, stakeholder roundtables and site visits we will meet our objective to incorporate varied stakeholder interests into innovative hydrologically-informed forest treatments. See also Task 7 below. 2. Building upon the hydrologic inferences about ponderosa pine treatments developed in Task 1, we will develop multiple candidate forest treatment scenarios likely to meet the stakeholder objectives identified in step 1. This consists of computer simulations of the amount, spatial arrangement and height characteristics of remaining trees, which control the prevalence of under-canopy, open, warm edge, and cool-edge environments. 3. Using the locally trained SnowPALM model, we will predict the effects of multiple candidate treatments. Key products of the model scenarios include snow losses to sublimation, melt volumes, and melt timing, all at 1-m spatial resolution. Model runs will be conducted for a wide range of winter weather since hydrologic outcomes of treatments are heavily dependent upon winter weather. 4. Via collaborative stakeholder roundtables, we will develop and agree on desired forest treatment outcomes beyond hydrology. 5. We will then review predicted outcomes of candidate treatments and evaluate the projected hydrologic benefits in concert with other stakeholder objectives including reducing fuel loads and continuity, large tree retention, biodiversity, insect and disease resistance, multiple recreation interests, livestock grazing, scenic value and implementation feasibility. 6. We will select two finalist experimental treatments and develop corresponding forest prescriptions with SJNF for bidding, contracting and implementation in Task 5.
Deliverables:
1. Consensus document defining desired outcomes and decision space. Desired outcomes will balance hydrologic benefits with other stakeholder priorities. 2. Model outputs predicting hydrologic impacts of multiple candidate treatments. 3. Prescriptions and cut/leave instructions for hydrologically-informed treatments.

Tasks
Task 5. Contract for and Implement water-smart treatments
Description of Task:
This task involves bidding, contracting, executing and administering hydrologically-informed prescription control forest treatments including post-treatment biomass handling. This project is located within the Salter Vegetation Management and Pine Prescribed Fire EAs. SJNF forestry staff are currently conducting standard ponderosa pine forest thinning and prescribed fire treatments in the area. The forestry work for this project as well as additional fuels reduction treatments will be funded with matching dollars from CO-DNR COSWAP and in-kind contributions from SJNF.

Method/Procedure:
Once the hydrologically-informed experimental treatments are developed, SJNF timber staff will develop and open a bid process. SJNF will execute a service contract with the successful bidder to implement the forest treatments. This contract will specify the cut, skid, deck and full removal of all merchantable (>9") diameters on a timely basis to allow for better comparison of data across treatments and avoid delays in staged implementation that could skew the data. Smaller timber will be decked for fuelwood contracts to local contractors and residents. A portion of the non-merchantable timber from the COSWAP-funded treatments will be processed into firewood (bucked and split) and delivered to our Ute Mountain Ute neighbors in Towaoc, CO. During the bidding process, forestry staff will layout, flag and mark the sale. Timber operations will be monitored by SJNF timber and harvest inspector staff.
Deliverables:
1. Forest treatment contracts executed 2. Hydrologically-informed treatments completed

Tasks
Task 6. Install and implement Post-treatment snowtography and forest structure/diversity assessments
Description of Task:
Once the hydrologically-informed treatments have been implemented in the Dolores watershed, we will work with SJNF and other local partners to install new snowtography and forest structure and diversity monitoring sites in each of the hydrologically-informed treatments to compare against the control and standard treatment sites installed in task 3. This will establish the needed infrastructure to understand how the hydrologically-informed treatments improve forest health and watershed resiliency as compared to no treatment, or treatment as usual. Funding from the CWCB would be used to implement these measurement stations and to conduct the first year of measurements.
Method/Procedure:
The full methods described in Task 3 will be replicated within the implemented hydrologically-informed treatments, following the protocols outlined in the snowtography handbook (Payton et al., 2021). These Snowtography stations will be designed so that the measurements will cover both a hydrologically-informed treatment as well as controls of no treatment and standard treatment. These new stations, in tandem with the baseline control stations, will allow us to have a strong experimental design that has both pre-implementation baseline data as well as strong localized controls for comparison. This provides a robust dataset for analysis that will allow us to understand how the different treatments and subsequent forest structures respond to changes in precipitation and temperature. We will also replicate the forest structure and diversity plot methodology described in Task 3 within the implemented hydrologically-informed treatments to document the differences in forest structure diversity in untreated, standard treatment and two hydrologically-informed forest treatments. This forest structure data will inform future forest hydrology assessments as well as add to the growing body of SJNF third-party monitoring on the Dolores District. These monitoring plans are informed by DWC's collaboratively-developed ponderosa pine desired conditions and resilience metrics.

Deliverables:
1. Implementation of Snowtography stations and forest structure/diversity plots in two hydrologically-informed treatment units. 2. A report summarizing forest structure and diversity metrics 3. Summary metrics from first year post-treatment snowtography and forest structure/diversity for all study units (control, standard treatment, and 2 hydrologically-informed units) 4. Detailed site map of all infrastructure installed and instructions for ongoing monitoring.

Tasks
Task 7: Stakeholder Coordination and Project Outreach and Education
Description of Task:
A unique and significant component of this project is the willingness of local forest and water managers, snow hydrologists and other stakeholders to collaboratively integrate multiple interests to achieve project objectives. Also important is Colorado DNR's $290,000 investment of COSWAP resources into planning and implementing this project. Dolores Watersheds Collaborative will leverage this broad-based commitment and enthusiasm, together with more than thirteen years of collaborative forest management, to coordinate stakeholder input and engagement throughout this project. We will also implement outreach and education to inform a broad audience of project partners, stakeholders, the scientific community and the public about the objectives and results of this innovative project.
Method/Procedure:

DWC will oversee the following methods to ensure this project meets the needs of multiple stakeholders.
 	
1. Forming a Forest Hydrology Technical Team
2. Coordinating and facilitating monthly or bi-monthly Tech Team meetings depending on project stage
3. Convening and facilitating stakeholder roundtables to accomplish the following:
    a. locate hydrologically-informed treatment sites
    b. agree on desired forest treatment outcomes
    c. integrate modeled hydrologic outcomes with additional stakeholder interests
    d. select and agree on hydrologically-informed forest treatments
4. Coordinating site visits to accomplish the above
5. Coordinating volunteer support for snowtography station installations
6. Implement education and outreach through:
    a. two peer-reviewed published papers
    b. at least one public presentation
    c. one public field trip
    d. at least one article for local papers
    e. a project story map for project partner websites
    f. presentation at Sustaining Colorado Watersheds Conference or another professional meeting

Deliverables:
1. Consensus document defining desired outcomes and decision space. Desired outcomes will balance hydrologic benefits with other stakeholder priorities 2. Agreed-upon hydrologically-informed forest treatments 3. Two peer-reviewed published papers 4. Project Story Map 5. Report on stakeholder engagement and lessons learned 6. Presentations

Tasks
Task 8: Project Management and Administration
Description of Task:
DWC will be responsible for the overall project management and coordination with CWCB and project partners including Mountain Studies Institute, USDA ARS SW Watershed Research Center, San Juan National Forest, Dolores Water Conservancy District and other stakeholders. DWC and project partners will work closely to ensure prudent use of funds, clear and efficient communication, creative approaches to technical components, effective scheduling and budget management and shared expectations.
Method/Procedure:
1. Project Management, Admin, Communications - Through regular communications, DWC will review progress and schedules, and work with partners and CWCB to ensure compliance with scope of work and make any necessary course adjustments. 2. Postdoc Hiring, Supervision and Modeling - This task will be shared by USDA-ARS and Mountain Studies Institute. 3. Timber Sale Contracting, Administration and Oversight - This will be overseen by San Juan National Forest 4. Project Invoicing and Reporting - DWC will review monthly invoicing and progress reports from project partners and forward to CWCB in a timely fashion
Deliverables:
1. Progress and final reports 2. Invoices, grant reimbursement documentation and budget tracking 3. Project schedule and updates 4. Regular meetings scheduled and meeting notes

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Budget and Schedule

This Statement of Work is accompanied by a combined Budget and Schedule that reflects the tasks identified in the Statement of Work.

Reporting Requirements

Progress Reports: The grantee shall provide the CWCB a progress report every six months, beginning from the date of issuance of the grant agreement. The progress report shall describe the status 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 Report: At completion of the project, the applicant shall provide the CWCB a final report on the applicant's letterhead that:

- Summarizes the project and how the project was completed.
- Describes any obstacles encountered, and how these obstacles were overcome.
- Confirms that all matching commitments have been fulfilled.
- Includes photographs, summaries of meetings and engineering reports/designs.

The CWCB will pay out the last 10% of the budget when the final report is completed to the satisfaction of CWCB staff. Once the final report has been accepted, and final payment has been issued, the grant agreement will be closed without any further payment.

Payment

Payment will be made based on actual expenditures and must include invoices for all work completed. The request for payment must include a description of the work accomplished by task, an estimate of the percent completion for individual tasks and the entire project in relation to the percentage of budget spent, identification of any major issues, and proposed or implemented corrective actions.

Costs incurred prior to the effective date of this grant agreement are not reimbursable. The last 10% of the entire grant will be paid out when the final deliverable has been received. All products, data and information developed as a result of the grant agreement must be provided to the CWCB as part of the project documentation.

Performance Measures

Performance measures for the grant agreement shall include the following:

(a) Performance standards and evaluation: Grantee will produce detailed deliverables for each task as specified. Grantee shall maintain receipts for all project expenses and documentation of the minimum in-kind contributions (if applicable) per the budget. Per grant guidelines, the CWCB will pay out the last 10% of the budget when the final report is completed to the satisfaction of CWCB staff. Once the final report has been accepted, and final payment has been issued, the grant agreement will be closed without any further payment.

(b) Accountability: Per grant guidelines full documentation of project progress must be submitted with each invoice for reimbursement. Grantee must confirm that all grant conditions have been complied with on each invoice. In addition, per Grant Guidelines, progress reports must be submitted at least once every 6 months. A final report must be submitted and approved before final project payment.

(c) Monitoring Requirements: Grantee is responsible for ongoing monitoring of project progress per Exhibit A. Progress shall be detailed in each invoice and in each progress report, as detailed above. Additional inspections or field consultations will be arranged as may be necessary.

(d) Noncompliance Resolution: Payment will be withheld if grantee is not current on all grant conditions. Flagrant disregard for grant conditions will result in a stop work order and cancellation of the grant agreement.

COLORADO
Colorado Water
Conservation Board
Department of Natural Resources

Colorado Water Conservation Board

Offline Water Plan Grant App – For Drafting Purposes

This is an offline version of the application questions. All materials and questions must be completed in the CWCB portal.

CONTACT INFORMATION:

Organization Contact: Dolores Watersheds Collaborative, Nina Willams
Position/Title: Coordinator
Phone: 970-560-1443
Email: nina@dwrfcollaborative.org

Organization Contact - Mountain Studies Institute, Dr. Jake Kurzweil
Position/Title: Research Hydrologist, Asst Director Water Programs
Phone: 415-302-9450
Email: jake@mountainstudies.org

Organization Contact - USDA-ARS SW Watershed Research Center, Dr. Joel Biederman
Position/Title: Research Hydrologist
Phone: 520-305-1424
Email: Joel.Biederman@usda.gov

Grant Management Contact: Nina Williams
Position/Title: Coordinator, Dolores Watersheds Collaborative
Phone: 970-560-1443
Email: nina@dwrfcollaborative.org

Agency Information:
Agency Type - 501c3 non-profit
Current Assessment: N/A
Number of Shareholders or Customers: N/A
Number of Shares: N/A
Number of Taps: N/A
Average Monthly Water Bill: N/A
Annual Water Delivery (acre-feet): N/A

GRANT DETAILS:
Primary Category (Water Plan Grant Only):
Watershed Health

Water Project Justification:
Provide a description of how this water project supports the goals of Colorado's Water Plan, specifically Partner Actions, and the applicable Roundtable Basin Implementation Plan and Education Action Plan. The Applicant is required to reference specific, needs, goals, themes, or Identified Projects and Processes (IPPs), including citations, (e.g. document, chapters, sections, or page numbers).

Decreased snowpack and increased wildfire in the Southwest has led land managers and collaboratives to prioritize forest health, source water protection, and water availability. This concept is evident by the Southwest Basin Implementation plan as well as the Colorado Water Plan identifying the need to balance water availability needs amongst all water use sectors while promoting healthy forests and watersheds. The Colorado Water Plan also identifies thriving watersheds that prioritize watershed health, forest health, wildfire mitigation, and river health as one of four key action areas. As forested, snow dominated, mountain watersheds are responsible for generating the majority of surface water available to all sectors in southwest Colorado, it is evident that interdisciplinary approaches to watershed management are imperative to ensure source water protection. Our local stakeholders including the Dolores Water Conservancy District (DWCD), who manages the McPhee reservoir (381,000 acer feet of capacity) serving multiple municipalities, one tribe, farmers and ranchers (63,000 irrigated acres) and downstream fisheries. DWCD is concerned about the future of the watershed and its ability to supply water in terms of both quantity, quality and timing. In the past five years there have been instances when rural municipalities have experienced dry up, and an earlier snowmelt has contributed to multiple fires in the last five years, threatening water quality.

With these recent changes in hydrology, DWCD has put an emphasis on and resources into understanding how different forest structures, and forest treatments can improve source water protection and hydrologic function. With this, DWCD in partnership with the United States Department of Agriculture (USDA), Dolores Watershed Collaborative (DWC), The Nature Conservancy (TNC), and Mountain Studies Institute (MSI) have been building and studying network of forest-snow monitoring stations, called snowtography sites, that span a range of forest types, treatments and structures, elevations, and forest types in the San Juan Mountains. This fills in a needed gap in the SNOTEL network that only captures open areas, which can overestimate water availability. With our current dataset, we are now able to train a localized forest-snow model called SnowPALM, at mid and high elevation sites in the Dolores watershed that will accomplish two major objectives. In the high elevation site, this model will greatly improve DWCD's ability to forecast water availability, while the mid elevation site will be utilized to develop hydrologically informed forest treatments. These treatments will be developed alongside our partners in the Dolores District of the San Juan National Forest, implemented, and monitored against a no treatment and a treatment as usual.

In addition to meeting the needs of our stakeholders, this project addresses challenges and advances goals and objectives of the Southwest Basin Implementation Plan including but not limited to 1) projects that build resilient watersheds and healthy forests impacted by drought, fire, and climate change; 2) efforts to enhance and maintain watershed health by protecting and/or restoring watersheds to ensure sustainable water supply, water quality, critical infrastructure, and/or environmental and recreational areas; and 3) supporting dialogue and fostering cooperation, collaboration and conflict resolution among diverse water users.

Related Studies:

E. Batllori, F. Lloret, T. Aakala, W.R.L. Anderegg, E. Aynekulu, D.P. Bendixsen, A. Bentouati, C. Bigler, C.J. Burk, J.J. Camarero, M. Colangelo, J.D. Coop, R. Fensham, M.L. Floyd, L. Galiano, J.L. Ganey, P. Gonzalez, A.L. Jacobsen, J.M. Kane, T. Kitzberger, J.C. Linares, S.B. Marchetti, G. Matusick, M. Michaelian, R.M. Navarro-Cerrillo, R.B. Pratt, M.D. Redmond, A. Rigling, F. Ripullone, G. Sangüesa-Barreda, Y. Sasal, S. Saura-Mas, M.L. Suarez, T.T. Veblen, A. Vilà-Cabrera, C. Vincke, & B. Zeeman (2020) Forest and woodland replacement patterns following drought-related mortality, Proc. Natl. Acad. Sci. U.S.A. 117 (47) 29720-29729, https://doi.org/10.1073/pnas.2002314117.

Belmonte, A., Ts. Sankey, T., Biederman, J., Bradford, J. B., & Kolb, T. (2022). Soil moisture response to seasonal drought conditions and post-thinning forest structure. Ecohydrology, 15(5), e2406.

Biederman, J. A., Brooks, P. D., Harpold, A. A., Gochis, D. J., Gutmann, E., Reed, D. E., ... & Ewers, B. E. (2014). Multiscale observations of snow accumulation and peak snowpack following widespread, insect-induced lodgepole pine mortality. Ecohydrology, 7(1), 150-162.

Biederman, J. A., Harpold, A. A., Gochis, D. J., Ewers, B. E., Reed, D. E., Papuga, S. A., & Brooks, P. D. (2014). Increased evaporation following widespread tree mortality limits streamflow response. Water Resources Research, 50(7), 5395-5409.

Broxton, P. D., Harpold, A. A., Biederman, J. A., Troch, P. A., Molotch, N. P., & Brooks, P. D. (2015).

Quantifying the effects of vegetation structure on snow accumulation and ablation in mixed-conifer forests. Ecohydrology, 8(6), 1073-1094.

Chase, C. W., Kimsey, M. J., Shaw, T. M., & Coleman, M. D. (2016). The response of light, water, and nutrient availability to pre-commercial thinning in dry inland Douglas-fir forests. Forest Ecology and Management, 363, 98-109.

Dwivedi, R., Biederman, J. A., Broxton, P. D., Lee, K., van Leeuwen, W. J., & Pearl, J. K. (2023). Forest density and snowpack stability regulate root zone water stress and percolation differently at two sites with contrasting ephemeral vs. stable seasonal snowpacks. Journal of Hydrology, 624, 129915.

Dwivedi, R., Biederman, J. A., Broxton, P. D., Lee, K., & van Leeuwen, W. J. (2023). Snowtography quantifies effects of forest cover on net water input to soil at sites with ephemeral or stable seasonal snowpack in Arizona, USA. Ecohydrology, 16(2), e2494.

Dwivedi, R., Biederman, J. A., Broxton, P. D., Pearl, J. K., Lee, K., Svoma, B. M., ... & Robles, M. D. (2024). How three-dimensional forest structure regulates the amount and timing of snowmelt across a climatic gradient of snow persistence. Frontiers in Water, 6, 1374961.

Li, D., M. L. Wrzesien, M. Durand, J. Adam, and D. P. Lettenmaier (2017), How much runoff originates as snow in the western United States, and how will that change in the future?, Geophys. Res. Lett., 44, 6163–6172, doi:10.1002/2017GL073551.

Lundquist, J. D., Dickerson-Lange, S. E., Lutz, J. A., & Cristea, N. C. (2013). Lower forest density enhances snow retention in regions with warmer winters: A global framework developed from plot-scale observations and modeling. Water Resources Research, 49(10), 6356-6370.

Manning, A. L., Harpold, A., & Csank, A. (2022). Spruce beetle outbreak increases streamflow from snow-dominated basins in Southwest Colorado, USA. Water Resources Research, 58(5), e2021WR029964.

O'Donnell, F. C., Donager, J., Sankey, T., Masek Lopez, S., & Springer, A. E. (2021). Vegetation structure controls on snow and soil moisture in restored ponderosa pine forests. Hydrological Processes, 35(11), e14432.

Payton, E., Biederman, J., & Robles, M. (2021). Snowtography: Snowpack & soil moisture monitoring handbook.

Sankey, T., & Tatum, J. (2022). Thinning increases forest resiliency during unprecedented drought. Scientific Reports, 12(1), 9041.

Simonin, K., Kolb, T. E., Montes-Helu, M., & Koch, G. W. (2007). The influence of thinning on components of stand water balance in a ponderosa pine forest stand during and after extreme drought. Agricultural and Forest Meteorology, 143(3-4), 266-276.

Veatch, W., Brooks, P. D., Gustafson, J. R., & Molotch, N. P. (2009). Quantifying the effects of forest canopy cover on net snow accumulation at a continental, mid-latitude site. Ecohydrology: Ecosystems, Land and Water Process Interactions, Ecohydrogeomorphology, 2(2), 115-128.

Westerling, Anthony LeRoy. (2016) Increasing western US forest wildfire activity: sensitivity to changes in the timing of spring. Philosophical Transactions of the Royal Society B: Biological Sciences 371.1696, 20150178.

San Juan Snowtography Network Expansion and Regional Analysis

Taxpayer Bill of Rights:

The Taxpayer Bill of Rights (TABOR) may limit the amount of grant money an entity can receive. Please *describe any relevant TABOR issues that may affect your application.*

PROJECT DETAILS:

OVERVIEW

Project Name: **Developing and Implementing Hydrologically-Informed Forest Treatments in Semi-arid Southwestern Colorado**

Project Description:

Southwestern Colorado is experiencing decreased snowpack and increased wildfire, leading the Colorado Water Plan to identify wildfire mitigation as a key action to support thriving watersheds. Likewise the Southwest Basin Implementation Plan recognizes that forest health projects are needed to increase source water protection. As over 70% of our water originates as snow in forested mountains, there is an urgent need to adjust forest management strategies to incorporate interdisciplinary knowledge including hydrology, forestry, and ecology. To address these community needs, we propose generating hydrologically-informed forest treatments in the Dolores watershed, leveraging three years of existing local data to generate high resolution, localized ecohydrologic models of the upper and lower Dolores watershed above McPhee Reservoir. The models will be applied to collaboratively develop and implement hydrologically-informed treatments via funding from COSWAP, install infrastructure necessary to assess the ecohydrologic impacts of these treatments, complete the first year of monitoring, develop protocols for future monitoring and conduct outreach. We will also use existing local datasets to develop a higher elevation forest hydrologic model, which can help improve predictions of snowmelt amount and timing. This proposal represents one of the first efforts to apply locally-informed modeling to design and implement forest treatments that delay snowmelt to enhance soil moisture, fuels moisture, and summer low flows.

Major Water Use Type:
Environmental, Municipal, Agricultural

Type of Water Project:
Study with educational components

Scheduled Start Date – Non-Construction:
Feb 2025 for activities funded my matching dollars only. November 2025 for WPG activities, if funded.

OUTCOMES

Please enter any applicable projected outcomes associated with this project:

Existing Storage Preserved or Enhanced - An intended outcome of this effort is to increase the length of time water is stored in the soil through delayed snowmelt through hydrologically-informed forest treatments. At this time we are unable to predict this in acre-feet.

Area of Restored or Preserved Habitat - This project designs and implements 30 acres of hydrologically-informed forest treatments in the SW Colorado ponderosa pine forests. Pending results, this project has the potential to inform water-saving forest treatments on approximately 50,000 acres of ponderosa pine forest in the Dolores watershed.

Number of Coloradans Impacted by Activity: 28,903 residents of Montezuma and Dolores counties

LOCATION

If the project location is unknown or cannot easily be determined because it cuts across multiple locations/basins, add the latitude and longitude of the main project proponent's headquarters/home office and click the related flag that reads "unknown - the location default used is the project proponents headquarters/home office". However, if the project cuts across multiple locations/basins and an applicable location can be identified, use the location that is most applicable to the project.

Latitude: 37.582778

Longitude: 108.438611

Lat Long Flag:
how location was determined, several options in portal

Water Source:
Upper Dolores watershed above McPhee Reservoir

Water Basins: Dolores River

Counties: Montezuma and Dolores counties

Water Districts (Division of Water Resources):

IPP PROJECT
N/A

FINANCIALS
Grant Request Amount: $849,147

Applicant Cash Match: $290,000
Applicant In-Kind Match: $290,117

Total Other Sources of Funding (not from Applicant):
Colorado DNR COSWAP - $290,000, secured, Cash
USDA-ARS - $122,470 - secured In-Kind
Mountain Studies Institute - $21,740 - secured In-kind
Dolores Water Conservancy District- $49,980 pending In-kind
Dolores Watersheds Collaborative - $50,743 - secured In-kind
University of Arizona - $19,000 - pending In-kind

Past CWCB Grants:
Please describe any past CWCB grant awards associated with this grant application (i.e. grant program, name of project, award amount, award date)

Wildfire Ready Watersheds - Upper Dolores WRAP (Dolores Watersheds Collaborative) - $375,506.00 November 2025

Water Supply Reserve Fund (Mountain Studies Institute) - San Juan Snowtography Network Expansion and Regional Analysis - $48,708.00

FILES
Upload any relevant supporting documentation, please ensure that files are clearly and descriptively named. Any documents required at the time of application submission are indicated below. Templates for Scope of Work, Budget and Schedule for grants can be found under the program specific webpages at https://cwcb.colorado.gov/funding/grants. Other attachments may include: maps, photos, letters of support, feasibility studies, or other relevant documentation.

Scope of Work (As a Word Doc)- required
Budget and Schedule (As an Excel spreadsheet - Complete both tabs)– required
Water Sharing Agreement Supplemental - required only for CSWA category
Engagement and Innovation Supplemental - required only for E&I category

Letters of Matching Third-Party Commitments
Additional Files

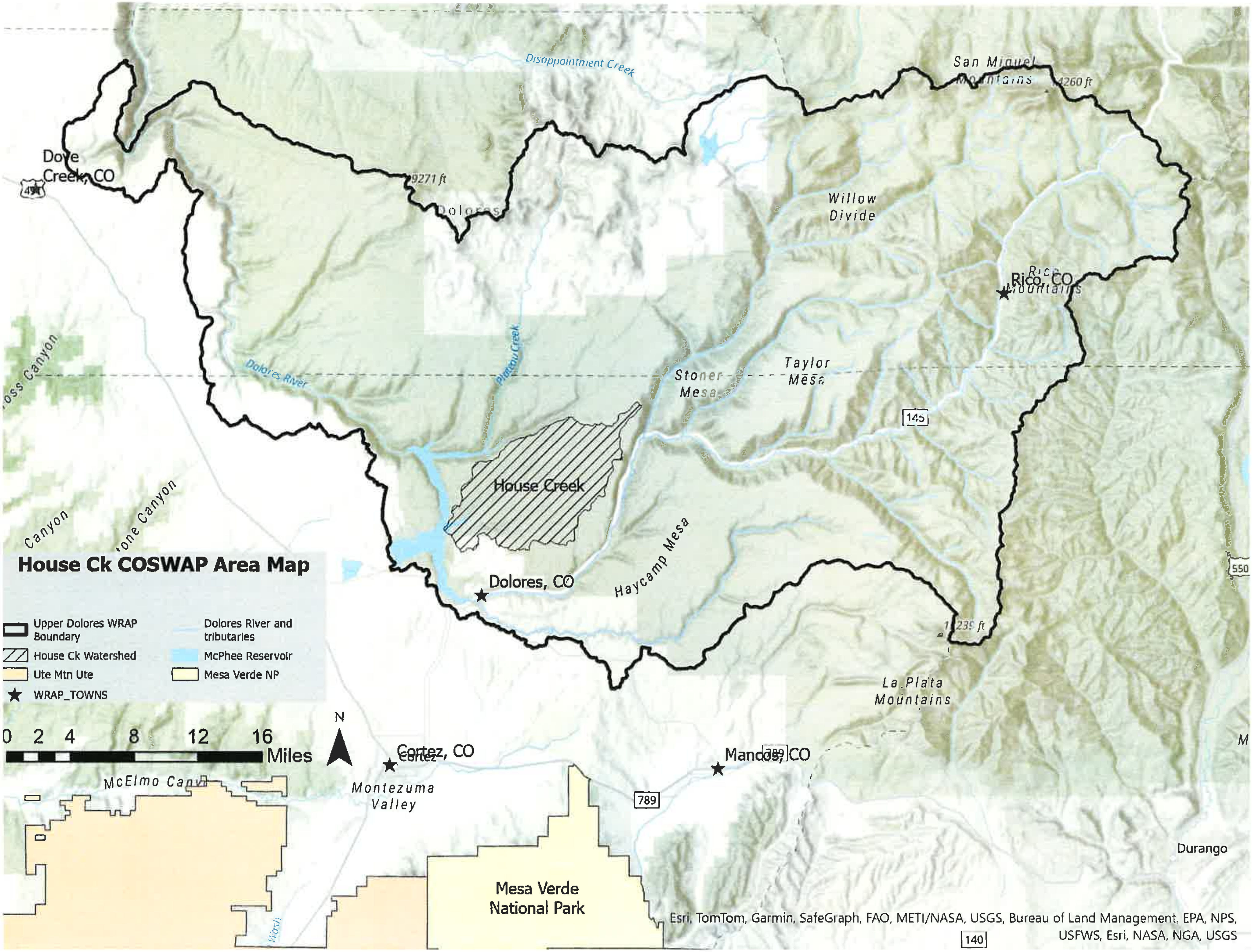
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Colorado Water Conservation Board

Water Plan Grant
Budget and Schedule

Prepared Date: April 17, 2025
Name of Applicant: Dolores Watersheds Collaborative
Name of Water Project: Developing and Implementing Hydrologically-Informed Forest Treatments in Semi-arid
Project Start Date: February 2025
Project End Date: June 2029

Task No.	Task Description	Task Start Date	Task End Date	Grant Funding Request	Match Funding	Total
1	Hire PostDoc, assimilate local data to develop a locally-trained SnowPALM model for mid-elevation ponderosa sites.	Nov 2025	Nov 2027	$ 224,785.00	$ 140,180.00	$364,965
2	Post doc assimilates local data to develop locally trained SnowPalm model for upper elevation forested sites	Aug 2027	Nov 2028	$ 116,152.00	$45,818	$161,970
3	Establish control and standard prescription snowtography stations and forest structure/diversity plots	Sept 2025	Sept 2026	$174,215	$70,511	$244,726
4	Collaboratively select experimental treatment sites and develop hydrologically-informed treatment scenarios, including stakeholder roundtables.	Feb 2025	Nov 2027	$115,652	$37,856	$153,508
5	Timber sale contract for and implement hydrologically-informed treatments	Nov 2027	Oct 2028	$0	$112,650	$112,650
6	Install and implement Post-treatment snowtography and forest structure/diversity assessments	Sep 2028	June 2029	$89,564	$48,496	$138,060
7	Stakeholder Coordination, Facilitation and Education and Outreach	Feb 2025	June 2029	$26,248	$75,280	$101,528
8	Project Management and Adminstration	Feb 2025	June 2029	$25,356	$10,728	$36,084
						$0
	Indirect			$77,197	$38,599	$115,796
			Total	$849,169	$580,117	$1,429,287


House Ck COSWAP Area Map
Upper Dolores WRAP Boundary
House Ck Watershed
Ute Mtn Ute
WRAP_TOWNS
Dolores River and tributaries
McPhee Reservoir
Mesa Verde NP
0 2 4 8 12 16 Miles
N
Dove Creek, CO
Dolores, CO
Cortez, CO
Mancos, CO
Rico, CO
Durango
House Creek
Mesa Verde National Park
San Miguel Mountains
Rico Mountains
La Plata Mountains
Willow Divide
Taylor Mesa
Stoner Mesa
Haycamp Mesa
Montezuma Valley
Disappointment Creek
Dolores River
Plateau Creek
9271 ft
789
145
550
140
Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USFWS, Esri, NASA, NGA, USGS