COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Colorado Water Conservation Board

Water Plan

Water Project Summary

Name of Applicant	San Miguel Watershed Coalition
Name of Water Project	Integrated Hydrological Modeling of the San Miguel Watershed: A modern tool for water resource evaluations
Grant Request Amount	**$150,000.00**
Primary Category	$150,000.00
Conservation & Land Use Planning	
Total Applicant Match	**$14,000.00**
Applicant Cash Match	$0.00
Applicant In-Kind Match	$14,000.00
Total Other Sources of Funding	**$86,500.00**
San Miguel County	$10,000.00
Colorado School of Mines	$10,000.00
Montrose County	$10,000.00
Town of Mountain Village	$10,000.00
Town of Ophir	$1,000.00
Town of Telluride	$10,000.00
Southwestern Water Conservation District	$30,000.00
Town of Naturita	$500.00
Fort Lewis College	$2,500.00
Town of Norwood	$2,500.00
Total Project Cost	**$250,500.00**

Applicant & Grantee Information

Name of Grantee: San Miguel Watershed Coalition
Mailing Address: PO Box 1601 Telluride CO 81435
FEIN: 841,500,508

Organization Contact: Adrian Bergere
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Grant Management Contact: Adrian Bergere
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Description of Grantee/Applicant

The San Miguel Watershed Coalition (SMWC) is an independent 510(c)(3) nonprofit organization established in Telluride, Colorado, in 1997. SMWC works to maintain and improve the ecological health of all 80 miles of the

free-flowing San Miguel River. SMWC conducts and facilitates river projects, provides community education opportunities, and conducts water quality testing. SMWC engages stakeholders from throughout the 1,550 square mile watershed—from the western San Juan Mountains to the slick rock canyons of the West End—to participate in collaborative efforts that promote our river's health and the economic vitality of our watershed's communities.

Type of Eligible Entity

- ☐ Public (Government)
- ☐ Public (District)
- ☐ Public (Municipality)
- ☐ Ditch Company
- ☐ Private Incorporated
- ☐ Private Individual, Partnership, or Sole Proprietor
- ■ Non-governmental Organization
- ☐ Covered Entity
- ☐ Other

Category of Water Project

- ☐ Agricultural Projects
  Developing communications materials that specifically work with and educate the agricultural community on headwater restoration, identifying the state of the science of this type of work to assist agricultural users among others.
- ■ Conservation & Land Use Planning
  Activities and projects that implement long-term strategies for conservation, land use, and drought planning.
- ☐ Engagement & Innovation Activities
  Activities and projects that support water education, outreach, and innovation efforts. Please fill out the Supplemental Application on the website.
- ☐ Watershed Restoration & Recreation
  Projects that promote watershed health, environmental health, and recreation.
- ☐ Water Storage & Supply
  Projects that facilitate the development of additional storage, artificial aquifer recharge, and dredging existing reservoirs to restore the reservoirs' full decreed capacity and Multi-beneficial projects and those projects identified in basin implementation plans to address the water supply and demand gap.

Location of Water Project

Latitude	38.130660
Longitude	-108.305987
Lat Long Flag	Stream location: Coordinates based on general location on stream
Water Source	Coordinates based off San Miguel Watershed centroid. Water source: San Miguel
Basins	Southwest
Counties	Montrose; San Miguel
Districts	60-San Miguel River Basin

Water Project Overview

Major Water Use Type	Agricultural
Type of Water Project	Planning (e.g. watershed)

Scheduled Start Date - Design
Scheduled Start Date - Construction
Description
As identified by the Southwest Basin Implementation Plan (SWBIP) and the Environmental and Recreational Needs Assessment of the San Miguel watershed, the San Miguel mainstem and tributary flows are susceptible to significant decreases in water availability, impacting agricultural, municipal, industrial, and recreational water needs. To meet these declines in water supply, the San Miguel Watershed Coalition (SMWC) and its stakeholders have identified a need to implement conservation management actions that create climate and drought resilient water supplies.
To inform decisions around which conservation management actions to prioritize, SMWC proposes to develop an integrated hydrologic/hydraulic tool that can be used to quantify changes in water availability under a changing climate, simulate the hydrologic response to wildfire and wildfire mitigation, evaluate the effectiveness of conservation efforts, and simulate other water management actions.
To enhance water education and innovation within the region, SMWC will create an internship with a Colorado-based university to train students in integrated modeling through hands-on experience and will host a workshop at the end of the project; both tasks are aimed at recruiting and retaining a skilled regional workforce. Additionally, this tool will be hosted by SMWC and will be available to any stakeholder to further understand water resource issues of interest in the San Miguel watershed.
Our proposed work directly supports goals A1, A2, A3, B2, B3, C1, C3, D2, E2, F3, and G3 of the 2022 SWBIP.

Measurable Results

New Storage Created (acre-feet)
New Annual Water Supplies Developed or Conserved (acre-feet), Consumptive or Nonconsumptive
Existing Storage Preserved or Enhanced (acre-feet)
New Storage Created (acre-feet)
Length of Stream Restored or Protected (linear feet)
Efficiency Savings (dollars/year)
Efficiency Savings (acre-feet/year)
Area of Restored or Preserved Habitat (acres)
Quantity of Water Shared through Alternative Transfer Mechanisms or water sharing agreement (acre-feet)
Number of Coloradans Impacted by Incorporating Water-Saving Actions into Land Use Planning
7,500 Number of Coloradans Impacted by Engagement Activity
Other
This project will create a highly effective tool to quantify water availability under a changing climate, allow water resource managers and stakeholders to test conservation strategies, evaluate the impacts of land use change on hydrology, improve fluvial hazard mapping, and address many other hydrologic issues. The watershed has 37,000 acres of irrigated land. The total area of the watershed is 1,560 mi2. The total population of the watershed is ~7500 people.

Water Project Justification

Our proposed work directly supports goals A1, A2, A3, B2, B3, C1, C3, D2, E2, F3, and G3 of the 2022 SWBIP. Both the Southwest Water Plan and the Southwest Basin Implementation Plan (SWBIP) note, the San Miguel watershed leans heavily on its robust agricultural communities and currently lacks water storage capacity compared to other subbasins (Section 5 of the 2022 SWBIP, Section 4.9.2 of the Colorado Water Plan). The Southwest region of Colorado has a pressing need to develop tools, measures, and actions that will assist with water conservation and drought planning while ensuring a viable economy and an intact ecosystem. Southwest Colorado has recently experienced first-hand the negative impacts of drought on the economic wellbeing of its

communities. This last year, many major river systems in the area saw the lowest flows on record, and the U.S. Drought Monitor listed the region as being in exceptional drought -- the highest category possible. As a result of the drought, ranchers and farmers needed to sell large parts of their herds and grow more drought-resistant crops. In addition to the lack of storage, the SWBIP also illustrates that the gap between water need and water availability for agricultural communities in the San Miguel basin is expected to grow with the current trend of decreased precipitation. Communities of the San Miguel watershed want to protect water resources across all sectors (agriculture, recreation, environment, municipal, industry). It is imperative to conserve water across the sectors to preserve the economic and environmental wellbeing of the basin and strive to meet Instream Flow appropriations. Goal D2 of the SWBIP notes the challenge of understanding and supplying the needs of multiple users, as environmental and recreational water supply needs were not quantified at the same level as agriculture before the Environmental and Recreational Needs Assessment (Lotic Hydrological, 2021).

The need for a robust tool to address water conservation and drought planning has also been identified by The San Miguel Partnership (the Partnership) which was a Southwest Basin Roundtable (SWBRT) subcommittee created to develop an E&R Needs Assessment in the San Miguel Watershed. The goal of the Partnership was to quantify E&R needs and identify top priority, multi-benefit projects in the watershed. The need for quantification and increased stakeholder input at the watershed scale was identified by the 2010 E&R needs assessment as part of the Statewide Water Supply Initiative (SWSI), the 2015 Colorado Water Plan, and the 2015 SWBIP. The Partnership's E&R Needs Assessment (Lotic Hydrological, 2021) is a comprehensive technical document created to understand gaps in water quantity data in the San Miguel watershed. The Needs Assessment quantified basic surface water needs based on future climate and growth alternatives without quantifying groundwater's role in the system. SMWC proposes to build and calibrate a more robust, powerful tool to be housed internally, for use in advancing the Partnership and SMWC projects that require more comprehensive modeling of water availability, climate, and hazards. The Partnership specifically mentions Integrated Hydrological Modeling of the San Miguel Watershed as a project to be moved toward the SWBRT IPP list with the specific goal of supporting a number of other identified projects on the list including:

- Wrights Mesa Drought Contingency Planning
- Streamflow Gauge Network Support
- Real-time Water Temperature Monitoring Program
- CC-Highline Ditch Infrastructure Improvements
- Floodplain Restoration Opportunity Inventory
- Invasive Riparian Vegetation Control
- Investigate Creative Water Use Agreements to Protect Fish

Although the recent Environmental and Recreational Needs Assessment report by Lotic Hydrological (2021) found the San Miguel watershed to be currently functioning well, they noted that it is at serious risk of hydrologic depletion due to climate change. Lotic noted that baseflows and overall groundwater contributions to the San Miguel River are not understood or quantified by current models. Existing tools do not provide the groundwater and climate-driven surface water dynamics needed. Additionally, the Colorado Water Plan and SWBIP (CWP, 9-42,43; SWBIP Goals: B2, B3, E2, F2, F3) identified the need for an integrated understanding of ecohydrologic interactions and watershed resilience to climate change as a "cross-sector challenge" (SWBIP, p.13). These issues and others identified by community members and stakeholders in the basin point to a clear need to develop advanced tools that are accessible to the community to quantify current and projected water availability and demands. Having an accessible, living hydrologic tool will allow stakeholders and resource managers to evaluate innovative conservation solutions to ensure that the basin is using the most effective measures to become climate resilient.

Through the development of a fully integrated groundwater-surface water modeling tool, the water availability throughout the basin will be understood at a high temporal and spatial resolution under varying climatic scenarios. The first step toward an effective conservation and drought contingency plan is understanding how the system will respond to varying levels of drought. Such an understanding directly supports identified community needs by quantifying water availability under projected future climate conditions and allowing for testing of

innovative conservation strategies across sectors, innovative ways to expand storage, and more efficient ways to transport and maintain water in the system (Goals A1, B3, B4, and C3 of the SWBIP). A tool as capable as MIKESHE, housed locally by a non-profit, will allow stakeholders to evaluate the viability of proposed solutions to balance the demands among agriculture, municipal, industrial, and environmental sectors that will allow the community to plan for current and future demands (Goal C1 of the SWBIP).

In addition to understanding water availability under a changing climate, the community identified, as part of the River Restoration study, a clear need to quantify the hydrologic response to wildfire and wildfire mitigation (San Miguel Watershed Coalition, 2022). As part of the proposed study, SMWC plans to create and run a high-resolution model of the Beaver Creek sub-watershed to evaluate the potential impacts of wildfire and wildfire mitigation. The result of the sub-watershed model will help quantify the hydrologic impacts of wildfire mitigation and allow the community to select adaptive and climate resilient management strategies (Goals E2, F3, and G2 of the SWBIP).

SMWC intends this tool be accessible to stakeholders while ensuring that a skilled labor force will be available to use it in the future. To achieve this goal, SMWC will be partnering with Colorado School of Mines to train a graduate student intern on model. Additionally, SMWC in partnership with Colorado-based universities, will host a local and remotely available workshop on integrated hydrologic modeling and the results of our study. The goals of the workshop will be to showcase our results, share knowledge and experience, and inspire and recruit future water resource managers. These goals aim to build the labor pool while helping create a water-fluent public (Goal A3 of the SWBIP).

The MIKESHE code was selected for multiple reasons to address conservation and drought planning needs. Currently, no existing tools or hydrologic models have been developed that are capable of evaluating the broad range of local- to regional-scale water resource issues in the San Miguel River watershed at an appropriate level of surface and subsurface detail and with physical processes. Although a StateMod model has already been created for the watershed, MIKESHE is a much different type of code, but the respective models are considered complementary and can support each other.

MIKESHE is able to simulate complex subsurface flows, storage, and stream-aquifer dynamics (especially groundwater baseflows) that are essential for predicting how physically realistic future changes in land use and climate will impact the system. Importantly, MIKESHE is driven by external, distributed, event-level (hourly) weather inputs (air temperature, precipitation, reference evapotranspiration), which permits evaluation of changes to important simulated hydrologic variables (i.e., groundwater heads, seep/spring discharge, snowpack/snowmelt, stream stage/flow) due to, for example, the changing climate.

To help determine the feasibility of constructing a functional fully integrated model for the San Miguel watershed, we obtained some essential datasets (i.e. topography, surficial geology, surface flow gage data, groundwater wells, and drainage network) and constructed a preliminary model framework as shown on Map 3 in the attached maps document. We believe an adequate dataset exists to construct and calibrate the model.

Evaluating alternative conservation or land use mitigation strategies, especially at a local scale, is challenging without first developing a capable tool. MIKESHE is a robust and versatile tool that can be easily run and modified to answer a multitude of questions. The tool is able to simulate a wide range of managed crop types, crop rotations, irrigation diversions, and water irrigation strategies that will allow users to quantify land use impacts on water availability. It simulates a broad range of hydraulic structures and urbanization, which permits users to evaluate innovative conservation approaches and designs and associated risks to infrastructure and the ecosystem. It is capable of simulating the fate and transport of pollutants in streams and aquifer systems, allowing the user to understand how to best mitigate the long-term impacts of mining and other pollutant inputs. MIKESHE uses rigorous, physically based solutions that are essential for correctly simulating and evaluating engineering designs, operations, and impacts (i.e., dams, diversions, culverts, gates etc.). A key feature of the MIKESHE and MIKEHydro codes is their graphical user interface (GUI), which facilitates faster model development, and, importantly, accessible visualization of inputs and outputs that allows functional use by non-experts. In other words, once the model is built, SMWC and/or stakeholders can visualize and run simulations with different inputs.

The community has identified the importance of developing the MIKESHE tool to pursue stakeholder-identified projects and understand long-term water availability due to its extensive capabilities, accessibility, and its ability to simulate a large number of environmental scenarios. The level of interest is apparent by the list of projects requested to be run after initial development of the tool. Requested future projects included (San Miguel Partnership, 2022; San Miguel Watershed Coalition, 2022):

- Wrights Mesa Drought Contingency Planning
- Streamflow Gauge Network Support
- Real-time Water Temperature Monitoring Program
- CC-Highline Ditch Infrastructure Improvements
- Floodplain Restoration Opportunity Inventory
- Invasive Riparian Vegetation Control
- Investigate Creative Water Use Agreements to Protect Fish
- Post-fire hazard planning and mitigation along the San Miguel and its tributaries and the HWY 145 corridor.

Finally, MIKEHydro (a complementary tool to MIKESHE) is a FEMA-approved package for riverine floodplain delineation. Although not a part of this work, the MIKESHE tool we are proposing to build here could in the future be combined with more detailed channel and valley cross section measurements to build a foundation for improved Fluvial Hazard Zone delineations. Specifically, both scenarios our team will run -- impact of climate change on baseflow and water availability, and the hydrologic response to wildfire and wildfire mitigation – could be used to generate inundation maps that are representative of future hydrologic conditions. These scenarios could provide a new dimension to CWCB's ongoing Fluvial Hazard Zone delineation protocol that more comprehensively addresses future riverine flood risks.

A compilation of the references cited in the proposal is presented as Appendix A.

Related Studies

The Integrated Hydrological Modeling of the San Miguel Watershed: A modern tool for water resource evaluations project will be complementary to the following studies:

- State of the San Miguel Watershed Report, 2020 (Climate, Water Quality, Water Quantity, Vegetation, Soils & Habitat Restoration, Development, Recreation and Tourism, Production)
- San Miguel River Restoration Study, 2022 (Section 02, 05).

The project will assist the objectives/initiatives identified by the following studies/documents and projects on the SWBRT's IPP list:

- San Miguel Environmental and Recreational Needs Assessment, Section 3.2.1, 3.3.1,
- Southwest Basin Implementation Plan, 2022 (Sections A1, A2, A3, B2, B3, C1, C3, D2, E2, F3, and G3)
- Southwest Basin Implementation Plan List:

o The Norwood Water Commission's proposed development of the Town of Norwood's 5 CFS conditional water right out of the San Miguel would travel in a pipeline following the existing utilities right of way up Beaver Creek Canyon and on to Wrights Mesa.

o Town of Ophir investigation of methods to provide for the long term water supply possibly including diversion and storage facilities. Town of Ophir is interested in using MIKESHE modeling to understand long-term water availability in Waterfall Creek, the town's municipal water source.

o Understand baseflow conditions to inform the proposed instream flow on lower Naturita Creek. Instream flow protection has been proposed for lower Naturita Creek because it provides spawning habitat for flannelmouth sucker, bluehead sucker, and roundtail chub. In addition, Naturita Creek provides year-round habitat for speckled dace. An instream flow right could potentially protect agricultural lands and deliver water to downstream users on the San Miguel River.

- San Miguel Partnership Strategies and Initiatives for Meeting San Miguel Water Use Needs

o Integrated Hydrological Modeling of the San Miguel Watershed is listed as number 12 on this list of projects

developed by the San Miguel Partnership (Partnership). The Partnership felt that Hydrological Modeling will be especially useful in advancing the goals of project numbers 1, 10, 11, and 13. Advanced integrated hydrological modeling may also be used to advance project numbers 14, 15 and 16 (See Appendix C for the full list of projects and details):

- 1: Wrights Mesa Drought Contingency Planning
- 10: Streamflow Gauge Network Support
- 11: Real-time Water Temperature Monitoring Program
- 13: CC-Highline Ditch Infrastructure Improvements
- 14: Floodplain Restoration Opportunity Inventory
- 15: Invasive Riparian Vegetation Control
- 16: Investigate Creative Water Use Agreements to Protect Fish.

A compilation of the references cited in the proposal is presented as Appendix A.

Taxpayer Bill of Rights

No Tax Bill of Rights provided