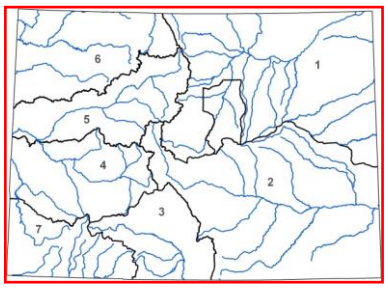
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Development of High Resolution Wetland Maps for Colorado Using Machine Learning Statewide

January 2022 Board Meeting

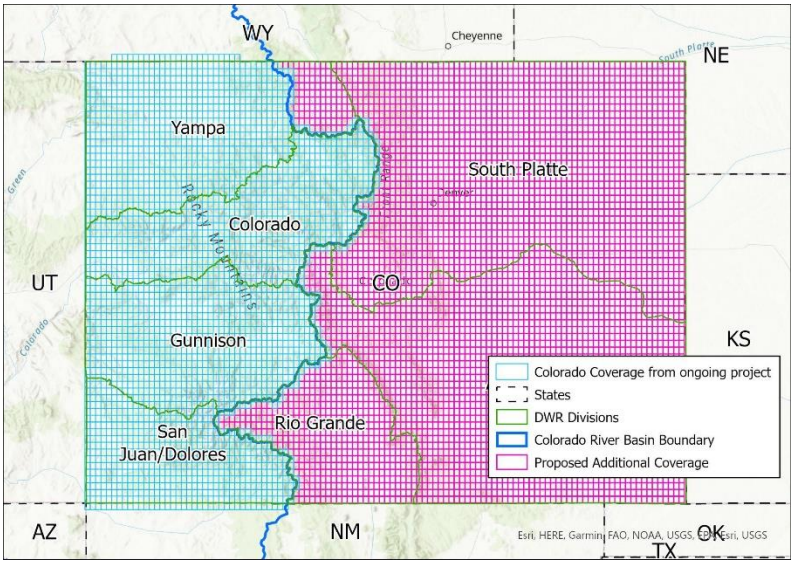
Colorado Watershed Restoration Program Application



LOCATION	
County/Counties:	All Counties
Drainage Basin:	Statewide

DETAILS	
Total Project Cost:	$238,080
Colorado Watershed Restoration Program Request:	$177,200
Recommended amount:	$177,200
Other CWCB Funding:	$0
Other Funding Amount:	$60,880
Applicant Match:	$0
Project Type(s): Planning	
Project Category(Categories): Watershed and Stream Restoration	
Measurable Result: Statewide GIS layer of current wetland delineations	

As Colorado experiences increasing impacts of climate change and human population growth, wetlands and riparian areas are central to any discussion of future water supply and quality for downstream users. One critical barrier to incorporating wetlands into statewide habitat, water and natural hazard mitigation planning and modeling is a lack of recent and frequently updated wetland mapping with statewide coverage.



This project will work to achieve the following objectives:

1. Colorado-wide geospatial layers of valley-bottom vegetated wetlands and beaver ponds for 6 time periods where NAIP imagery exists and 2-3 time periods when additional NAIP imagery becomes available.
2. Colorado-wide geospatial layers of wetland subclasses for 2-3 time periods as NAIP as well as other key model layers are available.
3. Colorado-wide layers of secondary wetland products for watershed and wildfire planning.
4. A technical memo describing the approach, results, uncertainty and application of the layers and secondary products.
5. A publicly available citizen science project focused on tracking beaver activity statewide.

1. Summary Sheet

Project Title: Development of High Resolution Wetland Maps for Colorado Using Machine Learning Techniques

Project Location: Entire state of Colorado, with multiple layers generated for all years of available input imagery: NAIP: (2009, 2011, 2013, 2015, 2017, 2019, future iterations). See attached map for study area

Grant Type: Watershed/Stream Restoration Grant

Grant Request/Amount: $177,200

Cash Match Funding: $60,880 from ongoing Walton Family Foundation project

In-kind Match Funding: $0

Project Sponsor(s): Colorado Watershed Assembly

Mailing Address: P.O. Box 460736, Glendale, CO 80246

Physical Address: 529 S. Race St., Denver, CO 80209, United States

Point of Contact: Diane Kielty, info@coloradowater.org, (303) 916-4645

Brief description of the Project:

As Colorado experiences increasing impacts of climate change and human population growth, our wetlands and riparian areas are central to any discussion of future water supply and quality for downstream users. One critical barrier to incorporating wetlands into statewide habitat, water and natural hazard mitigation planning and modeling is a lack of recent, frequently updated wetland mapping with statewide coverage.

The Colorado Watershed Assembly (CWA) will collaborate with Lynker and Colorado Natural Heritage Program (CNHP) to overcome this barrier by developing and promoting an advanced form of imagery-based wetland mapping that can be updated to capture current and future wetland conditions. Using cutting edge machine learning techniques, the project team will generate statewide layers of key wetland class boundaries across multiple time slices. These layers will be generated for every year that imagery is available through the freely available, high resolution National Agricultural Imagery Program (NAIP) dataset, which currently includes 6 specific time periods in Colorado. Most of the work will be completed in the first year, though we propose this as a multi-year contract (up to 5 years) to generate new maps as more NAIP imagery is released.

To ensure broad use of maps created through the proposed work, Lynker and CNHP will host mapping layers on one or more publicly available, online mapping tools like the Colorado Wetland Inventory. The team will work with key stakeholders to identify and generate secondary data layers to meet common statewide watershed planning and restoration needs. We will also engage a broader network of stakeholders and citizen scientists in tracking statewide beaver activity to both ground truth beaver-influenced wetland mapping and involve a broader network of Coloradans in watershed stewardship.

2. Scope of Work

2.1. Introduction And Background

Wetland maps are used by Colorado's watershed planning groups for a variety of purposes including pre- and post-fire planning, prioritization of riparian restoration work, and identification of habitats that support rare and other priority wildlife species. Currently, the best available statewide mapping product for Colorado is the National Wetland Inventory (NWI). While the NWI is the most comprehensive and detailed wetland map available in Colorado, and nation-wide, this dataset has been created over several decades by multiple different mapping partners. In many locations across CO, mapping has not been updated since the 1970s and 1980s, and wetland boundaries have changed due to factors like development or hydrologic modifications. Updating wetland maps using manual desktop or field-based efforts is prohibitively expensive, and not feasible to repeat regularly at a statewide scale.

The Machine Learning (ML) methods proposed in this project will complement and build upon NWI mapping by using the latest imagery, generating multiple time-periods of data, and improving mapping accuracy for the most dynamic wetland features such as beaver ponds and other riverine wetlands. The ML process can incorporate recently updated NWI mapping as training data, and integrate human mapping expertise to create an accurate, repeatable mapping process as future imagery and other data are available. ML together with Cloud compute capabilities and costs has enabled efficiencies in terms of geospatial data handling and processing to be realised allowing for ever increasing model precision and temporal repeatability.

Lynker is currently funded by the Walton Family Foundation (WFF) to deploy a methodology to inventory wetlands from earth observation data including the Sentinel-2A Multispectral Instrument with 13 bands, LiDAR and its derivatives and Aerial Photography. These methods include masking using probability modelling to reduce data processing costs, classification using convolutional neural networks (CNN) and decision trees, and GIS post processing where ancillary data such as soils, vegetation and hydrology are considered. These repeatable and automated techniques are based on the availability of specific remotely sensed datasets that are regularly updated. These methods also enable the data inputs to be understood in terms of feature importance (information gain) to the overall model accuracy.

Attachment F provides a detailed description of our modeling approach.

2.2. Objectives

The proposed work will benefit watershed health in Colorado by providing information to more effectively target restoration activities and track how our state's natural water infrastructure responds to droughts, fires, and restoration activities. Specific objectives of our proposed work are outlined below.

Our first objective is to ***create a series of statewide wetland maps*** coinciding with recent NAIP imagery years. This will be the first effort to map wetlands statewide, in a similar time period, since initial National Wetland Inventory mapping in the 1970s and 1980s. The updated maps will be particularly helpful in capturing changes in the extent of Colorado's most dynamic wetlands,

including beaver-influenced and other riverine wetlands that may expand or contract in response to peak flows, wildfire, development, sediment pulses, and biological activity.

With this updated mapping over multiple time periods, we will be able to ***monitor change in wetted wetland area and beaver presence over time*.** While NWI mapping is frequently utilized by land and water managers and planners, it often lacks the temporal and spatial resolution needed by stakeholders in rapidly changing environments such as agricultural areas, urban areas, and floodplains. NWI mapping is also typically carried out in units of topographic quads, and often doesn't span entire watershed units used in statewide planning efforts like Colorado's Water Plan, or local efforts such as stream management plans. See Attachment E for a map showing an example of NWI data that is no longer representative of local conditions.

The final objective of this project is to ***develop a set of secondary data layers*** to support specific, broadly applicable watershed planning and restoration site selection needs. Through the stakeholder engagement process, we will identify secondary data layers that will be beneficial to watershed planners engaged in efforts such as restoration prioritization for habitat and water quality benefits, pre- and post-fire planning, and drought planning. For example, the maps created in Task 2 would be the most comprehensive, up-to-date account of beaver-influenced wetlands statewide. As a growing number of stakeholders use the Colorado BRAT model to help identify potential large-scale riparian restoration areas relative to a range of habitat and water supply goals, we would have the ability to compare actual vs. modeled beaver dam density across the state to help planners and restoration practitioners identify areas with the greatest restoration need and highest probability of success. Early results of ongoing research in severe burn areas such as the Cameron Peak fire also suggest that increasing beaver complex size and number of dams are strongly associated with reduced burn severity and increased sediment capture from post-fire runoff. The data layers generated through this proposed work would enable comparison of pre- and post-fire wetland extent, as well as forecasting where beaver complexes and other wetlands are most likely to provide habitat refugia and capture sediment following future fires.

2.3. Tasks

This project will build on an existing collaboration between Lynker and the Colorado Natural Heritage Program funded by the Walton Family Foundation. The project funded by WFF includes the development of an imagery-informed machine learning model to generate high resolution geospatial layers across the Colorado River Basin for the following wetland classes:

> **Vegetated valley-bottom wetlands, Beaver ponds, Open water, Shoreline (including sandbars)**

The tasks below outline how this existing model will be leveraged to generate the same output for all of Colorado, and for more time periods, based on available data. Additionally, we will use this project to expand the model to generate layers of other wetland subclasses that have specific utility for watershed restoration, wildfire planning and other environmental interests.

In addition to the technical tasks, the Colorado Watershed Assembly will promote the product through its social media presence and marketing contacts. CWA uses LinkedIn, Twitter, Facebook, and Instagram virtual communities to tell Colorado about programs and watershed

activities throughout the state. Their online platforms will be used to market data and information generated through this project.

2.3.1. Task 1: Stakeholder Engagement

Part of this project involves developing additional wetland subclasses and wetland mapping products that have specific utility to environmental planning efforts around the state. The final set of wetland subclasses selected for modeling and mapping will depend on both the technical feasibility as well as specific use-cases identified by Colorado watershed planning stakeholders.

Prior to selecting the final set of additional wetland subclasses to be developed as part of task 3, the project team will engage with a range of watershed, restoration and fire planners to get feedback on how to make this data most useful for their work. Some specific agencies and groups that will be invited to participate in this engagement process include:

Colorado Water Conservation Board (CWCB), Colorado Parks and Wildlife (CPW), U.S. Forest Service (USFS), National Resources Conservation Service, Colorado Forest Restoration Institute (CFRI), U.S. Bureau of Land Management (BLM), various Water Conservancy Districts, academic researchers, the Healthy Headwaters Working Group (HHWG), the River Network, and Land Trusts.

In addition to stakeholder engagement in selecting wetland subclasses, the project team plans to enlist professional field scientists and a broader network of recreationists, private landowners, and other members of the public in helping track beaver activity statewide through a citizen science network. This effort is intended to involve more Coloradans in watershed stewardship, in places ranging from the Denver metro area to remote headwater beaver complexes, and will provide model validation data for mapping beaver-influenced wetlands.

Method/Procedure: Lynker and CNHP will conduct several stakeholder engagement meetings to solicit feedback on specific use cases for wetland data, gaps in current wetland datasets relative to watershed planning needs, and which wetland data products are/would be most useful in their planning. CNHP will create, promote, maintain, and manage data from a citizen science network focused on tracking beaver activity throughout the duration of the project. The citizen science data collection framework will utilize existing tools such as iNaturalist and ESRI's Survey123 platform, and be designed to directly support the modeling and mapping effort while educating users on the role of beavers in watershed health.

Deliverable: A short memo describing the findings from these engagement efforts, and a publicly available citizen science project

2.3.2. Task 2: Generate Wetland Layers For Colorado Using Existing Model

In this task, Lynker will deploy the model funded by the Walton Family Foundation to generate new wetland layers for all of Colorado and for the following time periods where NAIP imagery is available: 2009, 2011, 2013, 2015, 2017, and 2019.

Method/Procedure: We will use the existing, expert-trained machine learning model, and associated web framework to generate wetland and beaver pond layers throughout Colorado. See Attachment F for more technical details on how this task will be completed.

Deliverable: In this task, the project team will generate high resolution geospatial layers of specific wetland classes, for the identified time periods, for all of Colorado. Data will be hosted on one or more publicly available CNHP web mapping tools.

2.3.3. Task 3: Develop and Deploy Multi-Class Machine Learning Model For Subclasses

The project team will leverage the lessons learned in the WFF project and utilize available data to develop and test a new machine learning model, and generate layers for more detailed wetland subclasses. Detailed maps of the presence, geographic distribution and change over time in these wetland subclasses are applicable to a variety of different restoration and planning efforts. The targeted list of wetland subclasses include:

> **Emergent wetlands (including wet meadows), Shrub-scrub wetlands, Forested deciduous wetlands, Forested evergreen wetlands**

We recognize that some of these wetland classes will be difficult to accurately map using the available spatial datasets. The project team will balance modeling difficulty, the value of each wetland subclass and the generation accuracy to produce layers that meet an acceptable quality standard. This task will use additional input data beyond the NAIP imagery, which may mean that there are fewer time periods where these results can be generated.

Method/Procedure: See Attachment F for more technical details on how this task will be completed.

Deliverables: In this task, the project team will generate high resolution geospatial layers of the identified wetland subclasses, for time periods where input data is available, across all of Colorado. Data will be hosted on one or more publicly available CNHP web mapping tools.

2.3.4. Task 4: Wetland Change Analysis and Development of Secondary Products

Once the wetland layers are completed, Lynker and CNHP will conduct a detailed analysis to understand key metrics on wetland presence throughout Colorado and during different years. The exact analysis will depend on the application areas identified through stakeholder engagement, but will contain, at a minimum:

- Change in wetted valley bottom wetland area over time by watershed
- Presence and change in extent for key wetland subclasses over the entire analysis period
- Case studies comparing NWI and model-delineated wetland area over time
- Beaver pond prevalence compared to modeled dam capacity in the Colorado Beaver Restoration Assessment Tool (BRAT)

Additional analyses may include case studies comparing wetted wetland extent across drought vs. wetter years, and comparison of change in wetland area over time relative to geographic characteristics such as climate, elevation, geology, and runoff.

Based on feedback collected from stakeholders, Lynker and CNHP will also develop several secondary planning layers with greatest utility for restoration planning purposes. The details of this output will depend on the results from Task 1, and may include production of the following products:

- Identification of “recently wet” former wetlands that can be targeted for habitat restoration
- An analysis of change in beaver-influenced and overall wetted valley bottom wetland area within burn area perimeters during the analysis period
- Wetland location and extent relative to mapped Fluvial Hazard Zones
- Wetlands that are likely to serve as sediment capture zones in post-fire areas
- Large beaver wetland complexes located in high burn probability areas

Method/Procedure: We will conduct spatial and hydrologic analyses using the generated wetland and subclass layers and other currently available data products. We will generate additional secondary products as geospatial layers. Additionally we will develop a final memo describing the techniques and analysis results from all previous tasks.

Deliverables: This task will result in geospatial layers showing coverage of additional wetland subclasses at different times. These layers will be hosted on one or more CNHP online mapping tools. Upon completion of this task, we will also deliver a project summary memo.

2.4. Reporting

Colorado Watershed Assembly shall provide the CWCB with invoices based on work completed not to exceed 4 invoices through the course of the project. Project updates will be generated by the project team and transferred to CWA who will produce and provide CWCB with progress reports every 6 months. The progress report shall describe the completion or partial completion of the tasks identified in the statement of work including a description of any major issues that have occurred and any corrective action taken to address these issues.

2.5. Final Deliverables

This project will result in the following deliverables:

- Colorado-wide geospatial layers of valley-bottom vegetated wetlands and beaver ponds for 6 time periods where NAIP imagery exists and 2-3 time periods when additional NAIP imagery becomes available
- Colorado-wide geospatial layers of wetland subclasses for 2-3 time periods as NAIP as well as other key model layers are available
- Colorado-wide layers of secondary wetland products for watershed and wildfire planning
- A technical memo describing the approach, results, uncertainty and application of the layers and secondary products
- A publicly available citizen science project focused on tracking beaver activity statewide

The geospatial layers will be hosted on the Colorado Natural Heritage Program’s (CNHP) ArcGIS Online account and will be available for public viewing through one or more online mappers such as the Watershed Planning Toolbox, Colorado Wetland Inventory mapper, and/or Colorado Conservation Data Explorer (CODEX). All geospatial data will be accompanied by metadata explaining data development methods, potential uses, and data limitations relative to the NWI and other currently available datasets. Original data will be shared on a case-by-case basis with statewide conservation partners working to better understand, protect, and restore Colorado’s wetlands and riparian areas. Potential uses may include current and near-term NWI updates, wildfire research, and statewide hazard planning.

3. Budget, Timeline and Staffing

Task	Target Start Date	Target Completion Date	CWCB Funds	Other Funding, Cash*	Total
Task 1: Stakeholder Engagement and Citizen Science	Jan-2022		33,800		33,800
Task 2: Generate Wetland Layers For Colorado Using Existing Model	Mar-2022	July-2022	53,260	60,880	114,140
Task 3: Develop Multi-Class Machine Learning Model For Subclasses	Mar-2022	July-2022	49,240		49,240
Task 4: Wetland Change Analysis and Development of Secondary Products	Aug-2022	Dec-2022	40,900		40,900
	Totals		**177,200**	**60,880**	**238,080**

*Matching funding is from the Walton Family Foundation for their support of the development of the modeling techniques and development of Colorado-specific maps.	Cash Matching Funds	Requested % of Total
	25.57%	74.43%

Project Staffing:

The bulk of this project will be conducted in 2022, with some follow on work in the following years as additional NAIP imagery is flown. The table below outlines the key staff members, their roles and approximate availability during this project.

Short staff member bios can be found in Attachment D

Staff Member	Firm	Role	Budgeted Hours	% Utilization
Page Weil, PE	Lynker	Project Manager, Water Resources Engineer	480	24.00%
Josh Sturtevant	Lynker	Water Resources Engineer	280	14.00%
Sarah Marshall, PhD	CNHP	Wetlands Scientist	640	32.00%
Matt Lythe	Lynker Analytics	Senior Scientist	192	9.60%
Dan Bull	Lynker Analytics	Senior Data Scientist	604	30.20%
Rata Chapman	Lynker Analytics	GIS Specialist	510	25.50%
Diane Kielty	CWA	Project Administration	86	4.30%
Brianna Federico	CWA	Communications and Marketing	128	6.40%

4. Attachments

Immediately following this page, please find the following appendices:

Attachment A. Project Map

Attachment B. Background of Applicant Organization

Attachment C. Background of Partner Organizations

Attachment D. Staff Member Bios

Attachment E. Example of NWI Area In Need of Update

Attachment F. Detailed Description of Machine Learning Model Development and Approach

Attachment G. Letter of Support from the Walton Family Foundation:

Attachment H. Letter of Support from Colorado Parks and Wildlife

Attachment I. Letter of Support from Upper Gunnison Water Conservancy District

Attachment J. Letter of Support from Envision Chaffee County

Attachment K. Colorado Watershed Assembly State Sales Tax Exemption

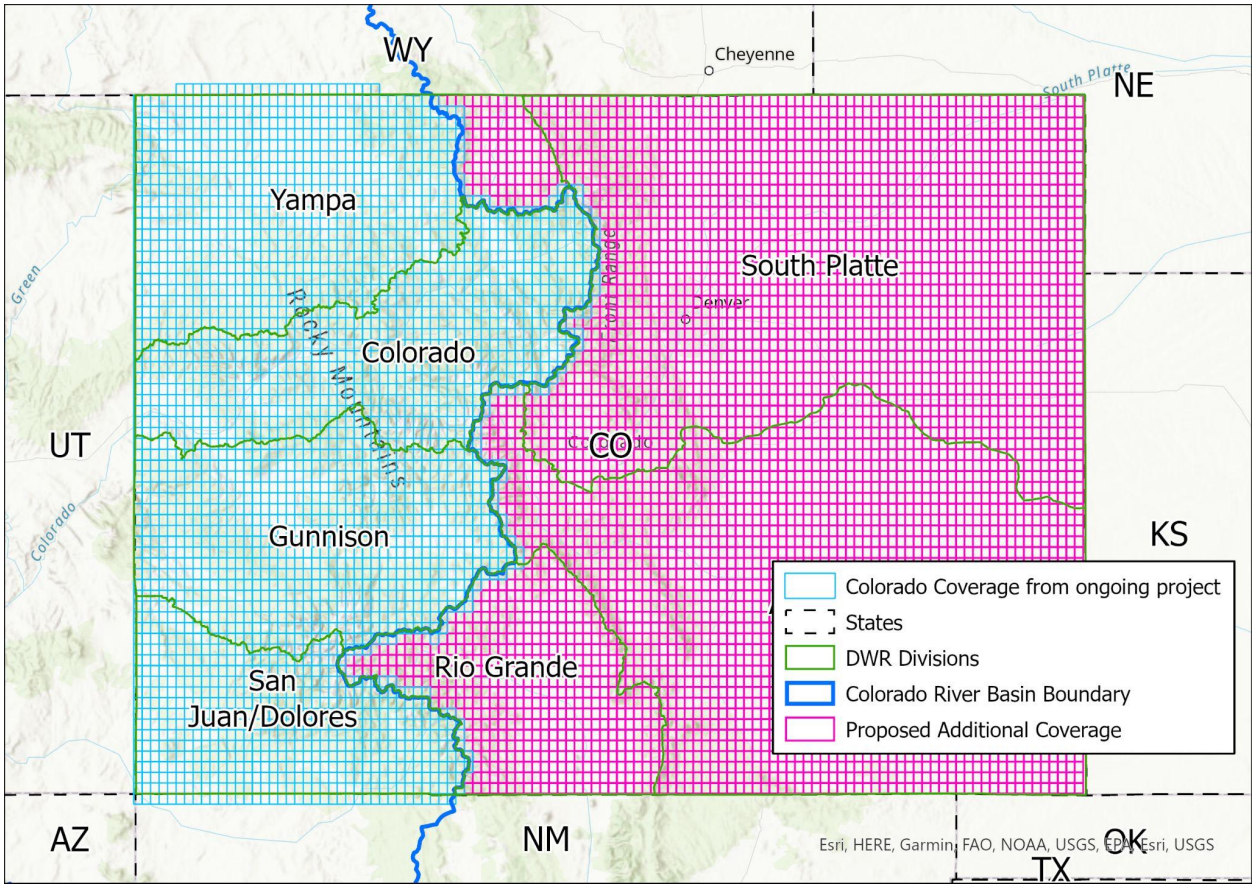
Attachment L. Colorado Watershed Assembly Certificate of Good Standing

Attachment M. Colorado Watershed Assembly Insurance Certificate

Attachment N. Colorado Watershed Assembly W-9

Attachment A. Project Map

In the map below, the blue areas represent NAIP aerial imagery coverage that has had wetland layers generated for the ongoing WFF project. The pink areas are the additional NAIP cells that will be generated in this project as part of the Colorado wide extension.



Attachment B. Background of Applicant Organization

This project is a partnership between the Colorado Watershed Assembly, the Colorado Natural Heritage Program at Colorado State University, Lynker and the Walton Family Foundation.

Applicant Organization: Colorado Watershed Assembly: Since Colorado Watershed Assembly (CWA) was created in 2001, our mission has been to provide support for collaborative efforts among stakeholders to protect and improve the conservation values of land, water, and other natural resources of Colorado's watersheds. Since 2015 CWA has focused attention on public perceptions of water and the Colorado Water Plan through increased engagement with the water quality community and expanding the knowledge and use of water quality data for local decision making.

Through the Inflow Newsletter and CWA website we provide updates on policy changes and practical advice to help identify and implement projects. CWA supports watershed protection at the community level by emphasizing local agenda-setting and engaging local expertise.

CWA Ongoing Projects Across Colorado

CWA manages several programs that encompass both government grants, contracts, and watershed organization contracts. Government work secured for 2021 includes Colorado Water Conservation Board Round Table Public Education, Participation, and Outreach (PEPO) for the South Platte and Metro Round Tables, Emergency Watershed Protection Monitoring, and administration of the Colorado Healthy Rivers Fund.

The Colorado Water Conservation Board and the Water Quality Control Commission collaborate with the Colorado Watershed Assembly to manage and operate the Colorado Healthy Rivers Fund which allows Colorado citizens the opportunity to support local watershed efforts by making voluntary contributions for such purposes. CWA serves as grant manager for awarded grants and administrator of the application process. We are in our third year of administering the program.

Watershed organization contracts and services in 2021 include Cherry Creek Stewardship Partners program management, Chatfield Watershed Authority program management, fiscal agent for the Upper Clear Creek Watershed Post-Fire Sediment, Debris Flow, and Fluvial Hazard Assessment, the Water Quality Forum, and the Fluvial Hazard Zone Training and Education project which provides educational support for CWCB's Fluvial Hazard Zone mapping program, lead communications and management of the Big Thompson Watershed Forum dissolution process, and continued management and outreach for the Colorado Water Quality Monitoring Council.

In 2020 CWA closed out a five-year CDPHE Nonpoint Source Program Outreach and Education grant that ran from 2015 – 2020. The total expenditures of the grant over the 5-year period were $807,415, with matching funds accrued at $322,966. As a 501(c)(3) Colorado organization that supports collaborative efforts, CWA provides network connectivity to diverse interests represented by Colorado's watershed groups, Conservation Districts, land managers, and technical specialists. The purpose of this grant had been to provide watershed support services to the local communities throughout the state.

Attachment C. Background of Partner Organizations

The technical work for this project will be conducted by the data scientists and water resources engineers at Lynker, Lynker Analytics and the wetlands experts of the Colorado Natural Heritage Program (CNHP). The Walton Family Foundation is currently funding the wetland mapping model development and deployment within the Colorado River basin.

Colorado Natural Heritage Program at CSU: CNHP has 40 years of experience conducting inventories of rare and imperiled species and habitats across Colorado, and is responsible for tracking the status of rare species and ecological communities throughout the state as part of the NatureServe Network. CNHP has led the state of Colorado in wetland inventory, mapping, and assessment for over 25 years. Information, data, and tools created and collected by CNHP target wetland conservation, wildlife habitat management, and restoration in priority areas across Colorado.

CNHP hosts the Colorado Wetland Inventory mapper, along with the Watershed Planning Toolbox, Colorado Beaver Restoration Assessment Tool (BRAT), and most recently the Colorado Conservation Data Explorer - all of which have free, publicly available maps. CNHP also hosts the Colorado Wetland Information Center, which is the state's most comprehensive online resource for wetlands and riparian areas in Colorado. Our federal, state, NGO, private sector, and academic partners rely on these resources to help inform wetland and riparian conservation and restoration planning and management statewide.

Lynker: is a small business with an outstanding record of service and support to large agencies as well as local customers. Our team has significant experience in water resources management including surface water and groundwater modeling, hydrologic forecasting, real-time data processing, information management, and geospatial analyses. Lynker is recognized as an engineering, science, and information technology company providing innovative solutions for environmental decision support systems, using a variety of different environmental data sources, from satellites to radar to stream gages in local rivers.

The Lynker Analytics team are experts in data infrastructure, data science and geospatial analysis. Artificial Intelligence (AI) and in particular deep learning holds great promise for organizations everywhere enabling knowledge to be created, distributed and acted upon faster than ever before. Lynker Analytics is highly skilled at using Neural Networks and the python Machine Learning/Data Science ecosystem such as Tensorflow, scikit-learn and xgboost.

Walton Family Foundation: The Walton Family Foundation is, at its core, a family-led foundation. Three generations of the descendants of our founders, Sam and Helen Walton, and their spouses, work together to lead the foundation and create access to opportunity for people and communities. We believe the best ideas can come from anywhere, so we stay open to new thinking from all over. And we partner with those who are closest to the problem because they're usually closest to the solution.

The Walton Family Foundation's Environment Program's mission is to protect water resources in the face of climate change to support healthier ecosystems and vibrant communities for generations. One of the key indicators of progress is the extent of wetlands and beaver dams in the Colorado River Basin. Wetlands improve water quality, provide resilience to climate change by reducing the impact of flooding, and improve water security by storing and slowly releasing water downstream. These habitat areas are key to the future of a water secure Colorado River

Basin. The Environment program intends to increase wetland extent over time and this project will inform the baseline and help inform target setting for the five year goal.

The Environment Program works to protect and support a climate resilient and healthy Colorado River Basin where nature and communities thrive together. A major focus of the program's work over the next five years will be to protect and improve wetland habitats by using policy and funding tools to scale up the extent of wetland coverage in the basin. In order to assess progress, the program will look at changes in acres of wetlands and number of beaver dams (or analogs) over the next five years.

Attachment D. Staff Member Biographies

Below, please find brief biographies for all key staff members.

Page Weil, PE, Water Resources Engineer and Project Manager. Mr. Weil is a water resources engineer with 12 years of experience in water resources engineering and water supply planning. Mr. Weil's municipal water resources expertise includes planning for supply, demand, changing operations and infrastructure development. Mr. Weil has supported several municipal entities in the Western US in modeling and optimizing the use of their various water sources to maximize yield and reliability. His work includes water rights accounting, developing water court and storage applications, and providing general guidance on basin-wide water rights issues including trans-mountain diversions, and major river administration policies and climate change impacts.

Josh Sturtevant, Water Resources Engineer. Josh Sturtevant is a Water Resources Scientist at Lynker Technologies with expertise in surficial hydrology, including streamflow forecasting and climate change impact analysis. Josh has extensive expertise in the use of the programming language Python. Josh leverages his skills in Python and other programming languages for hydrometeorological data analysis and visualization, including on High Performance Computers in Linux environments. He has demonstrated project experience using ArcGIS, QGIS, and Google Earth Engine for geospatial data analytics, including surficial feature mapping using high-resolution lidar products and the remote sensing of snow for improved parameter estimation in flood forecasting applications.

Sarah Marshall, Ph.D., Ecohydrologist. Sarah has more than 15 years of experience working with wetland and riparian ecosystems in the western U.S. She has a Ph.D. in Water Resources Engineering, with expertise in ecological restoration and the effects of land use and management on wetland hydrology, soils, and ecology. Her current work focuses on watershed planning, including prioritizing headwater wetland conservation and restoration efforts to meet water quality, water supply, and habitat needs in a changing climate. She has also developed a suite of tools, protocols, and web content to help partners better understand, manage, and assess the ecological condition of wetlands across Colorado and the

West. Her watershed and statewide wetland planning efforts are supported by extensive field and GIS-based wetland assessment and delineation experience.

Matt Lythe, Managing Director, Lynker Analytics. Matt is an environmental scientist and project manager with more than 20 years' experience in the science and technology industry with a specific focus on GIS, environmental sciences, and remote sensing.

Matt has worked across a range of technical and management roles with a background spanning research, software, consulting, data and analytics companies. Currently he manages the New Zealand Lynker team which specializes in environmental data science, database consulting and geospatial analytics. Matt and his team have extensive experience working with dense geospatial data and are current with the most best practice technologies required to handle these expanding data streams.

Daniel Bull, Senior Data Scientist, Lynker Analytics: Dan provides machine learning and data science expertise as part of our data science team. He leads the development and execution of key AI projects in collaboration with the wider team of experts. Dan has led several key land cover and vegetation mapping projects include wetland mapping in USA and carbon stock mapping in New Zealand. Dan has a background in plant science and horticulture.

Rata Chapman Olsen, Senior Geospatial Consultant, Lynker Analytics. Rata provides GIS, remote sensing, data transformation (engineering) expertise across a wide range of projects. Adept at using Python, ArcGIS, image processing and other tools Rata manages the data processing pipelines of key ML projects at Lynker Analytics. Project experience includes deforestation mapping, wetland delineation, building and road detection, vegetation mapping.

Watershed Assembly Staff

Casey Davenhill, Executive Director, Watershed Assembly

Casey is a graduate of Metropolitan State University of Denver with a degree in accounting and over 30 years of accounting experience, having worked for an international accounting firm and numerous small businesses and non-profits as a consultant. As Administrator for the Colorado Watershed Network and Executive Director for the Colorado Watershed Assembly, Casey has a long history of coordination with important programs and projects that have been facilitated by these two organizations. Casey uses her accounting training and experience to offer professional guidance to watershed and educational non-profit groups to maintain their financial accounts and provide grant and financial management support.

Diane Kielty, Program Manager

Diane came on board with the Colorado Watershed Assembly in 2015. Along with providing strategic guidance and operational support, she organizes and coordinates the Colorado Healthy Rivers Fund program, Chatfield Watershed Authority program and serves as oversight on all project activities. Diane's background in watershed work began in 2007 as a Project Development Consultant with the Clear Creek Watershed Foundation. She has managed project agreements with organizations including the United States Environmental Protection Agency, United States Department of Agriculture-Forest Service, Colorado Department of Public Health & Environment, and Colorado Division of Reclamation, Mining, & Safety. Diane served the Foundation as Project Manager for remediation of large-scale nonpoint source pollutants contributing to the State of Colorado's 303(d) list of impaired waters for trace metals.

Brianna Federico, Social Media Coordinator

Brianna is a Colorado native and graduate of Metropolitan State University in Convergent Journalism and Digital Media. She interacts with CWA's virtual communities and network users to tell Colorado about our programs and watershed activities throughout the state and bring meaningful and accessible content to our social media platforms. Brianna maintains the CWA social media pages and profiles on existing social media platforms for the

Colorado Watershed Assembly, Colorado Healthy Rivers Fund, and Cherry Creek Stewardship Partners.

Attachment E. Example of NWI Area In Need of Update

Example of existing NWI mapping that needs an update. This is a false color image showing the most up-to-date NWI polygons on top of recent imagery. Note the light green areas on the left side that overlap with a new residential area. Also that the stream channel has significantly changed position since the original mapping.

Attachment F. Detailed Description of Machine Learning Model Development and Approach.

The project scope entails three project phases.

Phase 1: Training and application of our existing Colorado River Basin ML models to this study area over all available time periods. These models:

a. identify and size wetland pond complexes, and
b. map the extent of beaver-influenced and non-beaver-influenced wetlands.

Phase 2: Develop a new sub-class wetland mapping system in Colorado using machine learning. This model will be trained using our Active Learning system integrated with GIS. This model will utilise NAIP imagery as well as Lidar elevation data where available.

Phase 3: Assessment of wetland hydroperiod which is the typical length of time that there is standing water at a location. The sub-class wetland polygons from the phase 2 work will be used as input and time series Sentinel-2 or Airbus SPOT data will be processed.

The project phases are shown schematically in Fig 1.

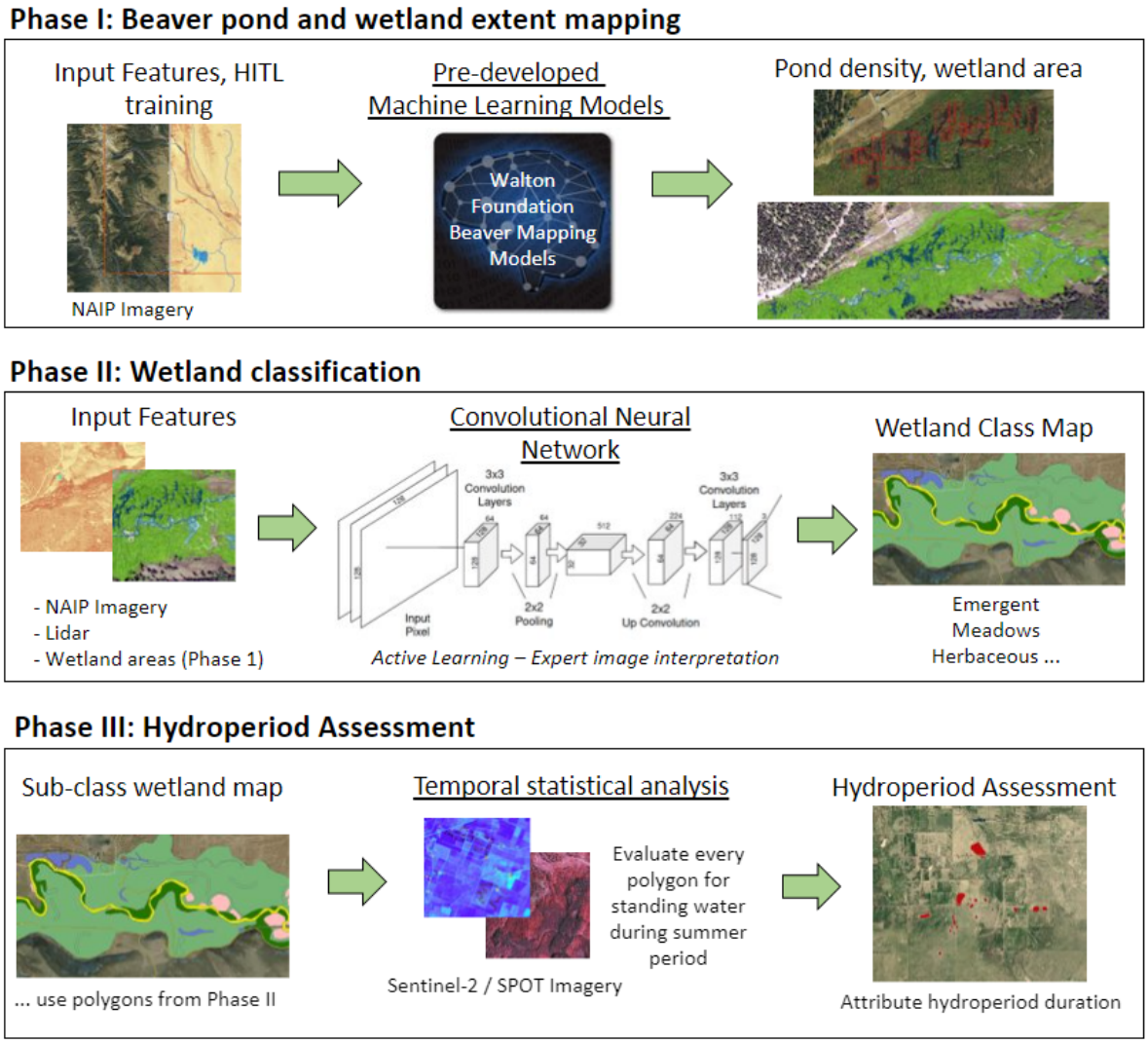


Figure 1. Wetland Mapping System Design

Beaver pond and wetland extent mapping

Lynker, Lynker Analytics and CNHP are currently developing an integrated AI system to track the extent of wetlands and presence of beaver dams (real and analogs) over time in the Colorado River basin (CRB) using Machine Learning. The scope of this work includes the identification of beaver ponds and associated beaver-influenced wetlands such as shrublands, wet meadows, and stream channels. Together, these are often referred to as discrete beaver "complexes." Other vegetated, valley bottom wetlands not influenced by beavers are also being mapped. The final production models from this project will be adapted and applied to this region. The two modelling approaches are described below.

Object Detection model to identify and locate Beaver Ponds

This supervised machine learning technique involves training a deep learning model to detect and differentiate beaver ponds by example. We are using NAIP imagery including false color composites such as Normalized Water Index (NWI) and Normalized Difference Vegetation index (NDVI) to locate and label beaver ponds. Our team has bootstrapped our model using NWI polygons which are then adapted to capture the range of variability that these objects exhibit. We use Active Learning to refine and improve the models iteratively guided by model entropy. Fig 2 shows our ArcGIS Online training system with pond training examples shown on the right hand image.

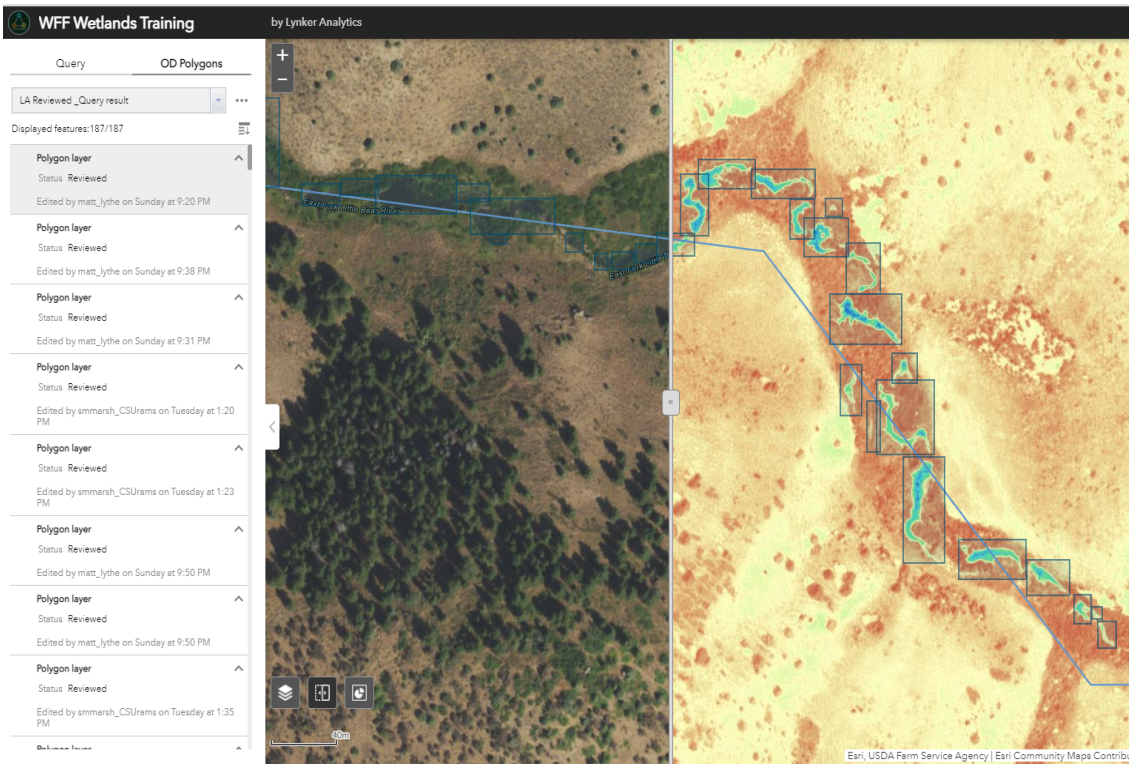


Figure 2. Object Detection Beaver Pond Training System.

The model has been trained in several landscapes within the CRB and is being iteratively refined to predict ponds from 4-band NAIP imagery. Typically, 1m resolution imagery is being used as input but we are also experimenting with the more recent high resolution NAIP data. Fig 3 shows an example of beaver pond predictions from our model in an area previously unmapped.

Figure 3. New Beaver ponds mapped using AI

Segmentation model to map vegetated wetlands

The second model which has been developed in the CRB project is a multi-class semantic segmentation neural network model. This model has been trained using spectral similar super-pixels describing areas of open water/channel, shoreline and vegetated wetland. A similar iterative training improvement method has been used to refine and calibrate the model to optimise the classification of these classes.

Fig 4 shows the output from the segmentation model which shows beaver ponds north of the stream within a broad area of beaver influenced wetland. The blue labelled polygons show the extent of previous wetland mapping from NWI.

These two models work in unison to produce a comprehensive inventory of beaver pond complexes and areal extent as well as the area of beaver influenced and non-beaver influenced wetlands. In the CRB study the models will be applied to several different NAIP data sets to measure change over time.

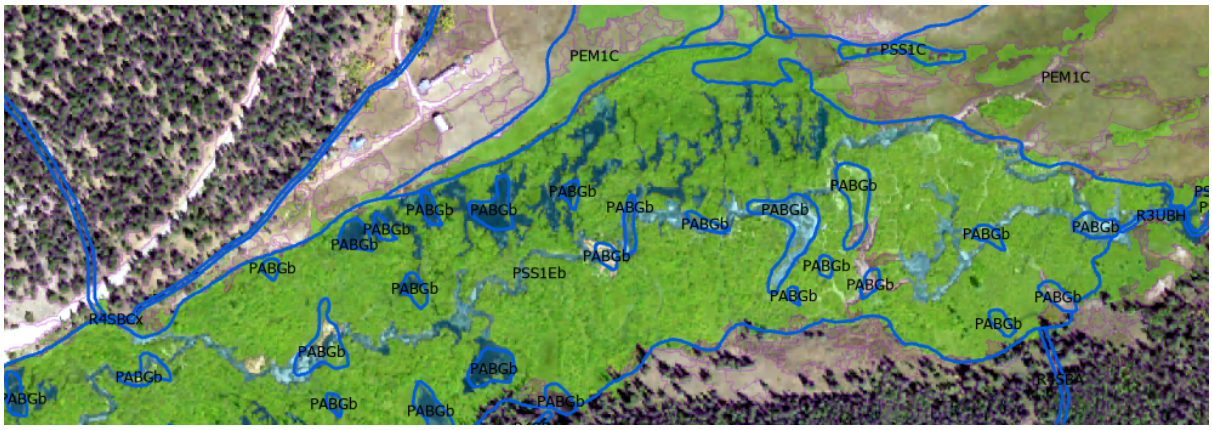


Figure 4. AI mapping results in comparison to NWI polygons (in blue)

We apply GIS post processing rules to separate natural beaver ponds from other ponds based on concordance with the object detection results plus further calibration based on measurement of perimeter:area ratio (beaver ponds often have convoluted shapes, often with "gradient" pond boundaries as they transition from open water to emergent wetland vegetation).

Wetland Classification

An additional semantic segmentation model will be developed to classify sub-class wetland polygons in this study area. We will adopt a similar training approach as used in the WFF project using spectrally similar super pixels to train wetland class. Our model will again be bootstrapped from NWI data checked and verified by CNHP staff using desktop review and field work. The proposed wetland classes will include Emergent, Shrubland, and Forest.

We will rely on 4-band NAIP imagery across multiple time periods and consider LiDAR if required. The goal will be to replicate and map in much finer detail at scale the sub class detail presently available in the Colorado Wetland Inventory (Fig 6).

Figure 5. NWI mapping

Once the models achieve maturity, they will be run across the entire Colorado NAIP archive comprising data for 2009, 2011, 2013, 2015, 2017, and 2019.

Hydroperiod Assessment

The final project phase will be the development of a machine learning model to detect temporal change in standing water within wetlands across the study area. The key project goal in this phase is to identify those wetlands exhibiting standing water with statistically significant change in wetness and resolve the date at which change occurred using a statistical time series analysis model.

This will be undertaken using statistical analysis of time-series Sentinel-2 (S2) imagery acquired over the past 5 years to identify changes in spectral response within the wetland polygons or near the wetland boundary. The analysis will consider all 13 S2 bands and band indexes including the NDWI – normalised differential wetness index, NDVI – normalised differential vegetation index and soil index.

Using targeted polygons from the phase 2 workstream we will develop a python script to retrieve reflectance information (within the target) over the 13 bands and upload this into a database. Once all the data has been uploaded to the database, we will calculate the NDWI and the NDVI for each pixel. We will then use a human review process to classify the change type and calibrate to ground truth information. By combining the wetness, vegetation and soil indexes over the RGB channels of a single image we will identify the changes to all 3 indexes at a glance, making it far easier for a human reviewer to verify the changes occurring in the wetland polygon.

We will use either a statistical approach or a machine learning model to assign hydroperiod. A statistical analysis of the mean annualised pixel values across target bands within known wetlands over multiple years will provide the basis for hydroperiod assessment. We have applied this successfully before in New Zealand to identify changes within wetlands (Fig 7). This example shows wetness increasing between images within a wetland polygon.

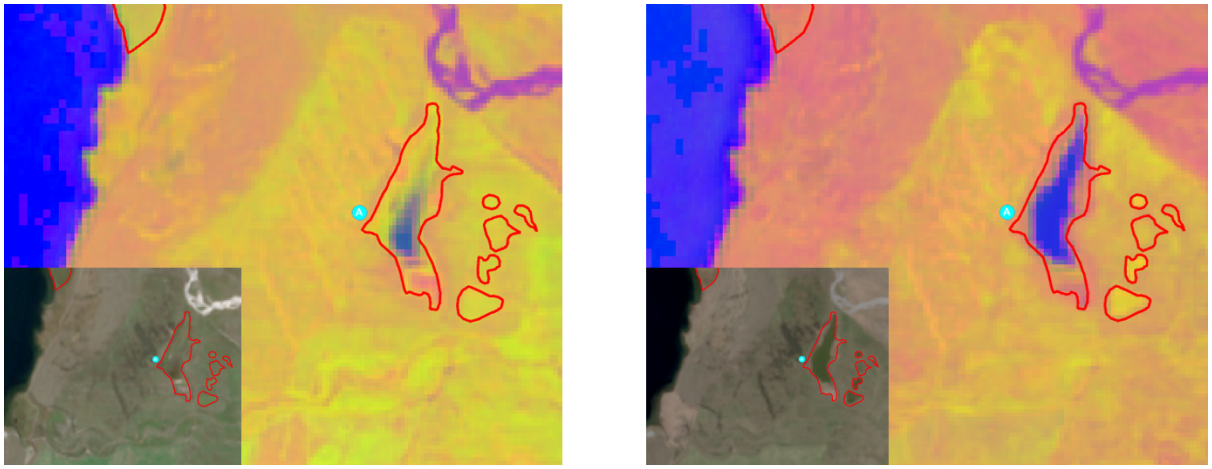


Figure 6. Monitoring wetland change over time using Sentinel-2, Canterbury, New Zealand

In the NZ example we have also used anomaly detection models such as isolation forest to identify wetlands with a high degree of change. This might help identify areas of more rapid change (e.g. vegetation removal, drying, flooding) across the state. Isolation forest is an unsupervised learning algorithm for anomaly detection that works on the principle of isolating anomalies, instead of the most common techniques of profiling normal points. The S2 data should provide a reliable method for us to track the hydroperiod for every target polygon. We will model this over the 5-year period taking into account dry and wet seasons. If S2 data is too coarse then 4-band 1.5m resolution imagery from Airbus SPOT will be considered.

WALTON FAMILY
FOUNDATION

November 1, 2021

To Whom It May Concern:

The Walton Family Foundation would like to express our enthusiastic support for the following project: *Development of High Resolution Wetland Maps for Colorado Using Machine Learning Techniques*.

As part of an ongoing project with Lynker and the Colorado Natural Heritage Program (CNHP), we have provided $159,740 in funding to pilot the use of machine learning techniques to develop wetland maps over time for the entire Colorado River Basin domain. Of that amount, $60,880 has been spent on activities to develop models and maps specific to Colorado and can be considered local in-kind matching funds.

While we have funded the development of the machine learning model used in this project, we fully support Lynker and CNHP redeploying it to generate additional wetland maps to support the goals of the Colorado Water Conservation Board.

Maps of wetlands and beaver ponds exist in Colorado, but many of these have not been updated in decades and very few are remapped often enough to show changes due to hydrologic conditions. The techniques piloted in this project are innovative and will generate up to date datasets that can be used in planning to meet a variety of environmental and conservation goals. We feel that the Colorado-specific expansion of this work aligns with the values of the Walton Family Foundation and will benefit many water resources stakeholders across Colorado.

We fully support this project and look forward to continuing to remain engaged with wetland mapping and restoration efforts in Colorado.

Sincerely,

Kara Stevens, Senior Strategy Learning and Evaluation Officer

Walton Family Foundation

kstevens@wffmail.com ; 202-718-9897

COLORADO
Parks and Wildlife
Department of Natural Resources

Terrestrial Programs Unit
317 W. Prospect Rd.
Fort Collins, CO 80526

November 1, 2021

To Whom It May Concern:

I am writing to express my strong support for the project ***"Development of High Resolution Wetland Maps for Colorado Using Machine Learning Techniques"***.

Colorado Parks and Wildlife has long partnered with the Colorado Natural Heritage Program (CNHP) to protect, map, and assess the condition of Colorado's wetlands and riparian areas. We are excited to see CNHP and Lynker's current effort to map beaver-influenced and valley bottom wetlands in the Colorado River basin be extended statewide.

Colorado has statewide National Wetland Inventory mapping coverage including beaver-influenced wetlands, but many parts of the state have not been updated since the 1970s and 1980s and few areas have been remapped often enough to show changes due to hydrologic conditions and level of beaver activity. The techniques piloted in this project are innovative and will generate up-to-date datasets that can be used in planning to meet a variety of environmental and conservation goals.

We feel that the Colorado-specific expansion of this work aligns with the goals of the CPW Wetland Wildlife Conservation Program, and will benefit many conservation and water resources stakeholders across Colorado. Additionally, more detailed beaver-influenced wetland mapping will help inform the next Wetland Wildlife Conservation Program Strategic Plan and support our efforts to encourage voluntary wetland habitat conservation and restoration across public and private lands statewide.

I fully support this project and look forward to continuing to remain engaged with wetland and riparian mapping efforts in Colorado. Please let me know if you have any questions regarding our support for this project.

Sincerely,

Brian D. Sullivan

Brian D. Sullivan
Wetlands Program Coordinator
Tel. 970-472-4306
brian.sullivan@state.co.us

Dan Prenzlow, Director, Colorado Parks and Wildlife • Parks and Wildlife Commission: Carrie Besnette Hauser, Chair • Charles Garcia, Vice-Chair
Luke B Schafer, Secretary • Taishya Adams • Karen Bailey • Betsy Blecha • Marie Haskett • Dallas May • Duke Phillips, IV • James Jay Tutchton • Eden Vardy

Upper Gunnison River Water Conservancy District

210 West Spencer Avenue, Suite B • Gunnison, Colorado 81230
Telephone (970) 641-6065 • www.ugrwcd.org

November 2, 2021

To Whom It May Concern:

The Upper Gunnison Water Conservancy District would like to express our enthusiastic support for the following project: *Development of High Resolution Wetland Maps for Colorado Using Machine Learning Techniques*.

Our district has worked with the Colorado Natural Heritage Program (CNHP) since 2013 to monitor plant community response to meadow and riparian restoration projects, and most recently to begin to assess the condition and functional role of our watershed's wetlands and riparian areas.

We are excited to see CNHP and Lynker's effort to map beaver-influenced and valley bottom wetlands in the Colorado River basin be expanded to include additional wetland classes and extended statewide. While the current National Wetland Inventory mapping has helped us understand the distribution and types of wetlands in the Upper Gunnison watershed, many parts of Colorado, including our watershed, have not been updated since the 1970s and 1980s. The techniques piloted in this project are innovative and will generate up-to-date datasets that can be used in planning to meet a variety of environmental and conservation goals.

We feel that the Colorado-specific expansion of this work aligns with our current efforts to assess the function and restoration needs of wetlands within our watershed as we plan for future wildfire risk, post-fire sediment, and droughts. Additionally, updated wetland mapping will help us track the progress of our collaborative work to restore meadows and riparian areas across public and private lands.

We fully support this project and look forward to continuing to remain engaged with wetland and riparian mapping efforts in the Upper Gunnison watershed.

Sincerely,

Sonja Chavez
General Manager

ENVISION

A FUTURE BUILT ON COMMON GROUND

To Whom It May Concern:

Envision Chaffee County would like to express our enthusiastic support for the *Development of High Resolution Wetland Maps for Colorado Using Machine Learning Techniques* project.

Our organization has worked with the Colorado Natural Heritage Program (CNHP) since 2017 to identify high-priority wetland and riparian areas for conservation and restoration. We have specifically targeted wetlands that provide multiple benefits for our water supply and wildlife habitat in Chaffee County.

We are excited to see CNHP and Lynker's effort to map beaver-influenced and valley bottom wetlands be expanded to include additional wetland classes and extended statewide. While the current National Wetland Inventory (NWI) mapping has helped us understand the distribution and types of wetlands in the Arkansas Headwaters watershed within Chaffee County, we recognize that floodplain wetlands including beaver complexes can change faster than the NWI mapping is updated. The techniques piloted in this project are innovative and will generate up-to-date datasets that can be used in planning to meet a variety of environmental and conservation goals.

We feel that the Colorado-specific expansion of this work aligns with our current efforts to assess the function and restoration needs of wetlands within our watershed as we plan for future wildfire risk, post-fire sediment, and droughts. Additionally, updated wetland mapping will help us track the progress of our collaborative work to restore wetlands and riparian areas across public and private lands.

We] fully support this project and look forward to continuing to remain engaged with wetland and riparian mapping efforts in Chaffee County.

Sincerely

CindyLW.

Cindy Williams
Co-Chair Envision Chaffee County
https://envisionchaffeecounty.org/

DR 0160 (02/16/11)
COLORADO DEPARTMENT OF REVENUE
DENVER CO 80261-0013

CERTIFICATE OF EXEMPTION FOR STATE SALES/USE TAX ONLY

THIS LICENSE IS NOT TRANSFERABLE

USE ACCOUNT NUMBER for all references	LIABILITY INFORMATION		ISSUE DATE
09817633	N	110105	Oct 20 2015

COLORADO WATERSHED ASSEMBLY
PO BOX 211729
DENVER CO 80221-0384

Barbara J. Brohl
Executive Director
Department of Revenue

▲ DETACH HERE ▲

GENERAL INFORMATION

Revenue ONLINE

The following services are available at *www.Colorado.gov/RevenueOnline* under **Business**.

Sales:

- Verify a Sales Tax License
- View Local Sales Tax Rates
- View Business Location Rates
- Find Local Taxes by Address
- View Sales Tax Rate Charts

Try Revenue Online today!

www.Colorado.gov/RevenueOnline

Scan this code with your smartphone or tablet to access Revenue Online

Attend our free sales tax classes. Live classes, online CPE and Webinars are available. To sign up, visit *www.TaxSeminars.state.co.us*

OFFICE OF THE SECRETARY OF STATE
OF THE STATE OF COLORADO

CERTIFICATE OF FACT OF GOOD STANDING

I, Jena Griswold, as the Secretary of State of the State of Colorado, hereby certify that, according to the records of this office,

COLORADO WATERSHED ASSEMBLY

is a

Nonprofit Corporation

formed or registered on 07/05/2001 under the law of Colorado, has complied with all applicable requirements of this office, and is in good standing with this office. This entity has been assigned entity identification number 20011133057 .

This certificate reflects facts established or disclosed by documents delivered to this office on paper through 10/25/2021 that have been posted, and by documents delivered to this office electronically through 10/26/2021 @ 11:37:08 .

I have affixed hereto the Great Seal of the State of Colorado and duly generated, executed, and issued this official certificate at Denver, Colorado on 10/26/2021 @ 11:37:08 in accordance with applicable law. This certificate is assigned Confirmation Number 13539541 .

Jena Griswold

Secretary of State of the State of Colorado

**********End of Certificate**********

Notice: A certificate issued electronically from the Colorado Secretary of State's Web site is fully and immediately valid and effective. However, as an option, the issuance and validity of a certificate obtained electronically may be established by visiting the Validate a Certificate page of the Secretary of State's Web site, http://www.sos.state.co.us/biz/CertificateSearchCriteria.do entering the certificate's confirmation number displayed on the certificate, and following the instructions displayed. Confirming the issuance of a certificate is merely optional and is not necessary to the valid and effective issuance of a certificate. For more information, visit our Web site, http://www.sos.state.co.us/ click "Businesses, trademarks, trade names" and select "Frequently Asked Questions."

COLOWAT-02 LGROSHONG

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 10/19/2021

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER License # 0757776 HUB International Insurance Services (COL) 2000 S. Colorado Blvd Tower 2, Suite 150 Denver, CO 80222	CONTACT NAME: Lisa Groshong PHONE (A/C, No, Ext): (303) 813-4207 FAX (A/C, No): E-MAIL ADDRESS: lisa.groshong@hubinternational.com
INSURED Colorado Watershed Assembly P.O. Box 460736 Glendale, CO 80246	INSURER(S) AFFORDING COVERAGE / NAIC # INSURER A : Alliance of Nonprofits for Insurance, Risk Retention Group (ANI) 10023 INSURER B : Pinnacol Assurance Company 41190 INSURER C : QBE INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY PRO-JECT X LOC OTHER:	X	X	2021-17815	10/20/2021	10/20/2022	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG LIQUOR LIABILIT	$ 1,000,000 $ 500,000 $ 20,000 $ 1,000,000 $ 2,000,000 $ 2,000,000 $ 1,000,000
A	AUTOMOBILE LIABILITY ANY AUTO OWNED AUTOS ONLY SCHEDULED AUTOS X HIRED AUTOS ONLY X NON-OWNED AUTOS ONLY			2021-17815	10/20/2021	10/20/2022	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 1,000,000 $ $ $
	UMBRELLA LIAB OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION $						EACH OCCURRENCE AGGREGATE	$ $
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N / A	X	4097119	10/1/2021	10/1/2022	PER STATUTE X OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ 500,000 $ 500,000 $ 500,000
A	Professional Liabili			2021-17815	10/20/2021	10/20/2022	SSPL	2,000,000
C	Accident Policy			2021-17815 - CACC	10/20/2021	10/20/2022	Vol / Part Accident	1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
State of Colorado and the Colorado Water Conservation Board is listed as an Additional Insured including Waiver of subrogation.

CERTIFICATE HOLDER

Colorado Water Conservation Board
Department of Natural Resources
1313 Sherman St., Room 721
Denver, CO 80203

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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Form **W-9**
(Rev. October 2018)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

▶ **Go to *www.irs.gov/FormW9* for instructions and the latest information.**

Give Form to the requester. Do not send to the IRS.

Print or type. See Specific Instructions on page 3.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.

Colorado Watershed Assembly

2 Business name/disregarded entity name, if different from above

3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only **one** of the following seven boxes.

☐ Individual/sole proprietor or single-member LLC ☑ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ▶ _____

Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is **not** disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner.

☐ Other (see instructions) ▶

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):

Exempt payee code (if any) 1

Exemption from FATCA reporting code (if any) 1

(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.) See instructions.

P.O. Box 460736

Requester's name and address (optional)

6 City, state, and ZIP code

Denver, CO 80246

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN*, later.

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Social security number

			–			–				

or

Employer identification number

8	4	–	1	6	0	0	0	8	9

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here Signature of U.S. person ▶ Cassidy Dorsett Date ▶ 10/27/2021

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to *www.irs.gov/FormW9*.

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, *later.*