Appendix B-8

LAKE TAHOE RESTORATION PROJECTS
ESTIMATED DIRECT COSTS & KEY MILESTONE DATES

Project Name: Landscape, Vegetation, and Restoration Effects on Stream Sediment and Nutrient Delivery
Agency: University of California, Davis, CA 95616
Prepared by: Michael G. Barbour, ENH Dept.
Phone: 530-752-2956
EIP #: 10110
SNPLMA Project #:_____

Identify estimated costs of eligible reimbursement expenses:

1. **Planning, Environmental Assessment and Research Costs** (specialist surveys, reports, monitoring, data collection, analysis, NEPA, etc.)	$ 6,000	11	%
2. **Direct Labor (Payroll) to Perform the Project**	$ 33,189	61	%
3. **Project Equipment** (tools, software, specialized equipment, etc.)	$ 3,000	6	%
4. **Travel** (including per diem where official travel status required to carry out project, such as serve as COR, experts to review reports, etc.)	$ 3,000	6	%
5. **Official Vehicle Use** (pro rata cost for use of Official Vehicles when required to carry out project)	$ 3,000	6	%
6. **Cost of Contracts, Grants and/or Agreements to Perform the Project**	$ 2,000	4	%
7. **Other Direct Costs** (direct labor for agency personnel to do project procurements; COR; PI; personnel assigned as NEPA lead; personnel assigned to review contracted surveys, designs/drawings, reports, etc.; project manager and/or project supervisor; and contracted costs for project manager and/or project supervisor if contracted separately	$ 3,000	6	%
TOTAL*:	$ 53,189	100	%

Estimated Key Milestone Dates:

Milestones/Deliverables:	Date:
Start Date	6/1/06

Watershed Assessment of Tributary Watersheds	**1/1/2007**
Watershed Assessment of Stream Restoration	**4/1/2007**
Mass Balance Model/Multiple Regression Model	**7/1/2007**
GIS Coverages Linked with Water Quality	**10/1/2007**
Final Completion Date:	10/1/2007

COMMENTS:

1. Includes amounts for other personnel in field who will assist the PI or the RA in surveying and data gathering. Includes water analyses charges beyond those performed by the RA, to be performed by units on the UC Davis campus.
2. Yearly amount for 50% RA GSR IV includes: (1) 50% 9 mo + 100% 3 mo = $23,603; (2) in- state fees = $8407; and (3) benefits at 5% = $1180; for a total of $33,189.
3. Supplies required for taking water samples; no item of $2500 or more will be purchased, therefore no funds for equipment are being requested.
4. Per diem for field work for the RA and an assistant will be charged at the rate of $35 @ per day (housing will be provided at minimal cost by the Tahoe Research Group at its house in Tahoe City); sufficient for approximately 40 field days per year.
5. Use of personal vehicle (32¢ per mile) or UCD official vehicle (various daily + mileage possibilities depending on vehicle type)
6. Coordination with other agencies and contracts: appointments and visits with individual staff to inform them of progress, to seek file data they may have, to prepare and give group presentations; travel expenses, duplication costs, etc.
7. Costs accrued by principal investigator or others involved in supervising the RA.
8. Overhead has been waived per sponsor policy

SCIENCE, RESEARCH & MONITORING
TAHOE PROJECT PROPOSAL

Project Name: Landscape, Vegetation, and Restoration Effects on Stream Sediment and Nutrient Delivery **EIP #** 10110

Lead Agency: UC Davis and UCD Tahoe Research Group/US Geological Survey

Contact: Michael Barbour/Tim Rowe
Phone Number: (530)752-2956/(775)887-7627
Email Address: mgbarbour@ucdavis.edu; **tgrowe@usgs.gov**

Threshold:
Threshold Standard:

Total Project Cost: $ 53,189
Round 6 Funding requested: $ 53,189
Is this a multi-year project? Potentially 2 yr

Project Description (Include a specific list of tasks and subtasks to be accomplished that will facilitate Basin agencies in writing a detailed scope of work):

This project focuses on how vegetation structure, stream restoration, historical management, and landscape attributes affect stream physical, chemical, and biotic processes in the westside Tahoe Basin watershed of Blackwood Creek.
Task 1: Assess the streamflow, sediment, nutrient (nitrogen and phosphorus), and productivity (chlorophyll) differences between different upland tributaries and sites along the mainstem of Blackwood Creek.
Subtask 1a: Establish upland tributary monitoring sites.
Subtask 1b: Collect and analyze water samples and stream data through field sampling and datalogging over two water years.
Subtask 1c: Assess vegetation, soil, parent material, management differences in upland tributaries.
Subtask 1d: Link landscape and vegetation differences to water quality outputs in a geographic information systems (GIS) analysis and multiple regression model.
Task 2: Assess the mass balance of different vegetation and landscape types on watershed parameters.
Subtask 2a: Place equipment to capture bulk deposition, precipitation amount, surface runoff, and soil water samples near stream sampling sites.
Subtask 2b: Collect and analyze water samples from bulk deposition, surface runoff, and soil water collectors.
Subtask 2c: Create a mass balance model from inputs (deposition) and outputs (surface runoff and stream water) and mechanisms that will be explained through soil, soil water, vegetation, landscape, and management differences.
Task 3: Assess the effects of stream restoration measures being carried out in Blackwood Creek.
Subtask 3a: Establish water sampling sites upstream and downstream of stream restoration measures.
Subtask 3b: Collect and analyze water samples and stream data through field sampling and datalogging over two water years.
Subtask 3c: Compare upstream and downstream sites along with historical downstream pre-restoration and post-restoration data in order to assess the effects of stream restoration measures.

For Science & Research Projects briefly summarize the current state of knowledge of this subject matter:

The Lake Tahoe Watershed Assessment (USDA Forest Service 2000) identified Blackwood Creek to be the fourth highest sediment producer in the Lake Tahoe watershed and its nutrient loading to be among the highest in the Lake Tahoe Basin. In addition, a cited knowledge gap from the Lake Tahoe Watershed Assessment is the baseline contribution of watersheds to sediment and nutrient loading. Separating out the background contribution to sediment and nutrient transport from the activities of humans is an important objective. Also, stream restoration measures are currently being carried out in the Lake Tahoe Basin in order to improve overall lake clarity and quality. However a detailed understanding of the effects of these measures remains to be delineated, this explanation will help in further guiding and focusing restoration efforts within the Lake Tahoe Basin.

Describe the purpose and need for the project: (Describe how this project will guide future management activities**.** This description should include a quantitative estimate of the anticipated gain in management information and describe how the research and/or monitoring project may inform the development and understanding of additional Key Management Questions (one page recommended)**:**

The purpose of this project is to arrive at quantitative approaches for the management and restoration of Tahoe's watersheds and forests. We seek to understand the water quality differences between distinct forest types in the relatively undisturbed portions of an important watershed in the Lake Tahoe Basin. Choosing appropriate values for water quality targets is vital for developing realistic restoration efforts that will benefit agencies, non-governmental organizations, private stakeholders, contractors, and researchers concerned with the management of Tahoe's watersheds. Our work will provide managers with useful predictive models (multiple regression and mass balance) that will aid in the implementation of restoration measures already underway, and may lead to new measures not yet in place.

Describe the goals and objective of the project (Describe Key Management Questions being addressed--Recommended 2-3 pages):

> 1. Objectives: List the objectives of the proposed research being tested during the project, and briefly state why the intended research is important.
> 2. Approach: Outline the research design, methods, and techniques that you intend to use in meeting the objectives stated above.
> 3. Identify the Key Management Questions being addressed and/or how the project may inform the development and understanding of additional Key Management Questions.

1. Objectives:
a. This project involves delineating the watershed contribution and budget of watersheds through assessing vegetation and soil characteristics as well as considering historical land use in these areas (e.g. grazing, logging, mining, roads). By quantitatively assessing the various vegetation (conifer forest, riparian, chaparral, meadow), soil (physical and chemical constituents) characteristics, and land use in upland watersheds and linking these to water quality outputs (flow, sediment, nitrogen, phosphorus), targets for water quality as well as forest management can be better understood.
b. This project seeks to begin the process of assessing the water quality and habitat benefits of stream restoration measures within Blackwood Creek. Achieving habitat and water quality targets are an important part of the expected outcomes of the stream restoration measures being undertaken in Blackwood Creek.
c. This project seeks to provide a predictive approach to watershed knowledge through mass balance,

multiple regression, and geographic information systems (GIS) analyses that provide predictive outcomes of water quality variables based on landscape and management characteristics. The outcomes of these analyses can inform resource managers with useful knowledge and guide future projects focused on restoration in the Lake Tahoe Basin.

2. Approach:

This project seeks to assess the baseline contribution of upland vegetation to sediment and nutrient loading as well as the cumulative effects of restoration measures being carried out in the Blackwood Creek watershed by the Lake Tahoe Basin Management Unit of the USDA Forest Service. Monitoring sites upstream and downstream of stream restoration measures, as well as at upland tributary watersheds within Blackwood Canyon for streamflow, sediment, and water quality parameters (e.g. nitrogen, phosphorus) and chlorophyll (as an indicator of primary productivity), will provide a valuable assessment of watershed characteristics. The factors to be examined that affect baseline watershed characteristics include vegetation cover and type, soils, geology, and historical resource extraction and management. In addition, collection and analyses of bulk deposition, surface runoff, and soil water will aid in the development of a watershed sediment and nutrient budget for these different sub-watersheds. Through using the 24-year long data set for the outflow of Blackwood Creek at Lake Tahoe, an understanding of the effects of recent management approaches and restoration measures can be attained. Some of the products of this project include a quantitative assessment of landscape parameters and management on water quality and geomorphic variables, quantitatively assessing the early effects of stream restoration measures, providing baseline values for water quality levels in upland watersheds, and developing a protocol for assessing watershed functioning within Blackwood Canyon. This study will also provide a multi-faceted approach to predicting water quality outputs through GIS analysis, multiple regression, and mass balance approaches that will aid in predicting water quality and environmental responses to baseline landscape characteristics and to the effects of resource use and extraction, management, and restoration.

3. Identify the Key Management Questions addressed.

This project meets the needs of Key Management Questions 1.1.1, 1.1.2, 1.1.3, 1.2.6, 2.1.4, 2.2.6, 4.1.2, 4.3.5, and 4.5.1 as identified by the Science Advisory Group (SAG) for the Lake Tahoe Basin. This project addresses the tributary watershed loadings to Blackwood Creek as well as the overall contribution of the mainstem of Blackwood Creek to Lake Tahoe. We will use historical water quality data and changes in land use and management to provide a historical perspective on the effects of human disturbance on water quality. A focus of this project is to arrive at useful results for nutrient and sediment loading values from the tributaries of Blackwood Creek as well as from its mainstem. We will examine the historical water quality record at the outflow of Blackwood Creek to Lake Tahoe and assess how changes in management affect nutrient and sediment loadings. One of the main goals of this project is to arrive at values for water quality and geomorphic parameters that represent the watershed dynamics inherent to the Blackwood Creek Watershed and its tributaries. Looking at how dynamics change through the watershed and in different tributaries will allow us to compare actual values with expected values for the parameters examined.

Forest stands in the Blackwood Creek watershed will be analyzed for species structure, composition, and resistance to disease in order to address the qualities that make forest stands resilient. Within the Blackwood Creek watershed there exist representative old-growth and seral mixed conifer stands that can be assessed for differences in structure, composition, and pathogen incidence. Through comparing the different states of old-growth stands we can arrive at a better understanding of processes that contribute to or detract from their health. By assessing vegetation structure and dynamics throughout the Blackwood Creek Watershed and comparing dynamics of recruiting species in the various conifer, riparian, meadow, chaparral, and rock outcrop communities, we can begin to predict the vegetation communities' future targets and structures. In addition, using aerial photo analyses, we can assess the change over time of the various vegetation communities.

The results of this study would hopefully inform other restoration projects in process and in the future to achieve restoration goals through the publishing of significant findings in a user-friendly

format for managers and the public alike. The stream restoration assessment of geomorphic parameters and water quality effects adds to the understanding of how best management practices (BMPs) such as fish ladder removal, culvert removal, and placement of downed woody debris affect watershed dynamics.

Describe the anticipated project accomplishments (provide a qualitative description of how the results of each task will reduce the uncertainty of predicting the behavior of the environmental processes being studied and may lead to solutions to environmental problems (one page recommended) to improve the agencies' abilities to protect the environment and achieve the management objectives.):

Task 1: Assessment of the streamflow, sediment, nutrient (nitrogen and phosphorus), and productivity (chlorophyll) differences between different upland tributaries and sites along the mainstem. Through the assessment of how different vegetation/habitat structures and characteristics affect sediment and nutrient loadings we hope to elucidate what the background vs. recent human activity effects are on water quality. These findings will aid in the understanding of expected effects of management as well as provide appropriate baseline values for other adaptive management studies and projects. We hope to aid in the management of upland watersheds for appropriate forest characteristics and contribute missing information to the Lake Tahoe Watershed Model. Through the analysis of GIS coverages and the development of a multiple regression model, we will be able to quantify how different vegetation and landscape attributes affect watershed sediment and nutrient dynamics. Within the GIS analysis we hope to develop coverages for each of the water quality parameters we measure.
Task 2: Assess the mass balance of different vegetation types on watershed parameters.
By quantitatively assessing the inputs, outputs, and mechanisms that affect water quality within watersheds, we can arrive at how different forest structures and vegetation types affect sediment and nutrient delivery. The mass balance model will link watershed outputs and geomorphic characteristics with watershed inputs and landscape characteristics.
Task 3: Assess the effects of stream restoration measures being carried out in Blackwood Creek.
The effects of such restoration acts as fish ladder removal, culvert removal, and downed woody debris emplacement) will be quantified through comparisons of upstream-downstream and pre- and post-restoration measures. These analyses will aid the USDA Forest Service and other public entities and stakeholders within the Lake Tahoe to make sound decisions regarding stream restoration and water quality improvement.

Describe the "readiness" of this project to move forward (environmental documentation, etc.; for projects that are a continuation of previous projects, provide a quantitative measure of the actual gain in management information (one to two paragraphs recommended):

Currently there is approval from the Forest Service's LTBMU for selecting and using monitoring sites along Blackwood Creek's tributaries and mainstem. As an example of collaboration with the Forest Service, we are scheduled to receive several water auto-samplers from LTBMU in October for deployment within Blackwood Canyon. In addition, the permitting process for this project has begun on a "fast-track" basis, in order to begin project implementation this fall. The USGS has expressed interest in collaborating with us on the monitoring of tributary and mainstem reaches in Blackwood Creek.

Describe potential partnerships for this project and include supporting documentation.

Potential partnerships involved in this project include the USGS, the Forest Service, and the USEPA.

The USGS will be the main sponsor/partner and the USFS will be considered as a collaborator. The USEPA's interest is in this project's objective to arrive at appropriate water quality targets (total maximum daily loads-TMDLs) for different landscape and vegetation types within the Lake Tahoe Basin. Another potential partner is the Lahontan Regional Water Quality Control Board, which has a stated interest in developing TMDL targets for both Blackwood Creek and the entire Lake Tahoe Basin.

Describe how this project will guide future management activities:
This project will aid in the development of predictive models regarding nutrient and sediment loading for specific vegetation/landscape conditions. These predictions will be helpful to models of water quality for Lake Tahoe. Our results will also help in the establishment of watershed monitoring protocols for stream restoration activities. By quantitatively assessing vegetation and landscape characteristics and linking them with watershed attributes, managers will have a powerful integrative tool that predicts the comparative effects of different vegetation-structure and land-use management strategies. This project seeks to aid in the development of the comprehensive Lake Tahoe Watershed Model and in the provision of data for appropriate threshold values for Tahoe's watersheds.

Include an 8 ½ X 11 map depicting the project, or research/study area.

Insert jpeg image using INSERT / PICTURE / FROM FILE

EVIDENCE OF PARTNERING WITH FEDERAL AGENCIES

The Forest Service is collaborating by way of donating equipment to our project, as described in the following email.

Subject: **Documentation of auto-sampler pickup from LTBMU**
Date: October 1, 2004 4:41:48 PM PDT
To: mgbarbour@ucdavis.edu

Begin forwarded message:

From: "Josh Meidav" <jsmeidav@ucdavis.edu>
Date: September 28, 2004 4:11:53 PM PDT
To: mgbarbour@ucdavis.edu
Subject: **Documentation of auto-sampler pickup from LTBMU**

Below is informal documentation of USFS collaboration (e.g. water auto-sampler property transfer from LTBMU to UCD).

Josh,

Stephanie Heller will be able to meet you at the Work Station in Meyers to deliver the samplers to you. We will just do a transfer of property to you and you will be blessed with either fixing, using, or disposing of the samplers (if they don't work at all). You should work out the meeting details with her via email or phone at 530.543.2838. I'll be doing an Environmental Education thing that day in the field.

I will see about the potential for you to take the photos and get them color photocopied here in town. We don't loan the original air photos but I think you could take them for a few hours to a copy shop. I'll see about it. Right now I think the contractor has them.

Meredith Manning
Hydrologist, Ecosystem Restoration
USDA Forest Service
Lake Tahoe Basin Management Unit
35 College Drive
South Lake Tahoe, CA 96150
530.543.2670

Tim Growe, of the USGS is interested in collaborating with us, as described in the following email.

From: mgbarbour@ucdavis.edu
Subject: **Expressing thanks**
Date: September 28, 2004 2:12:31 PM PDT
To: TGROWE@USGS.GOV
Cc: jsmeidav@ucdavis.edu

Dear Tim:

I'm Josh Meidav's major professor, and together we are writing a SNPLMA proposal, which will require us to partner with someone(s) in a federal agency. Josh has told me that you expressed an interest in being named in our proposal as a potential partner, should the proposal be funded. I am greatly indebted to you, if that is indeed the case. Our objective, on the face of it, is rather modest; but the contribution of our results will be magnified in importance when added to a developing lake-clarity model for Tahoe (by Charles Goldman and his Tahoe Research Group).

The information lacking from that model is the contribution of sediment and particular nutrients (N, P) from surface flow over (relatively) undisturbed forest ground. Undisturbed forest accounts for nearly 50% of the watershed's area, so whatever it contributes per acre or per watershed will be multiplied by a large number. Josh has the academic credentials to do this work (it's for his PhD); he completed a water quality project for his MS degree under Goldman, and he's taken courses and done field work in the area of forest ecology--so he's both a vegetation person and an hydrologist. He's devised a sampling scheme that is inexpensive, robust, and efficient, and the work will be restricted to Blackwood Creek watershed. Within that watershed, his sampling design will give us measures of runoff content for several major forest types, in particular white fir forest and mixed white-red fir forest. I believe that two seasons of data collection will be adequate for him to base his PhD dissertation on.

I don't believe we need a formal letter of interest from you, at this time. We will include your name and affiliation as a partner, should the proposal be funded. We will, of course, send you our proposal by email as soon as it's cleaned up and in its final form. The proposal is due October 4th, so you can expect to receive it shortly after that.

If you need more information, write me or call me (contact number is below) and I'll be very happy to respond. Again, thanks for you interest, Tim.