

Fill out the proposal template, being sure to include feedback from conversations with foundation staff about your proposal idea. Include citations for statements of fact, and in general provide evidence around context, proposed approach, etc. A list of references for citations should also be included. Be sure that the questions in each section are clearly answered, and use visuals (figures, pictures, tables, etc.) as needed to provide further clarity around the proposal.

PROJECT OVERVIEW

Provide a basic but thorough introduction about the problem the proposed project is trying to solve, such as information on its significance, causes, and past and current attempts to solve the problem. Do not expect deep familiarity with the topic or field. This section should describe the following:

- ***What is the background, significance, and causes of the problem?***

Forested watersheds in the United States provide essential drinking-water supply services to downstream communities. Although forests occupy only about one-third of U.S. land area, they generate roughly half of the nation's surface water supply, and nearly 150 million people receive some portion of their drinking water from forested lands (Liu et al., 2021). Dependence is particularly strong in the western United States and Pacific Northwest, where federally managed forests serve as the dominant source of municipal water (Liu et al., 2021; Robichaud and Padowski, 2024). Some municipal systems, including the Mill Creek watershed serving the City of Walla Walla, WA, Bull Run Watershed service the City of Portland, OR, and Cedar River Watershed, serving the City of Seattle, WA, rely on naturally high water quality and operate without filtration, making them especially vulnerable to disturbances that introduce sediment, ash, and nutrients into streams and reservoirs.

Over the past century, wildfire suppression and climate change have increased forest density and fuel loads across much of the western United States. Modern suppression practices unintentionally create a "suppression bias," in which low-intensity fires are removed while extreme fires escape control, leading to more severe wildfire events (Kreider et al., 2024). These high-severity fires produce large sediment pulses and long-term water-quality degradation (Kreider et al., 2024; Liu et al., 2021), sometimes forcing utilities to shut off intakes or implement costly treatment measures. Additionally, nearly three-quarters of utilities in the Pacific Northwest serving 76% of the population are exposed to moderate wildfire risk (Robichaud and Padowski, 2024). In this context, wildfire risk management has effectively become drinking-water infrastructure management.

Prescribed fire and thinning are widely recognized Natural Climate Solutions that reintroduce low-intensity fire, reduce fuel accumulation, and improve forest resilience (Kreider et al., 2024). However, implementation remains slow relative to the scale of need. The primary constraint is not willingness—for example, fuel treatments have already been authorized within the Mill Creek municipal watershed following detailed environmental analysis and protective design measures (U.S. Forest Service, 2025)—but the lack of quantitative guidance for day-to-day planning decisions. Managers must determine how much area to treat in a given year, where treatments should occur first, and how to sequence treatments while minimizing potential downstream effects on drinking water, aquatic habitat, and smoke exposure. Even beneficial treatments temporarily disturb soil and can increase erosion (Zema and Lucas-Borja, 2023). In municipal watersheds, managers therefore balance short-term disturbance against long-term wildfire risk. The challenge is not whether treatments are appropriate, but how to implement them at the necessary pace while maintaining water-supply protection and public confidence.

Because planners cannot predict how much burning can occur without affecting water quality, they act cautiously: burn areas are kept small, steeper slopes are postponed, and treatments are spread over many years. This creates an implementation gap: even where Natural Climate Solutions are approved and funded, treatments cannot proceed at the pace necessary to reduce wildfire risk because planners lack decision-ready guidance on where, how much, and in what sequence treatments can safely occur. Public concerns about smoke exposure and occasional escaped prescribed fires (Kolden, 2019; Kreider et al., 2024), combined with narrowing weather windows for safe burning (Swain et al., 2023), further constrain implementation.

- ***What has or is being done to solve the problem?***

The following description focuses on the Mill Creek municipal watershed (Fig. 1) as a representative case study. While this watershed already has an approved forest restoration project and implementation is underway, many municipal watersheds across the western United States face similar planning and implementation challenges.

Mill Creek managers have historically relied on risk assessments, technical review, and historical fire-regime analysis to guide treatment design. These analyses have consistently shown that the watershed is highly vulnerable to severe wildfire and that proactive fuels treatments are necessary to protect water quality, infrastructure, and aquatic resources.

In February 2025, the U.S. Forest Service completed the National Environmental Policy Act (NEPA) process for the Tiger-Mill Project, a forest fuels reduction and watershed protection project in the Mill Creek municipal watershed, and issued an Environmental Assessment, Finding of No Significant Impact, and Decision Notice (NEPA Environmental Assessment hereafter; U.S. Forest Service, 2025), allowing fuels reduction and watershed protection activities to proceed. The project was developed specifically to reduce wildfire severity and protect the City of Walla Walla drinking water supply.

Planned actions include both mechanical thinning and prescribed fire to restore more fire-resilient forest structure (Fig. 1). Thinning removes small and medium diameter trees and ladder fuels, while prescribed fire reduces surface fuels across larger areas and steeper terrain where mechanical treatment is limited. These treatments are designed to create conditions in which fire can occur without causing severe erosion or loss of water supply reliability.

The project also includes required monitoring by the U.S. Forest Service. The Forest Service will oversee implementation activities, enforce best management practices, and coordinate with the City of Walla Walla. Water quality monitoring—including turbidity measurements before and after burning—will be used to detect impacts, and site-specific burn plans will be developed prior to implementation. Since increased sediment loads following fire is the primary concern for drinking water treatment operations and aquatic ecosystem health, monitoring focuses on identifying post-disturbance sediment and runoff responses.

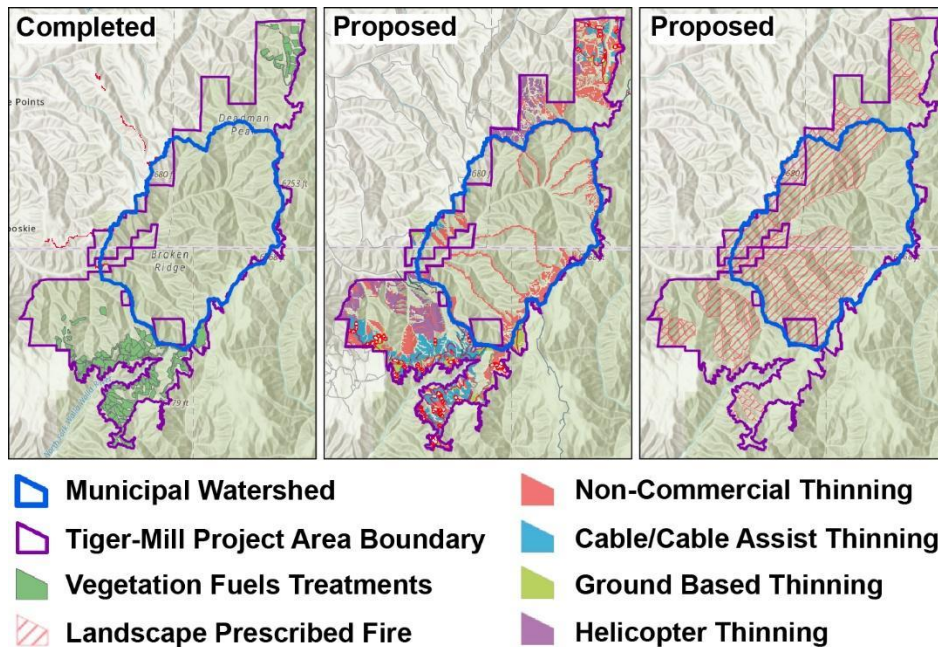


Fig. 1. Completed and planned forest fuel treatments in and around the municipal watershed.

- ***What are the weaknesses or limitations of existing approaches?***

Current planning processes can determine whether treatments are appropriate but not how they should be carried out in practice. Environmental review, best management practices, and monitoring help managers reduce risk and justify actions, but they do not tell planners how many acres can safely be burned each year, which areas should be treated first, or how treatments should be sequenced over time to protect water quality and aquatic/riparian habitats.

Monitoring is essential for detecting impacts after treatments occur and guide operational response if problems arise. However, it does not provide predictive guidance about acceptable levels of sediment in the water supply or identify treatment plans that balance wildfire risk reduction with downstream protection.

As a result, managers plan cautiously. Burn areas are kept small, higher risk slopes are postponed, and treatments are spread across many years rather than prioritized based on watershed risk. Existing approaches are heuristic, they yield treatments that are beneficial, but cannot determine how aggressively they can be implemented.

Current methods do not provide:

- clearly justified annual treatment limits,
- prioritization of burned areas based on downstream risk,
- multi-year sequencing under water quality and budget constraints, or
- integration of hydrologic response into routine planning decisions.

This inability to quantify acceptable disturbance in advance means that the implementation pace is governed by caution rather than risk-informed planning. This slows the deployment of prescribed fire and thinning despite available funding, authorization, and public support, limiting the effectiveness of Natural Climate Solutions.

PROGRAM LOGIC

Clearly articulate what the project will do and aims to achieve during the grant period. Carefully consider how activities are presented. This may include a diagram showing different activities and how they fit together, articulating discrete activities by time, location, programmatic aim, or other factors. In short, this section should use simple language to clearly explain the basic parameters of a project to allow a fair and thorough assessment of the project proposal.

This section should describe the following:

- ***What is the project and what will the project do?***

The proposed project will **develop** and **deploy** a planning tool that helps land managers decide how much prescribed fire and thinning can safely occur each year, where treatments should occur, and in what order they should be implemented to protect drinking water while reducing wildfire risk.

For this purpose, we propose the following objectives:

Objective 1. Co-develop the planning tool with local stakeholders to ensure it can be used in real management decisions

WEPPcloud is an established, decision-support tool developed and maintained by the project team in collaboration with the Forest Service Rocky Mountain Research Station. The tool already has over 4,500 registered users and has a wide user base in the US. The proposed project would extend WEPPcloud's scenario-based simulations into a treatment-placement tool. The first objective will focus on ensuring the proposed tool reflects real decisions and balances multiple priorities based on timing, location, cost, and impact.

We will work directly with the organizations responsible for the Mill Creek Municipal Watershed so the tool incorporates operational constraints and community concerns from the beginning. The NEPA Environmental Assessment for the Tiger-Mill Project authorized treatments, but it did not produce a method for deciding treatment pace, location, and tradeoffs among water supply, habitat, and operational feasibility.

During the first six months, the team will meet multiple times with stakeholders to establish what the tool must evaluate when recommending treatments, including:

- drinking-water protection priorities (City of Walla Walla),
- operational constraints such as burn windows and smoke management (U.S. Forest Service),
- watershed coordination and monitoring logistics (Walla Walla Basin Watershed Council),
- ecological objectives including summer baseflow and **Endangered Species Act listed steelhead, Chinook salmon and bull trout habitat** (Tribal partners).

Every six months thereafter, we will meet with these stakeholders to review model outputs and interpret results to ensure the tool produces information they can directly use during planning.

Objective 2. Develop and validate a predictive model of water-quality impacts from forest treatments

This objective creates a reliable method to predict how treatments affect runoff and sediment reaching the drinking-water intake.

We will expand WEPPcloud, an existing watershed modeling tool (<https://wepp.cloud/weppcloud/>; Lew et al., 2022), to evaluate treatment placement across the entire watershed. Currently, users can test a specific prescribed-fire scenario and examine its downstream effects, but they are not able to identify where treatments should occur to minimize water-quality impacts. The proposed tool will run many simulations and automatically apply treatments one area at a time across the watershed while leaving the rest unchanged. By measuring how each location affects sediment at the water-supply intake, the tool will produce a watershed-wide map showing where treatments provide the greatest benefit and where they pose the least water quality risk.

Objective 3. Improve prediction reliability through targeted water quality measurements and regional parameterization

This objective improves confidence in the planning tool by making sure the model correctly predicts how treatments affect runoff and sediment. It has two linked tasks: (1) water sampling in Mill Creek to validate the model, and (2) development of regional parameter sets so the tool can be applied in other watersheds in Pacific Northwest that lack monitoring data.

O3 Task 1. Mill Creek monitoring and model validation

The NEPA Environmental Assessment requires basic post-treatment monitoring to confirm that treatments do not degrade water quality. However, those measurements are designed for compliance, not for improving predictive models. In this project, we will expand water quality sampling to collect data that is specifically needed to calibrate WEPPcloud.

Water quality monitoring equipment will be installed at multiple locations in and around treated areas. Each treated unit will include at least two measurement points, arranged either as a paired watershed (treated vs. reference) or upstream and downstream of the treatment (Fig. 2). At each location we will install a turbidity sensor, a stream stage (water level) sensor, a water temperature sensor, and a data logger for continuous data recording. A minimum of four locations (two for prescribed fire and two for thinning) will be set up.

In addition, monitoring equipment will be installed near the municipal intake at the watershed outlet. Because WEPPcloud predicts suspended sediment rather than turbidity, this site will also include an automated ISCO sampler that collects water samples into 24 bottles during flow events. Samples will be analyzed in the laboratory to develop a relationship between turbidity and suspended sediment concentration. This relationship allows us to translate model outputs (suspended sediment concentration) into turbidity values used by the utility to assess water quality.

Monitoring will begin before treatments are implemented and continue for at least three years to capture watershed response to disturbance.

Monitoring Equipment

Equipment	Justification
Turbidity probes (8 total across 4 monitoring locations)	Four locations will be instrumented (two prescribed fire and two thinning), each with paired sampling points (upstream/downstream or disturbed/reference) to isolate treatment effects from background variability.
Data loggers (8 units)	Each turbidity probe requires a dedicated data logger to record high-frequency measurements.
Pressure transducer water-level sensors (8 e-tapes or stage sensors)	Water-level measurements are required to convert turbidity-derived suspended-sediment concentrations into sediment loads. Stage data allow development of rating curves and improve interpretation of treatment impacts on sediment transport.
Temperature probes (16 units) ibuttons	Continuous water temperature monitoring will support fisheries habitat assessment.
ISCO automated sampler (2 unit)	The automated sampler will collect water samples during storm events and peak runoff when sediment transport is highest. These samples will be used to calibrate turbidity–suspended sediment concentration relationships and validate model predictions.

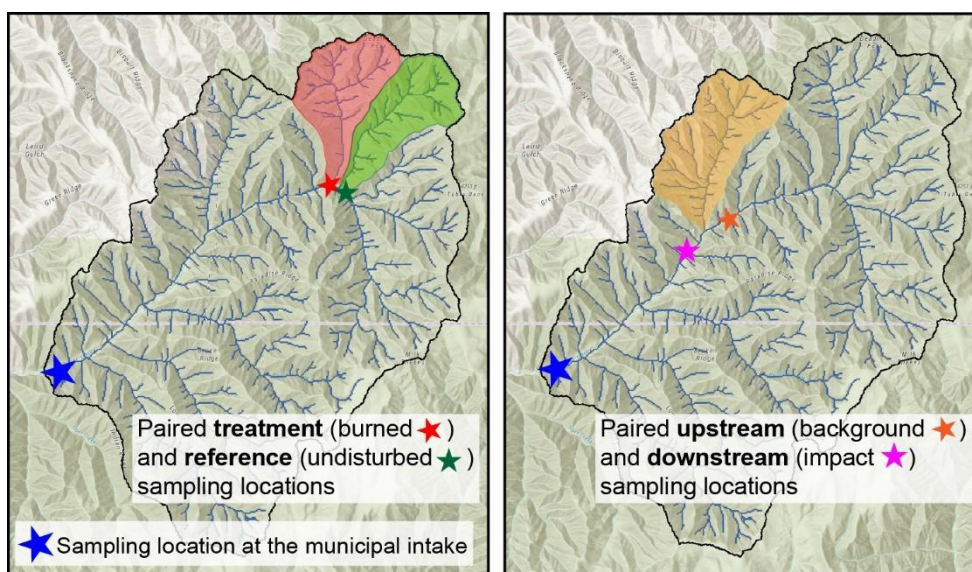


Fig. 2. Example of a spatial layout of treatment–reference and upstream–downstream monitoring sites within the study watershed

03 Task 2. Transferable regional parameter development

WEPPcloud users can simulate how water moves across the landscape using observed watershed characteristics describing soils, vegetation, terrain, and weather. Previous work by Dobre et al. (2022) showed that only a small set of parameters needs adjustment to accurately predict runoff and sediment across watersheds in the western United States. Recent model validations in burned watersheds across Oregon also demonstrate strong post-fire predictive performance in wetter Pacific Northwest basins (Basso et al., *in review*).

Mill Creek provides an important test case in a drier interior watershed. After calibration, we will compare results with additional sites in Pacific Northwest to identify parameter ranges that remain consistent across the region. These additional datasets may include undisturbed and post-wildfire conditions using available streamflow and sediment recorded at USGS monitoring locations, as well as data identified through stakeholder engagement (Objective 6), including observations provided from other managers from prescribed fire and thinning treatments.

From these analyses we will create:

- ✓ watershed-specific parameter sets that aid in tool validation
- ✓ regional, generalized parameter sets to extend tool usability to watersheds without field measurements
- ✓ a built-in setup process in WEPPcloud that lets new users prepare the model using their own data

This will allow users to either parameterize the model using their own monitoring data or apply regional parameters when monitoring is unavailable. The result is a transferable and scalable modeling scheme that can produce reliable predictions across the Pacific Northwest.

Objective 4. Develop an economic decision-support tool for treatment planning

A central innovation of this project is the development of a spatially explicit economic optimizing decision-support framework that integrates process-based hydrologic model outputs (from Objective 1 and 2) with optimization algorithms to identify cost-effective treatment strategies that protect drinking water supplies while reducing wildfire risk. While WEPPcloud provides scientifically rigorous predictions of erosion and sediment delivery under alternative treatment scenarios, it does not currently provide a systematic method to determine which treatments should be implemented, where they should be located, and how treatments should be sequenced over time under real-world budget, operational, and environmental constraints. This Objective 4 addresses that critical gap by developing an operational optimization framework that translates hydrologic model outputs into actionable management plans.

The PSU team, led by Principal Investigator Dissanayake, will design and implement a spatial mathematical optimization framework that identifies optimal treatment portfolios across the watershed. This framework builds on established conservation planning and spatial optimization methods and extends prior work linking hydrologic model outputs with integer programming decision models to identify least-cost treatment portfolios that meet environmental objectives. In prior applications, this framework demonstrated how linking WEPP-derived sediment predictions with optimization models allows managers to identify spatially targeted treatments that achieve sediment reduction thresholds at substantially lower cost than uniform or heuristic approaches

Integration of Hydrologic Predictions with Economic Optimization

The optimization decision-support framework will use spatially explicit outputs from WEPPcloud that quantify sediment yield and sediment delivery to downstream intake locations under alternative treatment scenarios, including prescribed fire, thinning, and untreated conditions. These outputs provide treatment-specific estimates of expected sediment reduction benefits for each hillslope or treatment unit across the watershed. The optimization model will incorporate these predicted sediment reductions together with treatment cost data, operational feasibility constraints, and management objectives to formulate a mathematical optimization problem to identify treatment strategies that maximize watershed protection per dollar invested.

The tool will use predicted hillslope erosion and sediment delivery to the water supply intake to evaluate tradeoffs among treatment cost, water quality protection, bull trout habitat conditions, and wildfire risk reduction.

In practice, WEPPcloud generates hillslope and watershed-outlet impact metrics for each candidate treatment scenario, and the optimization module selects a cost-effective treatment portfolio—i.e., which units to treat, with what treatment, and when—subject to water-quality targets and operational constraints.

Instead of evaluating each treatment area separately, The core optimization model identifies treatment portfolios that:

- ✓ reduce expected sediment at the water supply from treatment actions compared to a wildfire,
- ✓ maximize ecosystem service benefits per dollar of treatment investment, including reduced soil erosion and protection of water quality
- ✓ operate within real-world economic constraints, such as budgets.

This optimization approach provides several critical capabilities not currently available to managers:

- Identification of treatment locations that provide the greatest reduction in downstream sediment delivery per dollar of treatment investment.
- Determination of maximum feasible treatment area within specified water-quality protection thresholds.
- Prioritization of treatment locations under limited budgets.
- Identification of treatment sequences over multi-year planning horizons.
- Quantification of tradeoffs between treatment intensity, water quality protection, and budget requirements.

This capability is particularly important for municipal watersheds, where treatment-induced sediment increases must remain within acceptable limits to maintain drinking water treatability.

User Interface and Operational Decision-Support Tool

To ensure the optimization framework is accessible and usable by land managers, PSU will lead development of the optimization engine and decision outputs and will work jointly with the University of Idaho WEPPcloud team to implement these capabilities within the WEPPcloud platform. The WEPPcloud-based optimization decision-support interface will allow users to input management objectives, budget constraints, and operational parameters and generate treatment recommendations based on model outputs. WEPPcloud hosting and long-term platform maintenance will be managed by the University of Idaho, ensuring sustainability beyond the grant period.

The decision-support interface will allow managers to:

- Define budget constraints and planning timeframes.
- Specify water quality protection targets.
- Evaluate alternative management scenarios.
- Visualize prioritized treatment locations through spatial maps.
- Generate and compare multi-year treatment sequences under operational constraints.
- Compare treatment portfolios under different management objectives.

ser interface outputs will include ranked treatment priority maps, recommended treatment portfolios, and cost-effectiveness curves that show budget–outcome tradeoffs (i.e., how much additional protection is gained per additional dollar spent).

This integrated modeling and decision-support system will translate hydrologic model predictions into actionable annual and multi-year treatment plans that can be used directly in fuels planning strategies.

Objective 5. Deploy the operational planning tool in annual fuels management planning

The WEPPcloud-PATH tool will be used directly by U.S. Forest Service planners during annual treatment planning cycles in Mill Creek. Managers will use the tool to determine treatment size, location, and

sequencing over a 10-year timeframe. Rather than producing research guidance, the project produces operational plans used in real decisions.

Objective 6. Demonstrate regional transferability and support adoption across Pacific Northwest watersheds

We will evaluate and explore the transferability of WEPPcloud-PATH developed in collaboration with Mill Creek through coordinated engagement via workshops and seminars with regional land and water managers. Washington State University will lead outreach to state agencies, water utilities, watershed groups, and non-federal organizations across Washington, Oregon, and Idaho. Our plan is to share information about the WEPPcloud-PATH tool in the first year to collect feedback on where preventative forest management is a priority and explain how watershed managers could use the tool to make treatment-related decisions. In our second year, we would demonstrate tool capabilities and work with interested managers to discuss integration into their workflows. In our final year, we would host informational and hands-on training webinars to help managers learn how to use the tool in the context of their organization and watershed.

Concurrently, the USDA Forest Service Rocky Mountain Research Station will facilitate connections with federal land managers and national forest units, enabling evaluation of the framework under a range of federal planning and NEPA decision contexts. These interactions will help identify any additional, or federally-specific data requirements, operational constraints, and institutional barriers to adoption on federal lands.

To demonstrate transferability beyond the Mill Creek watershed, we will also apply the tool in collaboration with the Coeur d'Alene Tribe using existing field monitoring data from thinning treatments in the St. Joe watershed. These independent measurements will be used to evaluate model accuracy outside the development watershed and assess how well parameterizations transfer to different climatic and management conditions. [a sentence or two on treatments in St. Joe]

- ***What will the project achieve? In other words, what are the outcomes that the project will deliver during the grant period and how will you know the project is successful?***

During the grant period, the project will deliver operational outcomes that demonstrate real-world use of Natural Climate Solutions planning rather than research-only products. Each outcome corresponds to a project objective and includes measurable evidence of success.

Outcome 1. A jointly defined set of treatment criteria, acceptable impact levels, and planning requirements that guide all modeling and enable immediate adoption in Mill Creek.

Evidence of success: Documented decision criteria agreed upon by the U.S. Forest Service, City of Walla Walla, Tribal partners, and watershed stakeholders and incorporated into the tool's recommendations.

Outcome 2. A calibrated prediction tool that produces a spatial map ranking all potential treatment areas by their expected effect on sediment delivery to the drinking-water intake.

Evidence of success: Watershed-wide risk/benefit maps generated and used during planning discussions and incorporated into treatment selection.

Outcome 3. A validated model in Mill Creek and transferable calibration parameters for other watersheds.

Evidence of success: Agreement between predicted and observed runoff and sediment response, plus regional parameter sets usable without local monitoring data.

Outcome 4. Treatment portfolios that maximize water-supply protection while operating within real operational budgets.

Evidence of success: Annual treatment plans identifying maximum treatable area, deferred areas due to risk, and multi-year sequencing strategies.

Outcome 5. Demonstrated use of the tool in actual fuels planning in the Mill Creek watershed.

Evidence of success: Planning maps, ranked treatment areas, and treatment schedules produced and applied by U.S. Forest Service fuels planners.

Outcome 6. Instructions and examples that allow other managers and water utilities to use the tool without input from the model developers.

Evidence of success: Training workshops, documented workflows, and independent application or evaluation by at least one external agency.

- ***What is the specific need being addressed by this project?***

Due to the specific and interacting nature of weather, geography, and management decisions, managers struggle to determine the maximum safe level of disturbance in municipal watersheds. Acceptable erosion and sediment thresholds are difficult to identify, resulting in prescribed fire and thinning strategies that are intentionally conservative and slower than necessary to reduce wildfire risk.

This project addresses the need for a practical planning method that converts hydrologic science into clear annual guidance: which areas can be treated safely, which should wait, and how to sequence treatments while protecting water supplies.

- ***Why is this project an effective means through which to address this need?***

The project incorporates scientific modeling directly inside an existing decision process. It combines:

- ✓ a widely used operational hydrologic model (WEPPcloud),
- ✓ economic decision analysis (PATH),
- ✓ real management partners implementing treatments,
- ✓ field validation monitoring, and
- ✓ an already completed and approved environmental review (NEPA) with funded treatments scheduled to begin as early as fall 2026.

Because many planners already rely on WEPPcloud to simulate wildfire impacts, the proposed WEPPcloud-PATH tool fits naturally into the WEPPcloud portfolio and would bring significant benefits to users who rely on this framework for their current planning process. Additionally, since the treatments are approved and funded, the project immediately helps guide decision-making, answering key questions managers have been struggling with for decades via an interface they are already familiar with.

- *If relevant, who are the direct and ultimate beneficiaries of the project?*

Direct beneficiaries:

- ✓ U.S. Forest Service fuels planners implementing treatments
- ✓ City of Walla Walla drinking-water managers
- ✓ Fisheries managers concerned with sediment impacts

Ultimate beneficiaries:

- ✓ Downstream communities relying on municipal water supplies
- ✓ Aquatic ecosystems sensitive to sediment disturbance
- ✓ The public through reduced wildfire severity and emissions

- *If relevant, what geographies are served by the project?*

The pilot implementation occurs in the Mill Creek watershed (Washington/Oregon). Because the system automatically processes national datasets, once the tool is developed, the workflow can be applied to any forested watersheds across the western United States and other fire-prone regions.

- *Are the solutions that are the focus of this project generalizable to diverse contexts, and if so, how? Solutions can be generalizable by geography, stakeholder group, NCS pathway, NCS barrier, or other factors.*

Yes. The project develops a transferable decision framework rather than a site-specific model. The underlying modeling system (WEPPcloud) automatically ingests nationally available climate, soils, topography, and vegetation datasets, allowing the same workflow to be applied to any forested watershed without rebuilding the model.

The tool would generalize across:

Geography: Any forested watershed where wildfire and fuel treatments influence downstream resources, particularly in fire-prone regions of the western United States.

Stakeholders: Land management agencies (U.S. Forest Service, Bureau of Land Management, state agencies), municipal water utilities, conservation organizations, and private landowners.

Natural Climate Solution pathways: Prescribed fire, thinning, and other fuel-reduction treatments intended to reduce wildfire severity and associated emissions.

Implementation barriers: Uncertainty about downstream impacts (water quality, aquatic habitat, and smoke) that limits treatment scale and sequencing decisions.

The project aligns with how managers already plan treatments and uses publicly available data, so agencies can adopt it without new regulations or building their own models. The Mill Creek watershed serves as a pilot example of an approach intended for use in many watersheds, not a one-time site study.

- *Who are the key partners working on the project, and what are their specific roles?*

All partners have an established history of working together, which allows the project to move quickly from development to implementation.

The University of Idaho leads project coordination and develops the hydrologic decision-support framework through WEPPcloud. Portland State University and the U.S. Forest Service Pacific Northwest Research Station develop the economic optimization component to incorporate budget, water quality, and operational constraints into treatment planning.

The U.S. Forest Service Umatilla National Forest serves as the implementation partner, applying the tool directly in annual fuels planning and providing operational requirements such as burn windows, smoke constraints, and treatment logistics. The City of Walla Walla contributes drinking-water protection priorities and watershed data, ensuring the outputs address municipal risk management needs.

The U.S. Forest Service Rocky Mountain Research Station provides post-fire erosion science and technical oversight to ensure the modeling framework aligns with established federal assessment practices and is credible to land management agencies.

Local and regional engagement partners support adoption and broader applicability. The Walla Walla Basin Watershed Council facilitates watershed stakeholder coordination and monitoring, while the Confederated Tribes of the Umatilla Indian Reservation contribute fisheries and ecological priorities.

Washington State University connects the project to additional utilities and regional partners to support transferability beyond the pilot watershed.

SUSTAINABILITY AND SCALABILITY

If the project is to continue beyond the timeline of this grant, provide information on the plan for sustainability, as well as any plans for scaling components of the project (e.g., technologies, approaches, etc.).

The section should describe the following:

- ***Does your organization intend to increase the scale of this project after the grant period ends? If so, how will the project scale be increased, what is in place now to support scalability, and what actions will your organization and project partners take during the project term to facilitate scalability after the grant period has ended?***

Yes. The project is designed to create a planning tool that can be used beyond a single watershed. Although development and testing will occur in the Mill Creek watershed, the final product will be an online decision-support tool within WEPPcloud that other forested watersheds can use where prescribed fire planning is limited by water-quality concerns.

The tool uses nationally available climate and mapping data, so new watersheds can be analyzed without rebuilding the model or conducting new studies. After testing in Mill Creek, U.S. Forest Service districts, water utilities, and regional partners will be able to apply it to their own watersheds.

During the project, we will recruit other watershed managers (outside of Mill Creek) to participate in training and planning exercises to demonstrate how to use the tool. We will also produce guidance

documents and example treatment plans so managers can apply the process independently after the project ends.

- ***Does your organization intend to have this project continue after the grant period has ended? If so, what actions will your organization and project partners take during the grant period to facilitate sustainability, and how will the project be sustained when the grant period has ended?***

Yes. The project will move from a pilot in the Mill Creek watershed to broader accessibility through the existing WEPPcloud platform.

Because the tool is already used by federal agencies and water utilities, it can easily be applied to new watersheds. It uses publicly available data (terrain, landcover, soils, climate), so other areas can run it with minimal setup.

During the grant period, the project team and partners will prepare for wider use by creating example treatment plans, holding training sessions with agencies and utilities, demonstrating the tool during real planning cycles, and writing clear guidance on how to use it.

After the grant period, agencies and utilities will be able to use the tool directly in WEPPcloud on their own, allowing it to spread through normal management practice rather than continued project funding.

RISK AND MITIGATION

Using the table below, outline any significant assumptions and risks to achieving the project's aims, any steps you have taken or will take to mitigate those risks, and, to the extent the risks still exist, why you are confident that you can achieve the intended results regardless of the risks. If relevant, please also include risks associated with sustainability and scale mentioned above, and state how you plan to account for and/or mitigate them.

The proposed project builds on an existing operational modeling platform and established partnerships with land managers. Therefore, primary risks relate to validation timing, operational adoption, and long-term use rather than technical feasibility.

Risk	Mitigation
Prescribed fire implementation depends on weather and operational conditions; a burn may be delayed, limiting validation data collection in a specific year.	The decision-support tool can be developed and deployed independently of monitoring. Alternative treatment units and existing datasets will be used if burns are delayed. Monitoring is intended to refine predictive thresholds rather than enable basic functionality, so project outcomes do not depend on a single treatment event.
Managers require confidence in sediment and water-quality thresholds before using the tool operationally.	The project uses a hydrologic modeling framework already applied operationally by Burned Area Emergency Response (BAER) teams and utilities. Monitoring refines parameter confidence rather than model feasibility. Multiple monitoring locations and pre/post comparisons reduce

	dependence on any single observation, allowing thresholds to be established during the project period.
A decision-support tool may not be adopted if it does not fit existing workflows.	The tool will be used within an active fuels planning process with participating planners involved throughout development. Outputs are designed to match existing planning products (treatment polygons and annual portfolios), ensuring the tool supports required decisions rather than creating new ones.
Long-term sustainability after the grant period.	The platform will be hosted by the University of Idaho using an existing operational WEPPcloud infrastructure supported by multiple federal and utility partners. Because the tool extends an existing system rather than creating a standalone application, continued operation does not depend on project-specific funding.
Scalability beyond the pilot watershed.	The workflow relies on nationally available datasets and an existing user community. Training materials and demonstrations during the project will enable independent adoption by agencies after the grant period.
Federal managers may hesitate to rely on a new decision-support tool if it lacks agency credibility or demonstrated consistency with established post-fire science.	The project includes the U.S. Forest Service Rocky Mountain Research Station (RMRS), which has supported development of WEPP-based technologies for decades and has extensive experience in post-fire watershed assessment. As a Forest Service research unit with long-standing operational relationships, RMRS provides scientific oversight and agency familiarity that increases technical defensibility and likelihood of adoption by federal land managers.
Transferability to fuels treatments in watersheds beyond Mill Creek	A project partner at Washington State University maintains long-standing collaborations with western U.S. water utilities and has previously conducted regional needs assessments demonstrating demand for fuel-treatment planning tools. This partner will connect the project team with additional utilities and convene annual workshops and practitioner meetings during the project. These engagements provide early feedback, incorporate stakeholder needs into tool development, and create a pathway for adoption beyond the pilot watershed.
Computing resources and server capacity.	Dedicated server space will be procured for the project while maintaining compatibility with existing infrastructure, ensuring reliable performance during development and future expansion.
Model outputs may not reflect broader watershed priorities or may lack sufficient field validation if developed without local engagement and monitoring capacity.	The project partners with the Walla Walla Watershed Basin Council, which provides both stakeholder connectivity and on-the-ground monitoring support. Their relationships with regional and Tribal partners help incorporate concerns beyond drinking water (e.g., fisheries and habitat), while

	their dedicated staff enable consistent field data collection for model validation. This improves credibility, relevance, and adoption of the decision-support tool.
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PROPOSED PROJECT TIMELINE

Using a table, figure, or narrative structure, present the project timeline, incorporating the project's activities as outlined above in the project description, milestones for each activity and the project, and project aims for the proposed project.

BUDGET

Complete the budget template and provide a corresponding budget narrative. Together, the completed budget template and narrative should provide a clear picture of the financial resources you are requesting to support the project. The template focuses on articulating what the costs are to implement the project successfully, and the narrative should focus on why those costs are reasonable and appropriate for the project.

- **Budget template:** clearly presents the costs associated with the project to allow understanding of how much each project activity will cost, what the cost components are, as well as annual costs for the project.
- **Budget narrative:** The narrative presents why costs are reasonable and appropriate for the project. The narrative should provide information on the following:
 - o What are the major cost drivers and how do costs relate to planned activities and intended outcomes?
 - o Who are the key partners (i.e., subcontractors, subgrantees, etc.)? Please include a table of partners and their role in the project.
 - o To the extent possible, provide an explanation for why the proposed budget is realistic and reasonable in relation to the specific results the project is aiming to achieve?
 - o What efforts will you take to ensure that you deploy funds in an optimal manner?
 - o What additional funding, secured and/or prospective, will support this project??

Partner	Role
University of Idaho	Project lead and hydrologic modeling
Portland State University	Economic optimization modeling
USDA Forest Service – Pacific Northwest Research Station	Economic and policy integration
USDA Forest Service – Umatilla National Forest	Operational implementation
USDA Forest Service – Rocky Mountain Research Station	Scientific oversight and erosion science
City of Walla Walla	Municipal water management priorities
Confederated Tribes of the Umatilla Indian Reservation	Fisheries and ecological priorities
Washington State University	Regional stakeholder engagement and scaling
Walla Walla Basin Watershed Council	Local coordination and monitoring
Coeur d’Alene Tribe	Test site for the final tool