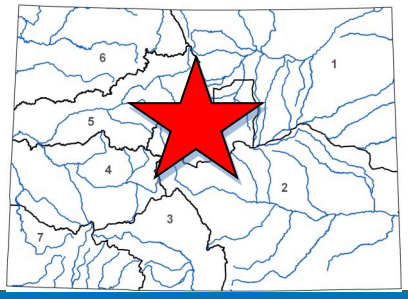
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Pacific Institute for Studies in Development, Environment and Security Diversifying Colorado's Water Portfolio:The Potential for Stormwater Capture and Use to Contribute to a Water Resilient Future

September 2022 Board Meeting

Water Plan Grant Application



LOCATION	
County/Counties:	Statewide
Drainage Basin:	Statewide

DETAILS	
Total Project Cost:	$299,635.35
Water Plan Grant Request:	$209,744.75
Recommended Amount:	$209,744.75
Other CWCB Funding:	$0
Other Funding Amount:	$
Applicant Match:	$89,890.60
Project Type(s): Planning/Study	
Project Category(Categories): Conservation and Land Use Planning	
Measurable Result: 4,900,000 Number of Coloradans Impacted by Incorporating Water-Saving Actions into Land Use Planning; Coloradans Impacted by Water Saving, New Supply developed, Efficiency Savings (%/Year), and Efficiency Saving (AF/Year). These metrics are key deliverables and embedded within the project's objectives.	

In April 2022, at a stormwater capture and use (SCU) convening hosted by ReNUWIt (Re-Inventing the Nation's Urban Water Infrastructure, a program of the National Science Foundation), the Water Research Foundation, and the Colorado School of Mines in Denver, Colorado, attendees identified a lack of information on the following aspects of SCU as a key barrier to scaled adoption in Colorado:
1. Baseline knowledge of the average volume of stormwater available to capture and use and the extent to which this strategy could be scaled across river basins.
2. Water rights and other conditions that affect the viability of SCU as a strategy for augmenting municipal water supplies.
3. The economic benefits of SCU, when employed as a scaled strategy.

Urban stormwater capture and use (SCU) in Colorado is an opportunity to develop and scale untapped water supplies, for the purpose of diversifying its water portfolio. It is a key strategy to help communities adapt to more variable precipitation patterns, as is expected to occur with climate change. This innovative project will provide a volumetric and economic assessment of the potential of urban SCU in Colorado, as defined within existing water law.

The five main objectives of this project include:
1. Quantify the untapped potential of urban SCU in Colorado, as allowed, and defined within existing water law. This analysis will be refined to reflect the potential in each of Colorado's eight river basins and the Denver metropolitan area.
2. Highlight existing examples where urban SCU have been employed successfully in the state and underscore the multiple benefits gained through this strategy.
3. Identify and monetize the overarching, multiple benefits associated with SCU.
4. Engage with and learn from an Expert Review Panel comprised of practitioners representing the following fields: academia, agriculture, Colorado water law, economics, public office, utilities, research and water quality scientists, and water supply planners.
5. With guidance from the Expert Review Panel, ensure we are reaching target audiences, to present the findings of this project and collaborate with the panel to socialize the idea of urban SCU within Colorado.

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Colorado Water Conservation Board

Water Plan

Water Project Summary

Name of Applicant	Pacific Institute for Studies in Development, Environment & Security
Name of Water Project	Diversifying Colorado's Water Portfolio: The Potential for Stormwater Capture and Use to Contribute to a Water Resilient Future
Grant Request Amount	**$209,744.75**
Primary Category	$209,744.75
Conservation & Land Use Planning	
Total Applicant Match	**$89,890.60**
Applicant Cash Match	$44,945.30
Applicant In-Kind Match	$44,945.30
Total Other Sources of Funding	**$35,000.00**
Gates Family Foundation	$15,000.00
The Water Research Foundation	$10,000.00
Adolph Coors Foundation	$10,000.00
Total Project Cost	**$334,635.35**

Applicant & Grantee Information

Name of Grantee: Pacific Institute for Studies in Development, Environment & Security
Mailing Address: 344 20th Street Oakland CA 94612
FEIN: 943,050,434

Organization Contact: Shannon Spurlock
Position/Title: Senior Researcher - Public Policy & Practice Uptake
Phone: 303-875-2249
Email: sspurlock@pacinst.org

Organization Contact - Alternate: Anne Thebo
Position/Title: Senior Researcher
Phone: 510-251-1600
Email: athebo@pacinst.org

Grant Management Contact: Shannon Spurlock
Position/Title: Senior Researcher - Public Policy & Practice Uptake
Phone: 303-875-2249
Email: sspurlock@pacinst.org

Grant Management Contact - Alternate: Nareeya Nalivka
Position/Title: Finance Manager
Phone: 510-251-1600 x 113
Email: nnalivka@pacinst.org

Description of Grantee/Applicant

The Pacific Institute creates and advances solutions to the world's most pressing challenges.

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	39.765381
Longitude	-105.029221
Lat Long Flag	Default/Proponent headquarters: If the location cannot be defined with flags above, use location of project proponent headquarters
Water Source	This project aims to quantify and monetize the potential for urban stormwater capture and use (SCU) as a means of understanding if urban SCU can significantly diversify Colorado's water portfolio and minimize the supply demand gap.
Basins	Arkansas; Colorado; Gunnison; Metro; Yampa/White/Green; Rio Grande; South Platte; Southwest; Nort...
Counties	
Districts	

Water Project Overview

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

Scheduled Start Date - Design 12/1/2022
Scheduled Start Date - Construction

Description

Urban stormwater capture and use (SCU) in Colorado is an opportunity to develop and scale untapped water supplies, for the purpose of diversifying its water portfolio. It is a key strategy to help communities adapt to more variable precipitation patterns, as is expected to occur with climate change. This innovative project will provide a volumetric and economic assessment of the potential of urban SCU in Colorado, as defined within existing water law.

Key objectives include:

1. Quantifying the volumetric potential of urban SCU in Colorado.
2. Highlighting examples where urban SCU has been employed in Colorado and delineate the associated multi-benefits.
3. Identifying and monetizing the multiple benefits associated with urban SCU.
4. Engaging with and learning from an Expert Review Panel comprised of practitioners representing these fields: academia, agriculture, Colorado water law, utilities, research and water quality scientists, and water supply planners.
5. Presenting project findings and collaborating with the panel to socialize the idea of urban SCU within Colorado.

This analysis will reflect the potential in each of Colorado's eight river basins and the Denver metropolitan area.

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)
4,900,000	Number of Coloradans Impacted by Incorporating Water-Saving Actions into Land Use Planning
	Number of Coloradans Impacted by Engagement Activity

Other

Diversifying Colorado's Water Portfolio: The Potential for Stormwater Capture and Use to Contribute to a Water Resilient Future is an innovate project whose aim is to provide outcomes for the following areas: Coloradans Impacted by Water Saving, New Supply developed, Efficiency Savings (%/Year), and Efficiency Saving (AF/Year). These metrics are key deliverables and embedded within the project's objectives. The project team looks forward to providing measured and monetized outcomes so that water and land use planners in Colorado will be informed about the untapped potential of urban stormwater capture and use.

Water Project Justification

In March 2022, the US EPA published the report, Pure Potential: The Case for Stormwater Capture and Use (SCU), which contained a clear call to advance the strategy of stormwater capture and use (SCU). They stated, "SCU, whether at an onsite, community, or watershed scale, offers an adaptive, multi-benefit approach to stormwater management that can create long-term, positive outcomes and contribute to the development of sustainable and climate-resilient communities (US EPA, 2022)."

Subsequently, in April 2022, at a SCU convening hosted by ReNUWIt (Re-Inventing the Nation's Urban Water Infrastructure, a program of the National Science Foundation), the Water Research Foundation, and the Colorado School of Mines in Denver, Colorado, attendees identified a lack of information on the following aspects of SCU as a key barrier to scaled adoption in Colorado:
1. Baseline knowledge of the average volume of stormwater available to capture and use and the extent to which this strategy could be scaled across river basins.
2. Water rights and other conditions that affect the viability of SCU as a strategy for augmenting municipal water supplies.
3. The economic benefits of SCU, when employed as a scaled strategy.

Following the EPA's publication and the findings of the SCU Colorado convening, the proposed project, Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future, was born. The five main objectives of this project include:
1. Quantify the untapped potential of urban SCU in Colorado, as allowed, and defined within existing water law. This analysis will be refined to reflect the potential in each of Colorado's eight river basins and the Denver metropolitan area.
2. Highlight existing examples where urban SCU have been employed successfully in the state and underscore the multiple benefits gained through this strategy.
3. Identify and monetize the overarching, multiple benefits associated with SCU.
4. Engage with and learn from an Expert Review Panel comprised of practitioners representing the following fields: academia, agriculture, Colorado water law, economics, public office, utilities, research and water quality scientists, and water supply planners.
5. With guidance from the Expert Review Panel, ensure we are reaching target audiences, to present the findings of this project and collaborate with the panel to socialize the idea of urban SCU within Colorado.

This innovative project will clarify and provide a baseline understanding of the untapped potential of urban SCU in Colorado. Measuring and monetizing the potential for urban SCU in Colorado meets four overarching measurable objectives of the Colorado Water Plan (CWP) (Colorado Water Conservation Board, Department of Natural Resources, 2015):
By 2025, 75% of Coloradans will live in communities that have incorporated water-saving actions into land-use planning (Land Use measurable objective)
By 2050, achieving 400,000 acre-feet of municipal and industrial water conservation. (Conservation measurable objective)
By 2030, reducing the projected 2050 municipal and industrial gap from as much as 560,000 acre-feet to zero acre-feet (Supply-Demand Gap measurable objective)
Improving the level of public awareness and engagement regarding water issues statewide (Education, Outreach, and Innovation measurable objective)

Additionally, this project is likely to positively promote the following strategies outlined by the Statewide Education Action Plan (SWEAP) (Water Education Colorado, 2020):
Outcome 1: The proportion of Coloradans in each basin who can identify how water supports their quality of life, as well as the threats to and potential solutions for a sustainable water supply, increases.
Outcome 3: The proportion of Coloradans in each river basin who report confidence in having the knowledge necessary to take an active role in water stewardship in their community increases.
Outcome 5: Increased participation in community discourse and decision processes about water at the state, regional, and local levels.
Outcome 6: Voters have access to factual information that addresses potential impacts to sustainable water resources in relevant issue areas.
Outcome 7: Increased proportion of Coloradans in each river basin that are demonstrating sustainable water

behaviors.
Outcome 8: Where relevant, local and state policies and practices are supportive of advancing statewide water literacy.
Outcome 9: Where relevant, local and state policies, regulations, and practices demonstrate a consideration of impacts on sustainable water resources.

Should this project determine that urban SCU is a strategy that offers compelling benefits and can be scaled under existing law, a framework for water professionals will be provided that outlines the volumetric potential by basin and for the Denver metro area, the legal context and constraints, identification of potential co-benefits from existing SCU projects in the state, and monetary benefits of employing urban SCU at scale in one or two basins. Notably, these outcomes will impact each of the Basin Roundtables and inform how they are able to meet their identified needs and gaps. Specifically, the selected roundtable priorities and goals below directly align with the aims and objectives of the project, Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future. It is important to note that there is variation in the certainty in the degree to which urban SCU will impact these goals, however, the project itself will directly quantify and articulate the degree to which many of these priorities and goals could be impacted by urban SCU.

Arkansas Basin Roundtable
The proposed project complements goals across several priority areas:
Municipal & Industrial Goals:
Meet the Projected Municipal Supply Gap in each subregion within the Basin.
Support regional efforts for cost-effective solutions to local water supply gaps.
Reduce groundwater dependence on unsustainable aquifers for municipal users.
Develop collaborative solutions between municipal, agricultural, and E&R users of water, particularly in drought conditions.
Agricultural Goals:
Support projects within and outside the Basin that will help meet the Arkansas Basin Agriculture water supply gap, maintain existing supplies, better manage vulnerable supplies, and maximize utilization of water users' entitlements.
Sustain recreation and environmental activities that depend on habitat and open space associated with farm and ranch land.
Environment & Recreation Goals:
Support projects and programs within and outside the Basin that protect Arkansas Basin E&R water supply needs and collaborate with municipal and ag users to enhance E&R values.
Maintain or improve native fish populations, restore habitat for fish species, and maintain or improve recreational fishing opportunities.
Maintain or improve aquatic, riparian, and avian habitat (including wetlands) that would support environmental features and recreational opportunities
Watershed Health Goals:
Maintain, improve, or restore critical water supply watersheds that could affect Arkansas Basin water uses and environmental and recreational values.
Improve water quality as it relates to the environment and/or recreation.
(Arkansas Basin Roundtable, 2021)

Colorado River Basin Roundtable
Overarching Goals: Address shortages in the headwaters area & Ensure adequate water supply for future needs (municipal and Industrial, including energy development)
Municipal & Industrial Goals: Encourage a high level of basinwide conservation & Develop local water conscious land use strategies

Environment & Recreation Goals: Protect and restore streams, rivers, lakes and riparian areas & A thriving basin economy
Watershed Health Goals: Improving water quality
(Colorado Basin Implementation Plan, 2022)

North Platte Basin Roundtable
Of the eight stated basin goals, this project complements the following five:
Maintain and maximize the consumptive use of water permitted in the Equitable Apportionment Decree and the baseline depletion allowance in Colorado's Plan for Future Depletions
Increase economic development and diversification through strategic water use and development
Continue to restore, maintain, and modernize critical water infrastructure to preserve current uses and increase efficiencies
Maintain healthy rivers and wetlands through the strategic implementation of projects that meet prioritized environmental and recreational needs
Support the continued development of local municipal infrastructure and water supplies
(North Platte Basin Roundtable, 2022)

Rio Grande Basin Roundtable
This project complements four of the five stated goals:
Healthy watersheds that provide critical ecosystem services, resiliency, improve water quality, and enhance local wildlife habitats
Aquifers with sustainable supplies of groundwater
Vibrant and resilient agriculture, recreation, municipal, and industrial economies
Adaptive, flexible, and creative water administration
(Rio Grande Basin Roundtable, 2022)

South Platte Basin & Metro Roundtables
This project complements seven of the 12 stated goals:
Maximize development of native South Platte supplies
Maintain and promote municipal and industrial conservation and efficiency
Maintain and promote reuse
Protect and enhance watershed function
Protect and enhance environmental attributes
Protect and enhance recreational attributes
Support collaborative development and management of supply options outside of the South Platte Basin
(South Platte Basin Implementation Plans, 2022)

Southwest Basin Roundtable
This project complements five of the seven stated goals:
Balance all needs and reduce conflict
Meet municipal and industrial water needs
Meet recreational water needs
Meet environmental water needs
Promote healthy watersheds
(Southwest Basin Roundtable, 2022)

Yampa/White Basin Roundtable
This project complements three of the eight stated goals:
Identify and address M&I water shortages

Quantify and protect environmental and recreational water uses
Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses
(Yampa/White Basin Implementation Plan, 2022)

Finally, the CWP Conservation & Land Use Project Grants put forth the criteria and considerations outlined below. Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future provides the means with which to address each of these considerations. Through measuring the volumetric potential of urban SCU, it is possible to understand if this strategy is significant enough to scale; by understanding the monetary benefits and identifying co-benefits, water professionals and planners can better understand if this strategy may be beneficial for their community. Finally, by couching this research and analysis within existing Colorado water law, a framework will be provided that may support the scaling of urban SCU, which will contribute to the diminishing of the M&I supply-demand gap as well as promoting inherent co-benefits such as improved water quality, environmental restoration, and flood mitigation.

This project meets and/or exceeds the intent behind the vast majority of these prompting questions. Through this project, there is the opportunity to:
Reduce overall future water needs through cost-effective water efficiency measures;
Implement actions identified in locally adopted water conservation, efficiency or drought management plans;
Integrate water efficiency planning and projects into overall water resource management;
Promote a water efficiency ethic throughout Colorado;
Explore additional water reuse options;
Integrate land use and water planning;
Advance drought mitigation planning efforts; and
Reduce impacts and prepare for the impacts of climate change.

Works Cited

Arkansas Basin Roundtable. (2021, April 12). Basin Implementation Plan (BIP). Retrieved from Arkansas Basin Roundtable: http://www.arkansasbasin.com/uploads/1/3/4/7/134740843/arkansas_basin_bip_revised_goals_actions_4-12-21_.p

Colorado Basin Implementation Plan. (2022, January). Retrieved from Colorado Water Conservation Board: https://ehq-production-us-california.s3.us-west-1.amazonaws.com/d7dc9e86e8ce465813264d35e670d9a0dbcb45b

Colorado Basin Roundtable. (2019, May 31). About the Colorado Basin Roundtable. Retrieved from Colorado Basin Roundtable: https://www.coloradobasinroundtable.org/about/

Colorado Water Conservation Board, Department of Natural Resources. (2015). Colorado's Water Plan: Collaborating on Colorado's Water Future. Denver: Colorado Water Conservation Board, Department of Natural Resources.

North Platte Basin Roundtable. (2022, January). North Platte Basin Implementation Plan. Retrieved from Colorado Water Conservation Board: https://ehq-production-us-california.s3.us-west-1.amazonaws.com/58254476f9fbb3c1f517429fdb390ac1834cfe92/c

Rio Grande Basin Roundtable. (2022, January). Rio Grande Basin Implementation Plan. Retrieved from Colorado Water Conservation Board: https://ehq-production-us-california.s3.us-west-1.amazonaws.com/f4544b76b3a8eb1d32722142ef500fce2bc94306/

South Platte Basin Implementation Plan. (2022, January). Retrieved from Colorado Water Conservation Board: https://ehq-production-us-california.s3.us-west-1.amazonaws.com/73aaf9ea5b5a75ec1b67c28a8b753fd300a0624c

Southwest Basin Roundtable. (2022, January). Southwest Basin Implementation Plan. Retrieved from Colorado Water Conservation Board: https://ehq-production-us-california.s3.us-west-1.amazonaws.com/c396161af87ab9b46e856153b2ea1b3d033df933

US EPA. (2022). Pure Potential: The Case for Stormwater Capture and Use. Washington, D.C.: US EPA. Retrieved from https://www.epa.gov/system/files/documents/2022-03/wrap-pure-potential-report.pdf

Water Education Colorado. (2020, May 15). Statewide Water Education Action Plan: A Common Agenda for Water Education's Role in Achieving Sustainable Water for Colorado by 2050. Retrieved from www.watereducationcolorado.org: https://www.watereducationcolorado.org/wp-content/uploads/2020/01/StatewideWaterEducationActionPlan_Execut

Yampa/White Basin Implementation Plan. (2022, January). Basin Implementation Plans. Retrieved from Colorado Water Conservation Board: https://ehq-production-us-california.s3.us-west-1.amazonaws.com/f8cb9e3a28a784970f44ee46255ecc779d145eaf/

Related Studies

Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future builds on projects approved by the Colorado Water Conservation Board. Examples include Colorado Growing Water Smart, the Denver One Water Plan, and Colorado WaterWise's Guidebook update.

Specific to Colorado Growing Water Smart, this project will assess the scalability of urban SCU, a water conservation and efficiency strategy. This study will provide a framework to understand the volumetric potential of SCU and opportunities for scaling within the existing Colorado water law. This assessment will provide insight and clarity around the scenarios in which urban SCU is a promising strategy for the community in which it will be located. Thus, this study has the potential to put another tool in the toolbox for local jurisdictions to plan and implement long-term strategies for the integration of land use and water planning.

Specific to the Denver One Water Plan, this project offers insight into the decision about whether to develop and incorporate urban SCU into their existing water resource portfolio. This assessment has the unique opportunity to directly inform the One Water Plan which serves as a unique and innovative approach to establishing policies around how the City manages its watersheds in a holistic manner.

Additionally, this project will directly inform Colorado WaterWise's recently funded project, Update to the 2010

Guidebook of Best Practices for Municipal Water Conservation in Colorado. Outcomes from this project directly apply to this update, and if approved, our team will engage Colorado WaterWise and share progress and results with them so that their final product reflects current studies and practices in urban SCU in Colorado.

This proposed project is built upon a foundation that reflects credibility, expertise, and practical experience with urban SCU. Below is a list of titles of those related studies. Due to a character constraint, we are only able to provide a sampling of the study titles here; a complementary document listing a complete bibliography is included in the Additional Attachments.

Benefit Accounting of Nature-Based Solutions for Watersheds: Guide.
International Stormwater BMP Database: 2020 Summary Statistics.
Economic Framework and Tools for Quantifying and Monetizing the Triple Bottom Line Benefits of Green Stormwater Infrastructure.
The Untapped Potential of California's Urban Water Supply: Water Efficiency, Water Reuse, and Stormwater Capture.
Incorporating Multiple Benefits into Water Projects: A Guide for Water Managers.
Economic Evaluation of Stormwater Capture and Its Multiple Benefits in California.
National Western Complex Rainwater Harvesting Demonstration & Stormwater Management Innovation.
Stormwater Capture in California: Innovative Policies and Funding Opportunities.
Pure Potential: The Case for Stormwater Capture and Use.

Taxpayer Bill of Rights

N/A

Last Updated: May 2021

Colorado Water Conservation Board
Water Plan Grant – Statement of Work – Exhibit A

Statement Of Work	
Date:	**June 30, 2022**
Name of Grantee:	**Pacific Institute**
Name of Water Project:	**Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future**
Funding Source:	**Colorado Water Plan – Conservation and Land Use**

Water Project Overview:

The Pacific Institute respectfully seeks a Colorado Water Plan grant for the project, *Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future.*

This innovative and pioneering project will create a baseline understanding in Colorado about the untapped potential of urban stormwater capture and use (SCU) to contribute to the existing water supply demand gap, as well as to identify and monetize the benefits associated with SCU as a water supply and the multi-benefit outcomes that are inherent within this strategy. Notably, there are a handful of existing, novel SCU projects in the state that were community-driven and have provided multiple benefits to the communities in which they are located. Regardless of these exemplary projects, there is demonstrated hesitancy to promote urban SCU as a scalable strategy in Colorado for two key reasons:

1. The volumetric range of urban SCU in Colorado is unknown and therefore this strategy is excluded from broader water resiliency conversations and solutions.
2. The scalability of SCU in Colorado is not well understood within the context of Colorado water law, with many local governments assuming that SCU is not viable under Colorado water law.

To address the first reason, we will calculate the volumetric potential that SCU in urban areas can make toward filling each basin's municipal and industrial supply gap. This can be done through a spatial analysis that quantifies the total urban runoff that can be expected on an annual basis for a range of precipitation years across the state. With these numbers, stakeholders from Colorado's eight basins and the Denver metropolitan basin roundtable will be better equipped to explore legal, location-appropriate

opportunities for capturing and reusing urban runoff and the benefits associated with the capture and use of that water.

To address the second reason, we will also detail currently allowable SCU practices under Colorado water law and requirements necessary to implement larger-scale adoption of SCU, which may require substitute water supply plans and augmentation plans. Based on Colorado water law, widespread harvesting of rainwater or runoff is not allowed unless the user obtains water rights to augment depletions caused by harvesting rainwater or runoff. A maximum of two rain barrels with a combined storage of 110 gallons or less are allowed at each household. Collected rainwater with these systems may be used to irrigate outdoor lawns, plants or gardens. Individual homeowners may choose to install rain barrels on downspouts for lawn irrigation, and a water right is not required for this, but any large-scale implementation would require water rights. Rainwater users also need to consider the water quality of the collected rainwater to understand if it is suitable for the proposed use. A Colorado Division of Water Resources approved augmentation plan for the placement and proposed use of the reclaimed water is required for larger scale applications. As part of this project, innovative concepts such as umbrella augmentation plans at a regional scale will be conceptualized.

Additionally, the economic costs and benefits of urban SCU in Colorado are unknown, and therefore, the extent to which SCU is competitive with complementary strategies is currently unknown. SCU has the potential to help cost-effectively close the expected supply and demand gap in many of Colorado's urban areas, resulting in positive economic impacts for local economies (e.g., avoided losses in economic output, industries, and employment). In addition, SCU projects can result in multiple benefits. For example, nature-based solutions for SCU can provide increased recreational opportunities, energy savings, carbon reduction, improved health outcomes, neighborhood revitalization, and other ecosystem services. Through this effort, the project team will identify, quantify, and where possible, monetize the co-benefits that would be realized in Colorado if urban SCU was applied and scaled, as deemed appropriate by law and community needs. This assessment will provide a geographic overview of locations where co-benefits could accrue from urban SCU projects, an economic analysis for up to two basins of the water supply benefit of SCU, and an assessment of potential co-benefits using existing SCU projects in the state as case studies.

The Pacific Institute, along with its subcontractors, One Water Econ and Wright Water Engineers, will create a baseline understanding of the potential for urban SCU in Colorado; through this project, our team will recognize existing constraints and pose potential frameworks to address key concerns expressed around scaling SCU. We will provide a comprehensive approach, with a clear and defined methodology, to create a baseline study that will: 1. quantify the volumetric potential for SCU in Colorado; 2. define and delineate under which circumstances SCU is currently allowed in Colorado water law; and 3. identify, quantify, and where possible, monetize the benefits associated with SCU, including potential co-benefits of SCU projects.

This project will provide this information at the state level, as well as breaking it out to align with the eight river basins plus the Denver metropolitan area roundtables.

Based on key findings from this project, our team will provide recommendations and next steps, as well as outreach and communication to share our findings with key stakeholders in Colorado and other relevant areas.

Notably, the project team is aware of the legal context and implications of SCU in Colorado. Thus, an integral part of this project is the establishment of an Expert Review Panel that reflects the knowledge, experience, and perspectives from stakeholders across the state to provide constructive feedback and guidance to the methodology, as well as to assist with the outreach of project results to key target audiences in Colorado.

Project Objectives:

The objectives of *Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future* include:

1. Quantifying the untapped potential of urban SCU in Colorado, as allowed, and defined within existing water law. This analysis will be refined to reflect the potential in each of Colorado's eight river basins and the Denver metropolitan area.
2. Identifying and monetizing the overarching, multiple benefits associated with stormwater capture and use.
3. Highlighting existing examples where urban SCU have been employed successfully in the state and underscore the multiple benefits gained through this strategy.
4. Engaging with and learning from an Expert Review Panel comprised of practitioners representing the following fields: academia, agriculture, Colorado water law, economics, public office, utilities, research and water quality scientists, and water supply planners. Use panel guidance to identify target audiences, and to help socialize the idea of urban SCU within Colorado.
5. Distill and distribute project findings into recommendations and suggested next steps to key stakeholders.

To achieve these objectives, the Pacific Institute offers expertise in the following areas:

1. Project Management. PI staff will manage this project and be responsible for meeting the defined objectives. PI staff will also work with project consultants, Wright Water Engineers and One Water Econ, to align work products with deliverables. PI staff have extensive, demonstrated experience managing projects across sectors and geographies.
2. Quantitative data analysis, including spatial analysis. The PI team assembled for this project has many years of professional experience in geospatial analysis using geographic information system (GIS) products, such as by ESRI (e.g., ArcGIS) as well as open-source products such as QGIS. The team is also composed of staff with backgrounds in cost-benefit analysis, specifically for evaluating water management approaches (e.g., Diringer, Shimabuku, and Cooley 2020). Most applicable to this project, both staff responsible for the stormwater capture quantification

method development and application for a similar project in California will be part of this team (see Cooley et al. 2022). The team will be prepared to adapt the methodology used in California to the Colorado context. Our team also brings strength in our ability to perform quantitative data analysis using statistical methods and tools such as R, which we have done in many projects for the Pacific Institute and at other institutions.

3. Audience Outreach & Engagement. The Pacific Institute also brings multiple decades of globally recognized science communication and outreach expertise, with strengths in transforming and adapting complex, technical information into insightful and audience-relevant outputs, such as with data visualizations, infographics, and other communication approaches.
4. Stormwater capture and use policy analysis. The Pacific Institute is a recognized leader in evaluating and identifying policy solutions for improving water management. Our process for policy analysis includes performing interviews and collecting input from experts and relevant stakeholders, performing literature reviews and analysis, and exploring case studies from the US and beyond. Specific to stormwater capture and use, PI staff have led analysis of policy from California and Texas, publishing both reports and journal articles on the findings (Shimabuku, Diringer, and Cooley 2018; Diringer et al. 2020; Diringer, Shimabuku, and Cooley 2020).
5. Water resilience. The Pacific Institute's 2030 goal is to catalyze the transformation to water resilience in the face of climate change. For this project, we will seek to draw on our growing expertise and experience in work seeking to deliver on this goal (e.g., see Brill et al 2021; Chapagain et al. 2021).

In addition to the Pacific Institute, primary research and analysis will be performed by two key project partners, One Water Econ and Wright Water Engineers, Inc. (WWE).

One Water Econ is a small woman-owned economics consulting firm known for innovation and leadership within the water sector. The firm's team members have a strong track record of delivering high-quality and relevant applied research. We are known for clarifying complex problems and bringing together the technical and policy solutions necessary to ensure successful project implementation.

One Water Econ's clients include water sector utilities, government agencies, research foundations, and non-profit organizations. The firm's economists routinely partner with engineers, scientists, and other multi-disciplinary team members to provide a holistic perspective on water resource issues. The firm's primary water economics- and planning-based services include:

- Benefit-cost, triple bottom line (TBL), and economic impact analysis
- Valuation of water-related services and infrastructure, such as related to public health, ecosystem, recreation, agriculture, and impacts on local economy
- Market-based solutions for water supply, clean water, and stormwater management
- Affordability assessments and customer assistance program evaluation
- Evaluation of water use and demand across sectors
- Climate change vulnerability and adaptation planning
- Survey design and implementation, focus group and workshop design.
- Spatial analysis with a full suite of Geographic Information Services (GIS) support

Headquartered in Loveland, Colorado, One Water Econ's founder and proposed lead staff member for this effort brings more than 20 years of experience working to address high profile economic issues across the water sector. One Water Econ's recent work includes developing a tool for The Water

Research Foundation to help utility practitioners quantify and monetize the co-benefits of green stormwater infrastructure (GSI) at the city, neighborhood, or watershed scale. One Water Econ recently initiated a project in Southern California to develop recommendations for water conservation and stormwater incentive program models for consideration by the Metropolitan Water District of Southern California and Los Angeles County. The firms' economists recently completed a multi-year study to assess benefits and costs, design, and administer a pilot groundwater market for agricultural users in Madera County, California.

Wright Water Engineers, Inc. brings the following expertise:

Founded in 1961, Wright Water Engineers, Inc., (WWE) is a Colorado-based, employee-owned and operated, full-service water resources, environmental, and civil engineering firm based in Denver, Colorado, with outlying offices in Glenwood Springs and Durango. WWE's staff of approximately 45 people includes engineers, hydrologists, scientists, biologists, chemists, geologists, hydrogeologists, and ArcGIS specialists. WWE is well known for its expertise in Colorado water rights and stormwater management, including WWE staff who regularly testify as experts, prepare criteria manuals for local governments, publish, teach continuing engineering education, and are highly involved with professional organizations statewide and nationally.

WWE's work on stormwater quality management has earned the firm a national reputation in this area of practice. As one of the co-developers of the International Stormwater Best Management Practices (BMP) Database, WWE has led the compilation and analysis of data for nearly 800 BMP monitoring sites across the country, ranging from traditional stormwater management (e.g., extended detention ponds) to green infrastructure practices (e.g., Clary et al. 2020). The database includes SCU projects in several states, including the Denver Green School in Colorado. WWE has led the way with Green Infrastructure (GI) Low Impact Development (LID) in the mountain west, working with the Mile High Flood District (MHFD) on criteria for our climate, monitoring innovative practices around the Denver metropolitan area and nationally, and continually networking with colleagues around the country to stay on the cutting edge of stormwater treatment practices. WWE has worked with local governments to prepare storm drainage criteria manuals in various parts of Colorado, including criteria related to the interface between Colorado water law and stormwater management.

WWE staff members have decades of experience in water rights engineering throughout Colorado and in neighboring states. WWE's services range from a preliminary evaluation of water rights through engineering and testimony for water court decrees. WWE's staff of engineers, hydrogeologists, and wetland scientists provide full capability in analyzing water rights. Analyses are performed efficiently with the use of the latest GIS mapping and data management techniques. WWE works closely with water attorneys to effectively serve the needs of clients. In Colorado, typical work tasks include analysis of data and relevant existing decrees from the Colorado Decision Support System (CDSS) database. From this point, analyses and modeling of the water rights are performed. Legal and physical availability of water is evaluated through analysis of historic diversion records as well as consideration of call records.

Last Updated: May 2021

Tasks

Task 1 – Identify, Convene & Engage Expert Review Panel

Description of Task:

Across the nation, urban stormwater capture and use has delivered compelling results, though it has only been minorly adopted in Colorado, a headwater state where, as the National Oceanic and Atmospheric Administration states: "[s]ince 2000, the Colorado River basin has been experiencing a historic, extended drought that has impacted regional water supply and other resources, such as hydropower, recreation, and ecological goods and services" (NOAA 2022).

In order to plan and execute a project that is robust and considers numerous perspectives that inform and are informed by urban SCU, at the outset, this project will identify, convene, and engage with a 12-15 member Expert Review Panel to provide the following guidance:

1. Ensure that key questions and nuances related to urban SCU in Colorado are incorporated.
2. Inform and review the methodology applied to this project.
3. Work alongside the project team to disseminate results with key stakeholders and audiences.

Expert Review Panel members will come from professionally relevant sectors related to SCU and demonstrate extensive experience and knowledge in the following sectors: academia (specializing in water quality and quantity), agriculture, Colorado water law, utilities, science (specializing in analytics and research), and water resource and supply planning and management.

Subject to project approval, the following panelists have committed their time, effort and expertise; pending approval of this proposal, these commitments will be formalized.

Stephen Barr, Non-Profit Manager/Elected Official
Independent (unaffiliated with current employer or municipal representative)

John Covert, Government Relations Coordinator
Denver Trout Unlimited

Jens Jensen, Shareholder
Welborn Sullivan Meck & Tooley, P.C.

Frank Kinder, Water Efficiency & Sustainability Manager
Northern Water Conservancy District

Cynthia Koehler, Executive Director
WaterNow Alliance

Holly Piza, P.E., D. WRE, Research and Development Director
Mile High Flood District

Last Updated: May 2021

David Smith, Principal
Water Innovation Services

Sybil Sharvelle, Ph.D., Associate Professor
Colorado State University, Department of Civil and Environmental Engineering

Katie Spahr, P.E., Ph. D., Research Program Manager
The Water Research Foundation

Scott Struck, Ph.D., Senior Research Scientist
National Renewable Energy Laboratory

Additionally, representation from the following sectors will be sought:

- Agriculture (1 seat)
- Transportation Water Quality Expert (1 seat)
- Economist (1 seat)

Method/Procedure:

An Expert Review Panel of 12-15 members representing key stakeholders and perspectives in SCU and knowledge of the Colorado context will be invited to inform the questions guiding this project, constructively review project findings and content, and help to identify and communicate with key audiences surrounding the project's outcomes.

All meetings will be virtual and occur every other month. A Charter will be drawn up that clearly defines the roles, responsibilities, and scope of the Expert Review Panel. It is expected that each panelist will expend up to 32 hours of their time over the course of a year for their commitment. All panelists will be offered a stipend of $1,000 compensation for their time.

Accordingly, panelists will receive relevant materials for review prior to meetings as well as follow-up and any required next steps for future convenings.

Deliverable:

Each virtual meeting with the Expert Review Panel will be accompanied by a written summary of meeting discussion (questions, concerns, insights, etc.) and any major outcomes. All feedback delivered by the expert panel will be incorporated into the final products and deliverables from this project; however, the project team will be ultimately responsible for all content, findings, recommendations, and other products.

Finally, the project team will include a complete summary of all discussions with the expert panel relating to opportunities for the dissemination of project findings and outcomes.

PI will provide CWCB staff with copies of these documents.

Last Updated: May 2021

Tasks
Task 2 – Defining the Current Practice, Volumetric Potential, and Limits of Stormwater Capture & Use in Colorado
Description of Task:
This task will take a multi-pronged approach to define the current urban SCU practices in Colorado, including highlighting case studies. Primary contributors will be PI and WWE. This project will summarize the relationship between existing Colorado water law and SCU, including currently allowable limited-volume SCU at the residential scale and the potential for larger scale SCU, which requires water rights through individual augmentation plans and/or substitute water supply plans. Case studies including recent work at the National Western Complex/Spur Campus, the Denver Green School, Sterling Ranch, and other examples will be summarized as case studies. Findings will be summarized to identify SCU successes, impediments, and opportunities for scaling of SCU to identify the current and potential role that SCU can play in the water resilient future for Colorado. Where legal, estimates of the volumetric potential for urban SCU will help to identify regions of the state where further consideration of this multi-benefit supply approach should be explored. Using existing, publicly available data and a transparent approach, we will quantify the total statewide and basin-scale volume of urban stormwater potentially available for use.
Method/Procedure:
A literature review, sourcing information from state agencies and statutes, academic reports and articles, and other online resources will be used to inform the discussion of existing Colorado law and practice of urban SCU. Case studies will be explored through information from websites, project reports, and through knowledge from project staff and the Expert Review Panel. Urban volumetric stormwater capture potential will be estimated at the basin scale using spatial datasets that delineate urban impervious surface cover within each basin and measurements of precipitation (U.S. Census Bureau 2010; U.S. Geological Survey 2019; PRISM Climate Group 2022). A runoff coefficient will be applied to estimate the total volume of runoff expected from the measured precipitation falling on impervious area. Precipitation will be calculated using two different approaches for an initial case study in the Denver area. The first approach will follow the methods applied in Cooley et al 2022, based on a “high”, “medium”, and “low” rainfall year using historical precipitation from the PRISM Climate Group (2022). The second approach will utilize recent work completed by WWE at the National Western Complex that included continuous simulation of 63 years of continuous rainfall using EPA’s Stormwater Management Model (SWMM) (Earles et al. 2021). The SWMM modeling will be used to conduct a reasonableness check of the simplified method for estimating precipitation totals and variation. The project team will compare the outcomes of the two approaches to understand the amount of variation between the two. These results may help in future work to identify both simplified and more advanced tools for similar analyses.
Deliverable:

The findings from the literature review on existing Colorado water law and practice of SCU will be composed as a chapter of the final project report. The case studies will be woven into this chapter and/or be described in a stand-alone chapter, to be determined by the project team should the project be funded.

The main deliverable for the urban SCU volumetric potential analysis will be a white paper/report that describes the analysis performed, data used, and results for the eight river basins plus the Denver metropolitan area roundtables. This information will also be incorporated into the final project report. If time and resources are available, the project team will also work to create a draft of the white paper that can be submitted to an open-source academic journal, allowing a more formal documentation of methods and outlet to the broader water community.

PI will provide CWCB staff with a copy of the white paper/report.

Tasks

Task 3 – Gaining a Robust Understanding of the Multiple Benefits Associated with Scaling Stormwater Capture & Use in Urban Colorado

Description of Task:

The Pacific Institute has, for several decades, played a leading role in identifying and advancing innovative strategies for sustainable water management and use, including SCU. We recognize the potential opportunities embedded within SCU; the opportunity to develop new sources of local supply in urbanized areas as well as the associated multiple benefits such as enhanced water quality, flood mitigation, and increased water efficiency. Stormwater capture is an increasingly key strategy to help communities adapt to more variable precipitation patterns, as is expected to occur with climate change.

Thus, this proposal seeks to identify, quantify, and where possible, monetize the co-benefits that would be realized in Colorado if urban SCU was applied and scaled, as deemed appropriate by law and community needs. This assessment will provide a geographic overview of locations where co-benefits could accrue from urban SCU projects, an economic analysis for up to two basins of the water supply benefit of SCU, and an assessment of potential co-benefits using existing SCU projects in the state as case studies.

The first portion will be a high-level exercise to identify locations/basins where stormwater capture co-benefits may accrue. This work will include identifying the factors related to co-benefit generation, such as (but not limited to) drinking water aquifer presence, waterways with water quality impairment caused by urban runoff, and/or locations of open space adjacent to urban areas that could be used for and enhanced by stormwater management. The outcomes from this subtask will help spatially and visually connect the volumetric estimates of stormwater capture potential to specific locations/regions across the state. This effort will also provide important inputs into the subsequent economic analyses.

Second, for one or two basins (likely one on the Front Range and one in another area of the state), the project team will quantify the potential for SCU to close the municipal and industrial water supply demand gap and quantify the resulting avoided economic losses for affected local economies, including direct, indirect, and induced impacts across different industries and for households. Estimates will include avoided losses in economic output and employment (e.g., relative to reduced water availability), as well as the value of increased water supply for local residents (as applicable).

The third piece will focus on assessing the potential co-benefits associated with SCU projects, helping

to make the case for why planning and implementing projects that include a multi-benefit approach are key to a water resilient/wise/secure and equitable future. For this assessment, the project team will identify, quantify, and develop high-level monetized estimates of the co-benefits associated with two projects where SCU has been applied in Colorado. These case studies will demonstrate the potential value of more widespread adoption of SCU strategies where it makes sense.

As an important note, the economic assessment will not provide a comprehensive benefit/cost comparison of all potential water supply augmentation/demand management alternatives for urban areas across the state's eight basins. As a second phase to this work (or optional task), the project team proposes a more comprehensive comparison, which would include the extent to which SCU is an additive option (versus a mutually exclusive alternative), as well as a more detailed evaluation of the potential co-benefits associated with SCU projects within each basin. This will allow for a better comparison of potential options, accounting for the full range of financial, environmental, and social benefits.

Finally, the economic analysis task is somewhat modular and therefore, support for any one or two of the three subtasks listed above could be performed mostly independently from the other subtasks.

Method/Procedure:

Building on outputs from Task 2, the project team will identify locations/regions where key co-benefits could accrue from urban stormwater capture using GIS (i.e., ArcMap Pro). This work includes identifying spatial datasets that contain information on the factors related to co-benefit generation, such drinking water aquifers, land use layers, 303d listed waterways, U.S. American Community Survey data, and others. It will also include applying cartographic principles for ensuring the information displayed is conveyed accurately and meaningfully for understanding the scale and certainty of the findings.

For the second component, the team will review local economic development plans and relevant literature to better understand the nature of expected growth (i.e., type of industries/industry clusters) and the water-dependency of those industries. We will use the IMPLAN economic impact model for Colorado to assess the mix of current economic activity and estimate the avoided economic losses associated with increasing urban supplies through SCU.

To assess co-benefits for the case study applications, the project team will rely in part, on the Green Stormwater Infrastructure (GSI) Triple Bottom Line (TBL) Benefit Cost Tool (and/or the methods developed for that Tool) to quantify and monetize SCU co-benefits (for up to 12 co-benefit categories). The TBL GSI Tool was developed by members of the proposed project team from One Water Econ. This analysis will demonstrate the significant potential for incorporating and achieving multiple benefits through the implementation of SCU projects, and to be able to compare total TBL benefits to estimated costs of SCU interventions.

Deliverable:

Last Updated: May 2021

The deliverables for this task will include maps highlighting benefit potential, as well as the outcomes from the economic analysis and case studies demonstrating monetized comparison of SCU co-benefits to costs. We will also provide a detailed description of the methods and data as part of the final report.

PI will provide CWCB staff with copies of these maps and an analysis summary.

Tasks

Task 4 – Recommendations & Next Steps

Description of Task:

As this project works through its defined tasks, the project team anticipates many learning opportunities that will benefit this work as well as water professionals and land use planners. Thus, based on our learnings, we will catalogue and delineate recommendations that inform the practices and potential scaling of urban SCU in Colorado. These findings will be shared with the Roundtables to disseminate our results, maximize their impact, and support the Roundtables in their efforts to broaden communications, outreach, and education programs, as stated in their relevant Basin Implementation Plan goals.

Under Task 3, the project team will conduct a high level of overview of the potential benefits of SCU. This will allow for a fair comparison of water supply augmentation/demand management alternatives, providing input into the ideal mix of options for Colorado's future water supply portfolio. In addition, Task 3 will establish a baseline from which to conduct a detailed economic assessment of potential co-benefits across the eight basins and the Denver metro area.

Method/Procedure:

The project team will meticulously catalogue our methodology and outcomes, with an eye toward how our learnings can inform the work of water professionals and planners. This input will reflect empirical research and analysis as well as contributions from the Expert Review Panel. All recommendations will acknowledge, and be couched within, existing Colorado water law, to paint an accurate picture of urban SCU in the statewide context.

Deliverable:

In the project's final report, the project team will make recommendations and suggest meaningful next steps to understand the potential of urban SCU as a scalable strategy in Colorado. These findings will also be distributed to the Roundtables so that they are able to further their stated Basin Implementation Plan goals related to engaged and informed citizens and broadening communications, outreach, and education programs.

PI will provide CWCB staff with a copy of the final report.

Tasks

Task 5 – Communication & Outreach: Sharing Results with Key Stakeholders

Description of Task:

Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future is an innovative project with the potential to provide a framework for increasing water resiliency in Colorado through the scaling of urban SCU. If this strategy is worth pursuing, or even if it is not feasible, it is worth disseminating the project results so that land use planners throughout the state have the necessary information needed to make well-informed water policy and planning decisions.

Method/Procedure:

The project team will evaluate which forms of outreach will be the most effective to reach target audiences. Primary avenues include the production of a fact sheet with project findings, blogs, white paper submission to journals, meeting presentations, webinars, and conference presentations.

In addition to the deliverables outlined below, the project team will partner with members of the Expert Review Panel to identify and pursue additional outreach and education opportunities.

Deliverable:

Last Updated: May 2021

The project team will pursue and participate in a number of the following outreach and engagement strategies:

Fact sheet production and distribution

Social media promotion (blogs and social media posts across numerous platforms)

Report developed into a white paper and submission to open-source journals and relevant publications

Webinars in partnership with key stakeholders (American Planning Association Water & Planning Network, WateReuse Association, US EPA National Water Reuse Action Plan, Pisces Foundation, Water Research Foundation, Water Education Colorado, Colorado Association of Stormwater and Floodplain Managers, WaterNow Alliance, and Green Infrastructure Leadership Exchange)

Meeting presentations (Basin Roundtables, Colorado Ag & Water Alliance)

Conference presentations (Colorado Water Congress, Sustaining Colorado Watersheds Conference, Colorado WaterWise Symposium, 'Shed Conference, Colorado Stormwater Center Symposium, and ProGreen Expo)

Presentation materials and links will be included with the final report.

PI will provide CWCB staff with a copy of any outreach and engagement strategy documents listed above.

Budget and Schedule

This Statement of Work shall be accompanied by a combined Budget and Schedule that reflects the Tasks identified in the Statement of Work and shall be submitted to CWCB in excel format.

Reporting Requirements

Progress Reports: The applicant shall provide the CWCB a progress report every 6 months, beginning from the date of issuance of a purchase order, or the execution of a contract. 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 purchase order or grant 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 contract 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 this contract must be provided to as part of the project documentation.

Performance Measures

Performance measures for this contract 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 in Exhibit C. 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 purchase order or grant 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

Water Plan Grant - Exhibit C
Budget and Schedule

Prepared Date: June 30, 2022
Name of Applicant: Pacific Institute

Name of Water Project: Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future
Project Start Date: December 1, 2022

Task No.	Task Description	Task Start Date	Task End Date	Grant Funding Request	Match Funding		Total
					Cash	In-Kind	
1	Identify and Convene Expert Review Panel	12/1/22	11/30/23	$ 33,177.90	$ 7,109.55	$ 7,109.55	$47,397
2	Defining the Current Practice, Volumetric Potential, and Limits of Stormwater Capture & Use in Colorado	12/1/2022	11/30/23	$44,613.80	$9,560.10	$9,560.10	$63,734.00
3	Gain a Robust Understanding of the Multiple Benefits Associated with Scaling Stormwater Capture & Use in Urban Colorado	12/1/2022	11/30/23	$44,010.40	$9,430.80	$9,430.80	$62,872.00
4	Recommendations and Next Steps	12/1/2022	11/30/23	$29,708.00	$6,366.00	$6,366.00	$42,440.00
5	Communication & Outreach: Sharing Results with Key Stakeholders	12/1/2022	11/30/23	$14,275.10	$3,058.95	$3,058.95	$20,393.00
	Other Direct Costs	12/1/2022	11/30/2023	$12,498.05	$2,678.15	$2,678.15	$17,854.35
	Indirect Costs	12/1/2022	11/30/2023	$31,461.50	$6,741.75	$6,741.75	$44,945.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
Total				$209,744.75	$44,945.30	$44,945.30	$299,635.35

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Colorado Water Conservation Board

Water Plan Grant - Detailed Budget Estimate
Fair and Reasonable Estimate

Prepared Date: June 30, 2022
Name of Applicant: Pacific Institute
Name of Water Project: Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future

Detailed Budget Estimate

Task 1 - Identify and Convene Expert Review Panel	Pacific Institute							Subcontract	Subcontract - OWE			Subcontract - WWE						
Sub-task	Project Manager & Senior Researcher 1	Director of Research	Senior Researcher 2	Senior Researcher 3	Communications Associate	IT Specialist	Subtotal	Expert Panel Reviewers	Principal/Lead Economist	Associate Economist	Subtotal	Senior Principal Engineer/ Consultant	Principal Engineer/ Consultant	Water Resources Engineer	Subtotal	Project Total	CWCB Funds	Matching Funds
Rate	$ 101	$ 150	$ 114	$ 84	$ 61	$ 78		Lump sum	225	140		$ 242	$ 231	$ 129				
	Estimated Hours							Estimated Cost per Task and subcontractor										
Secure expert panel commitments	20						$ 2,020.00				$ -				$ -	$2,020.00	$1,414.00	$606.00
Prep for panel meetings/addl team mtgs	6		6	6			$ 1,794.00		6		$ 1,350.00		8		$ 1,848.00	$4,992.00	$3,494.40	$1,497.60
Panel meetings (6 mtg*2hr/mtg)	12	6	12	12			$ 4,488.00		12		$ 2,700.00		24		$ 5,544.00	$12,732.00	$8,912.40	$3,819.60
Mtg notes/Post-mtg follow-up	12		2	2			$ 1,608.00				$ -				$ -	$1,608.00	$1,125.60	$482.40
Panel communications	20						$ 2,020.00				$ -				$ -	$2,020.00	$1,414.00	$606.00
Report chapter on expert panel process	20	2	2	5			$ 2,968.00		1		$ 225.00	4			$ 968.00	$4,161.00	$2,912.70	$1,248.30
Project Management	15	6	12	12			$ 4,791.00		1		$ 225.00		8		$ 1,848.00	$6,864.00	$4,804.80	$2,059.20
Expert Panel Reveiwer Stipend ($1000 per Reviewer)							$ -	$ 13,000.00			$ -				$ -	$13,000.00	$9,100.00	$3,900.00
Task 1 Subtotal							**$19,689.00**				**$ 4,500.00**				**$ 10,208.00**	**$47,397**	**$33,177.90**	**$14,219.10**
Task 2 - Defining the Current Practice, Volumetric Potential, and Limits of Stormwater Capture & Use in Colorado																		
Landscape assessment - CO water law and SCU	5		7	15			$ 2,563.00				$ -		28		$ 6,468.00	$9,031.00	$6,321.70	$2,709.30
Precipitation analysis - more granular							$ -				$ -	12	4	24	$ 6,924.00	$6,924.00	$4,846.80	$2,077.20
Precipitation analysis - PRISM data			15	35			$ 4,650.00				$ -	8	2	2	$ 2,656.00	$7,306.00	$5,114.20	$2,191.80
GIS analysis - urban runoff estimates			20	45			$ 6,060.00				$ -	8	4		$ 2,860.00	$8,920.00	$6,244.00	$2,676.00
Senstivity/Validation analysis			2	5			$ 648.00				$ -	6	2		$ 1,914.00	$2,562.00	$1,793.40	$768.60
Researching Case Studies	15		20	35			$ 6,735.00				$ -		8		$ 1,848.00	$8,583.00	$6,008.10	$2,574.90
Write report chapter & white paper	10	5	25	35			$ 7,550.00				$ -		8		$ 1,848.00	$9,398.00	$6,578.60	$2,819.40
Develop map sharing findings/case studies			25	15			$ 4,110.00				$ -	2	4	2	$ 1,666.00	$5,776.00	$4,043.20	$1,732.80
Project Management	10		12	12			$ 3,386.00				$ -		8		$ 1,848.00	$5,234.00	$3,663.80	$1,570.20
Task 2 Subtotal							**$35,702.00**				**$ -**				**$ 28,032.00**	**$ 63,734.00**	**$ 44,613.80**	**$ 19,120.20**
Task 3 - Gaining a Robust Understanding of the Multiple Benefits Associated with Scaling Stormwater Capture & Use in Urban Colorado																		
Spatial analysis - multiple benefits of SCU			20	40			$ 5,640.00		2	2	$ 730.00		2		$ 462.00	$6,832.00	$4,782.40	$2,049.60
Direct economic benefits/impacts			2	2			$ 396.00		32	40	$ 12,800.00		2		$ 462.00	$13,658.00	$9,560.60	$4,097.40
Case for multi-benefit approach	5		5	10			$ 1,915.00		40	48	$ 15,720.00		2		$ 462.00	$18,097.00	$12,667.90	$5,429.10
Write report chapter	5	5	10	30			$ 4,915.00		30	30	$ 10,950.00		4		$ 924.00	$16,789.00	$11,752.30	$5,036.70
Project Management	10		12	12			$ 3,386.00		8		$ 1,800.00		10		$ 2,310.00	$7,496.00	$5,247.20	$2,248.80
Task 3 Subtotal							**$16,252.00**				**$ 42,000.00**				**$ 4,620.00**	**$ 62,872.00**	**$ 44,010.40**	**$ 18,861.60**
Task 4 - Recommendations and Next Steps																		
Synthesize findings	45		7	15			$ 6,603.00		2.00		$ 450.00	2	12		$ 3,256.00	$10,309.00	$7,216.30	$3,092.70
Develop recommendations	20		10	10			$ 4,000.00		2.00		$ 450.00	2	12		$ 3,256.00	$7,706.00	$5,394.20	$2,311.80
Team Meetings	12		12	12			$ 3,588.00		10.00		$ 2,250.00				$ -	$5,838.00	$4,086.60	$1,751.40
Develop final report, conclusions, and recommendations	40	5	25	25			$ 9,740.00		8.00		$ 1,800.00		12		$ 2,772.00	$14,312.00	$10,018.40	$4,293.60
Project Management	15						$ 1,515.00		2.00		$ 450.00		10		$ 2,310.00	$4,275.00	$2,992.50	$1,282.50
Task 4 Subtotal							**$25,446.00**				**$ 5,400.00**				**$ 11,594.00**	**$ 42,440.00**	**$ 29,708.00**	**$ 12,732.00**
Task 5 - Communication & Outreach: Sharing Results with Key Stakeholders																		
Develop outreach materials (1 pager, etc.)	10		5	10	20		$ 3,640.00				$ -		4		$ 924.00	$4,564.00	$3,194.80	$1,369.20
Webinar presentation(s)	20		5	5	5	5	$ 3,705.00		2.00		$ 450.00		4		$ 924.00	$5,079.00	$3,555.30	$1,523.70
Conference attendance (staff time)	35						$ 3,535.00				$ -				$ -	$3,535.00	$2,474.50	$1,060.50
PI Project Website Design to "house" project outputs					5	5	$ 695.00				$ -				$ -	$695.00	$486.50	$208.50
Project Management	25		5	5	5	5	$ 4,210.00				$ -		10		$ 2,310.00	$6,520.00	$4,564.00	$1,956.00
Task 5 Subtotal							**$15,785.00**				**$ 450.00**				**$ 4,158.00**	**$20,393.00**	**$ 14,275.10**	**$ 6,117.90**
Total - All Tasks																**$236,836.00**	**$165,785.20**	**$71,050.80**
Total - Other Direct Costs																**$17,854.35**	**$12,498.05**	**$5,356.31**
Total - Indirect Costs																**$44,945.00**	**$31,461.50**	**$13,483.50**
Grand Total																**$299,635.35**	**$209,744.75**	**$89,890.61**

Other Direct Costs

Item: Communications & Outreach Materials	Copy Editing	Layout	Digital Images				Total
Units:	Per Page	Per Page	Per Image				
Unit Cost:	$20.00	$36.00	$20				
Final Report, Conclusions, and Recommendations	100	100	10				$5,800
White paper	20	20	2				$1,160
1 pager	1	1	1				$76
Total Units:	121	121	13				
Total Cost:	$2,420.00	$4,356.00	$260.00	$0.00	$0.00	$0.00	$7,036.00

Item: Conferences (3) & Meetings (2)	Meals	Lodging	PI Mileage	Registration	WWE mileage		Total
Units:	Per Diem	Per Diem	Miles	NA	Miles		
Unit Cost:	$ 100.00	$200	$0.535	$450	$0.535		
Conference 1 - Beyond Front Range	3	2	300	1	0		$1,311
Conference 2 - Beyond Front Range	3	2	300	1	0		$1,311
Conference 3 - Front Range	1	0	30	1	100		$566
Meeting 1 - Beyond Front Range	2	1	300	0	500		$561
Meeting 2 - Front Range	1	0	30	0	250		$116
Total Units:	10	5	960	3	850		
Total Cost:	$1,000.00	$1,000.00	$513.60	$1,350.00	$454.75	$0.00	$4,318.35

ITem: IMPLAN model for Colorado	Software	Total
Units:	License	
Unit Cost:	$ 6,500.00	
IMPLAN	1	$6,500
Total Units:	1	
Total Cost:	$6,500.00	$6,500.00

PACIFIC INSTITUTE

Research for People and the Planet

June 30, 2022

Kevin Reidy
Water Conservation Technical Specialist
Colorado Water Conservation Board
1313 Sherman St.
Room 718
Denver, CO 80203

Dear Mr. Reidy,

I am writing to confirm that Pacific Institute is able to dedicate $44,945.30 in internal funds to be used as a direct cash match are for the project entitled *Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future*. This cash match will compliment the $44,945.30 in-kind match, making the total matching funds for the proposed project $89,890.60. This represents 30% of the total project budget of $299,635.35. The remaining 70% ($209,744.75) is the grant amount that we are requesting from the Colorado Water Conservation Board (CWCB).

Additionally, the project team, which includes Pacific Institute, Water Wright Engineers, and One Water Econ, have applied for three additional grants to support this project. The total funds requested from these three additional grants are $35,000.00. Should these funds be awarded, they will be used to replace the equivalent amount of the cash match from the Pacific Institute such that the total cash match will remain the same for the project.

Please feel free to reach out if you have any questions or need further information.

Thank you,

Pete Stanga
Chief Operating Officer
Pacific Institute
Pstanga@pacinst.org
(510) 251-1600 x101

Expert Review Panel Bios

Stephen Barr has over 13 years of experience in the international development and environmental engineering industries, having received his B.Sc. in Environmental Engineering from Cal Poly San Luis Obispo, and his M.Sc. in Science, Technology, and International Development from the University of Edinburgh. Mr. Barr began his career working for various consulting firms throughout California performing environmental site investigations and construction oversight on behalf of public and private entities. During and in between consulting, he volunteered for international non-profit organizations to conduct water and wastewater projects in Cameroon, Honduras, Thailand, and the West Bank. Mr. Barr eventually transitioned to managing business development efforts for an international development consultancy, primarily focusing on the fields of local governance, environment, and water and infrastructure for US Agency for International Development programs.

Mr. Barr moved to Colorado in 2018, and currently manages volunteer teams conducting short-term water and wastewater engineering projects for underserved communities across the United States, which includes training and managing professional and student volunteers and coordinating with State and Federal agencies to identify and support small and rural communities with water and wastewater projects. In addition, Steve is currently on City Council for a municipality in the South-Metro region and has been serving since November of 2021, with a focus on infrastructure planning and improvements throughout his city.

John Covert worked for the City of Colorado Springs in the 1970s and 80s as a city planner and 10 years as deputy City Manager responsible for intergovernmental relations. In the late 80s he led an effort to reform Colorado Springs stormwater management. Before moving to Denver in 1990, John was appointed to the CWCB representing the Arkansas Basin. He has continued advocating for air, land and water conservation including formation of an NGO that helped establish Colorado's renewable energy standard. As a board member for Denver Trout Unlimited, John has focused on stormwater management and the recently funded ecological restoration project for the Denver South Platte River.

Jens Jensen is a water law attorney who represents water users across the state. In addition to representing clients in water court, Mr. Jensen has testified before the Water Resources Review Committee and is an active participant in the Colorado Water Congress. He has also presented continuing legal seminars on water law. Recently, Mr. Jensen has been part of an expert panel on rainwater harvesting, and he represents clients on rainwater harvesting issues. Outside of water law, Mr. Jensen also represents clients across the natural resources sector, including in the renewable energy sector. In his spare time, he enjoys spending time in the great outdoors with his family, hiking, fishing, or just enjoying the peace and quiet of the mountains.

Frank Kinder is the Water Efficiency and Sustainability Manager for Northern Water, a regional water conservancy district serving 33 cities, 29 rural domestics, and 614,000 acres of farmland in northeast Colorado. Responsibilities include commercial efficiency services through landscape consultations, indoor and outdoor water audits, conservation outreach and education, landscape transformation grants and managing a Conservation Garden at Northern Water's headquarters. Frank has a master's degree in Applied Geography emphasizing Sustainable Development and an undergraduate in Finance from the University of Colorado. Frank serves as Advisory Committee Chair for One World One Water Institute and has served as Board Co-Chair of Colorado Waterwise and others. He established the first WaterSense labeled home in

Colorado and the first EPA WaterSense New Homes rebate in the nation. Awards include 2011 Fort Carson Award for Sustainable Progress through Partnerships, 2012 Colorado Biz Magazine GenXYZ Top 25 Young Professional, 2013 Rising Star by Colorado Springs Business Journal, and 2014 University of Colorado, Colorado Springs Alumni Sustainability Award. Others include 2013, 2015 EPA WaterSense Award of Excellence for Strategic Collaborations and 2012, 2014, 2020, and 2021 EPA WaterSense Utility Promotional Partner of the Year Awards.

Cynthia Koehler is an environmental attorney and water policy expert with 30 years of experience working on federal and state water and natural resource issues. She is the co-founder and executive director of WaterNow Alliance, a nonprofit network of local water leaders dedicated to advancing sustainable, equitable and climate resilient water solutions nationwide. She has also served for the last 14 years as an elected member of her local water district, serving a population of about 200,000. She is an appointed member of US EPA's Environmental Financial Advisory Board, and previously served on EPA's Local Government Advisory Committee (2016-18), and Governor Brown's Urban Advisory Group (2018-17). She serves on the Board of the Water Education Foundation and the Advisory Council for the Pacific Institute, among others. She worked previously as the Legislative Director for California water issues for the Environmental Defense Fund. She is the recipient of The Bay Institute's Hero of the Bay Award as well as other commendations for her environmental leadership. She has written and speaks extensively on water, utilities and sustainability issues. Cynthia holds a B.A. from Pomona College and J.D. and Environmental Law Certificate from the University of Oregon School of Law.

Holly Piza, P.E., is Research and Development Director for the Mile High Flood District in Denver, CO. Holly works with local governments throughout the Denver metro area to support stormwater quality and storm drainage criteria and project implementation. She managed an innovative stormwater capture and use system at the Denver Green School, which included a real-time control irrigation system using water captured in a cistern at the Denver Green School. Holly is also experienced in the interface between Colorado water rights and required stormwater release rates from detention facilities. She also currently serves as President of the Environmental and Water Resources Institute of the American Society of Civil Engineers.

Dr. Sybil Sharvelle, P.E., is a Professor in the Civil and Environmental Engineering Department at Colorado State University and directs the Urban Water Center. Her doctoral work included development of a system for treatment of graywater for potable reuse during space missions. This project led to her current interest in fit-for-purpose water systems, in which she has led projects funded by the Water Research Foundation, USEPA and National Science Foundation. Dr. Sharvelle was a member of the National Research Council Committee for Beneficial Use of Graywater and Stormwater and chaired the NWRI panel for Decentralized Non-Potable Water Systems.

David Smith, after 31 years with the U.S. Environmental Protection Agency, founded Water Innovation Services in 2022 to support water management agencies and organizations in policy analysis, regulatory and financial planning, and strategic development. During his tenure at the EPA's Pacific Southwest Region, Dave managed each Clean Water Act core program and specialized in stormwater management and development of integrated water management approaches. Dave was a coauthor of the national Water Reuse Action Plan and co-led 5 actions under that plan, including Action 3.3 that focused on building the nation's capacity to capture and use stormwater and Action 2.6, which evaluated how water permitting approaches can enable or

discourage water recycling investments. Since 2008, he conceived and led several projects aimed at improving stormwater permitting, monitoring, and financing strategies to incentivize implementation of multiple-benefit stormwater management projects. At Water Innovation Services, Dave helps clients launch innovative, integrated stormwater and wastewater management approaches, focusing on stormwater harvesting, wastewater recycling, infrastructure finance, and permitting process improvement. He holds a Master of Public Policy degree from the University of California, Berkeley, and a B.A. in Government from Wesleyan University.

Dr. Katie Spahr, P.E., is a Research Program Manager at The Water Research Foundation and manages a portfolio of projects spanning water treatment across the sector. She is the Foundation's subject matter expert in nature-based solutions, water reuse, and disinfection by-products. Dr. Spahr is an active participant in stormwater capture and use initiatives at a national level through EPA's Water Reuse Action Plan. She also helped plan and co-host a workshop on the barriers and opportunities for stormwater capture and use on the Front Range of Colorado. Dr. Spahr received her PhD in Civil and Environmental Engineering at Colorado School of Mines where her research focused on the ancillary social and environmental benefits of green and grey stormwater infrastructure. Her Master's thesis from the University Colorado at Boulder focused on the barriers to implementing greywater systems in Colorado. Dr. Spahr's previous experience includes working as a water resources and water quality engineer at Arapahoe County Water and Wastewater Authority in Centennial, CO and she holds professional licensure in Environmental Engineering in the State of Colorado.

Scott Struck, Ph.D., is a Senior Research Scientist in Water Programs for the National Renewable Energy Laboratory, Denver, CO. Dr. Struck has a multi-disciplinary background including experience with the U.S. Environmental Protection Agency Office of Research and Development, as well as over 20 years of consulting engineering experience in stormwater management. He was instrumental in the development of the National Stormwater Calculator for EPA, which includes both cost estimation and computational methods for rainwater harvesting. Dr. Struck is past president of the Environmental and Water Resources Institute of the American Society of Civil Engineers and teaches as adjunct faculty at the Colorado School of Mines. He has also conducted research supporting an update of the Mile High Flood District's Urban Storm Drainage Criteria Manual, Volume 3, which guides stormwater quality management in the metro Denver area.

Related Studies & References

The proposed project, Diversifying Colorado's Water Portfolio: The Potential for Urban Stormwater Capture and Use to Contribute to a Water Resilient Future, builds on existing projects approved by the Colorado Water Conservation Board. Recent examples include Colorado Growing Water Smart and the Denver One Water Plan.

As it relates to Colorado Growing Water Smart, this project will assess the scalability of urban SCU, a water conservation and efficiency strategy. This study will provide a framework to understand the volumetric potential of SCU and opportunities for scaling within the existing Colorado water law. This assessment will provide insight and clarity around the scenarios in which urban SCU is a promising strategy for the community in which it will be located. Thus, this study has the potential to put another tool in the toolbox for local jurisdictions to plan and implement long-term strategies for the integration of land use and water planning.

As it relates to the Denver One Water Plan, this project offers insight into the decision about whether to develop and incorporate urban SCU into their existing water resource portfolio. This assessment has the unique opportunity to directly inform the One Water Plan which serves as a unique and innovative approach to establishing policies around how the City manages its watersheds in a holistic manner.

Additionally, this project will directly inform Colorado WaterWise's recently funded project, Update to the 2010 Guidebook of Best Practices for Municipal Water Conservation in Colorado. The outcomes from this project will directly apply to this update, and if approved, our project team will engage Colorado WaterWise and share progress and results with them so that their final product reflects current studies and practices in urban SCU in Colorado.

Finally, our team is proud to say that this proposed project is built upon a foundation that reflects credibility, expertise, and practical experience with urban SCU. Please see the list below for a list of those related studies, as well as a few resources which have informed this proposal.

Bibliography

Brill, Gregg, Tien Shiao, Cora Kammeyer, Sarah Diringer, Kari Vigerstol, Naabia Ofosu-Amaah, Michael Matosich, Carla Muller-Zantop, Wendy Larson, and Tim Dekker. 2021. "Benefit Accounting of Nature-Based Solutions for Watersheds: Guide." CEO Water Mandate. https://ceowatermandate.org/nbs/.

Chapagain, Ashok, Morgan Shimabuku, Jason Morrison, Gregg Brill, John H. Matthews, Kari Davis, Sandra Ruckstuhl, and Colin Strong. 2021. "Water Resilience Assessment Framework." CEO Water Mandate. https://ceowatermandate.org/resilience-assessment-framework/.

Clary, Jane, Patricia Flood, Adam Kremers, Bill DeOreo, and Mark Crookston. 2015. "Exploring the Role of Landscape Water Conservation and Efficiency in Meeting Colorado's Water Gap: Expected Benefits of Landscape Water Conservation Best Management Practices." 2015 Update to GreenCO Literature Review. Green Industries of Colorado (GreenCO).

Clary, Jane, Jonathan Jones, Marc Leisenring, Paul Hobson, and Eric Strecker. 2020. "International Stormwater BMP Database: 2020 Summary Statistics." Project No. 4968. Water Research Foundation.

Clements, Janet, Jim Henderson, and Alan Flemming. 2021. "Economic Framework and Tools for Quantifying and Monetizing the Triple Bottom Line Benefits of Green Stormwater Infrastructure." WRF #4852. Water Research Foundation. https://www.waterrf.org/research/projects/economic-framework-and-tools-quantifying-and-monetizing-triple-bottom-line.

Cooley, Heather, Anne Thebo, Sonali Abraham, Morgan Shimabuku, Peter Gleick, and Sarah Diringer. 2022. "The Untapped Potential of California's Urban Water Supply: Water Efficiency, Water Reuse, and Stormwater Capture." Oakland, CA: Pacific Institute. https://pacinst.org/publication/california-urban-water-supply-potential-2022/.

Diringer, Sarah, Heather Cooley, Morgan Shimabuku, Sonali Abraham, Cora Kammeyer, Robert Wilkinson, and Madeline Gorchels. 2020. "Incorporating Multiple Benefits into Water Projects: A Guide for Water Managers." Oakland, California: Pacific Institute. https://pacinst.org/wp-content/uploads/2020/06/Incorporating-Multiple-Benefits-into-Water-Projects_Pacific-Institute-_June-2020.pdf.

Diringer, Sarah E., Morgan Shimabuku, and Heather Cooley. 2020. "Economic Evaluation of Stormwater Capture and Its Multiple Benefits in California." *PLoS ONE* 15 (3): e0230549. https://doi.org/10.1371/journal.pone.0230549.

Earles, Andrew, Katie Knight, and Chris Olson. 2021. "National Western Complex Rainwater Harvesting Demonstration & Stormwater Management Innovation." Online Presentation presented at the Colorado Stormwater Symposium, Colorado Stormwater Center, August 26. https://www.youtube.com/watch?v=7-ZT6WTdpuw&t=2432s.

National Oceanic and Atmospheric Administration. 2022. "Colorado River Basin Current Conditions." Drought.Gov. June 2022. https://www.drought.gov/watersheds/colorado.

PRISM Climate Group. 2022. "PRISM Gridded Climate Data." Oregon State University. https://prism.oregonstate.edu/.

Shimabuku, Morgan, Sarah Diringer, and Heather Cooley. 2018. "Stormwater Capture in California: Innovative Policies and Funding Opportunities." Pacific Institute. https://pacinst.org/publication/stormwater-capture-in-california/.

U.S. Census Bureau. 2010. "Urban and Rural Areas." Shapefile. https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html.

US EPA. 2022. "Pure Potential: The Case for Stormwater Capture and Use." https://www.epa.gov/system/files/documents/2022-03/wrap-pure-potential-report.pdf.

U.S. Geological Survey. 2019. "NLCD 2016 Impervious Surface Conterminous United States." U.S. Geological Survey. https://www.mrlc.gov/data/nlcd-2016-percent-developed-imperviousness-conus.