

Sound Watershed Consulting

Creating Functional Water Environments



Squaw Creek Restoration Project

REVISED DRAFT

Working Project Master Plan and Scope of Work

Version 2.C

*for
The Friends of Squaw Creek
Truckee River Watershed Council
and associated granting agencies*

Prepared by:

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October 6, 2009

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Hydrology
Geomorphology
River Ecology
Restoration Design
Sustainable Forestry
Integrated Watershed Management

Squaw Creek Restoration

REVISED Draft

Working Project Master Plan and Scope of Work *(version 2.C)*

October 6, 2009

Sound Watershed Consulting (SWC) is pleased to provide this revised draft proposal for the next phase of the Squaw Creek Restoration Project. This draft document includes recommendations for tasks associated with the pool of currently available funding, and outlines additional tasks that will promote progress toward an integrated and comprehensive restoration program. This document is divided into several sections:

The **Recommended Task Priorities** section outlines the scope of work that we recommend for the currently available funding. At the present time, the projects we are recommending slightly exceed the available funding. However, with additional partner contributions and/or stakeholder input toward priorities, we believe we can finalize a scope of work that can advance the project. We intend to use this document to help facilitate agreement regarding the scope of work by the key Friends of Squaw Creek stakeholder group (e.g. landowners, supporting agencies, funding partners and associated administrative organizations).

The **Working Preferred Alternative** section describes a revised version of Alternative 2 from the *Lower Squaw Creek Conceptual Restoration Plan Final Report* (PWA 2007). The revisions are based on additional input and feedback from the public, technical and landowner workshops conducted between May 2008 and March 2009. We note that these revisions are still conceptual, and substantial additional work is needed to continue to revise these ideas. The actual location, distribution and definition of these and/or other concepts will continue to be refined as the project evolves.

The **Working Master Plan Outline** section describes a working document, subject to changes in response to available funding, adjustments in the preferred alternative, advancements in specific restoration actions, and growing understanding that evolves in response to new information. Budget numbers associated with the Master Plan section are very rough, and based on our professional judgment of costs based on the experiences of similar projects (both our own, and those of other similar projects that we are tracking).

SWC will work closely with the Friends of Squaw Creek (FOSC), the Truckee River Watershed Council (TRWC), and appropriate sub-consultants in the

course of moving this project forward. The specific consulting team for each task will be identified as funding is released. We will continue to draw sub-consultants from the talented pool of scientists, engineers and consultants who participated in the Phase 2.1 workshops.

Prior project developments and documents are available for review at

<http://www.soundwatershed.com/squaw-creek-restoration.html>

RECOMMENDED TASK PRIORITIES

The following section describes the current scope of work recommended to move the project forward as discussed in relevant Technical Workshops and meetings with key stakeholders. It is based on the existing level of funding available, the desire to move forward quickly with some type of on-the-ground actions, and the desire to move closer toward a more fully detailed preliminary site design for the entire project area.

The following selection of projects carefully considered the existing information, critical data needs, and the sequencing of components required to meet project objectives.

RECOMMENDATIONS FOR AVAILABLE FUNDING

Sound Watershed recommends the following tasks, as defined by the associated budgets and scope of work, be applied to existing remaining funds. At the present time (October 2009), approximately \$56,500 remains from existing funds, only \$43,520 of which is currently authorized. An additional \$12,987 from the Sierra Nevada Conservancy grant *may* be available if (and when) authorization is received from the CA Department of Finance. Other funds may also be identified from existing stakeholders and/or other resources as the project proceeds.

Given the (seemingly) continuous changes in the status of available funds, this section outlines a set of tasks that can fit the contractual requirements of the funding entities. It breaks tasks into the smallest definable elements that can be supported by contractual deliverables to allow the greatest flexibility in how the collection of tasks is funded from the various sources. This will greatly assist Sound Watershed, the Truckee River Watershed Council, and funding agencies in the contracting for these tasks.

We've divided these tasks into three groups:

Recommended Tasks – these tasks are recommended for funding without reservation. They are priority tasks with broad support that will best advance the overall project.

Contingent Tasks – these tasks require some cooperation and commitment from associated landowners. They represent projects that can be evaluated, designed, permitted and implemented by Summer 2010.

Other Priority Tasks – these tasks outline additional priorities that can be used to round out available funding in combination with Contingent Tasks. If desired, these may be substituted for other Conceptual Refinement & Preliminary Restoration Tasks (see page 20) or Additional Technical Analysis Tasks (see page 22). Such substitutions should receive broad support by listed stakeholders.

We are seeking input from the stakeholders regarding this proposed scope so that we can proceed with essential data collection before winter conditions arrive.

The working budget is as follows:

| # | Proposed Tasks | Budget | Sub-Total |
|-----------------------------|-------------------------------------|------------------|------------------|
| | Remaining Authorized | \$ 56,507 | |
| Recommended Tasks | | | |
| 1 | Coordinate with Key Stakeholders | \$ 9,080 | |
| 2 | Review Existing Studies | \$ 1,440 | |
| 3 | Streamflow Monitoring Stations | \$ 16,000 | |
| 4 | Water Detention Storage Feasibility | \$ 7,710 | |
| | Sub-Total | | \$34,230 |
| Contingent Tasks | | | |
| 5 | Select Bank Stabilization Design | \$ 16,400 | |
| 6 | Searchlight Pond | \$ 7,700 | |
| 7 | Olympic Channel Improvements | \$ 9,600 | |
| | Sub-Total | | \$33,700 |
| Other Priority Tasks | | | |
| 8 | Case Studies of Similar Projects | \$ 6,000 | |
| 9 | Bank Stabilization Priorities | \$ 7,800 | |
| | Sub-Total | | \$13,800 |
| | Total | | \$ 81,730 |

Note that only a subset of these tasks can be funded.

COORDINATION & FACILITATION WITH KEY STAKEHOLDERS

Objective: align and maintain project across multiple stakeholders

Task

This task will continue to coordinate activities among 3 granting agencies (SNC, Placer & Lahontan), 2 administrative entities (FOSC and TRWC), 3 monitoring entities (SVPSD, DWR and Placer County Flood Control) and the 3 landowners (Ski Corp, Resort and Poulsen Properties). Activities will include occasional coordination meetings, scope revisions, reporting activities, funding coordination, and maintenance of general goodwill.

Deliverable

Our deliverables will be a quarterly summary reports that will be made available on the project website, along with other key project deliverables. Other reporting requirements associated with contracts with funding agencies will also be provided.

Task Budget

| | | # | Mike Liquori | Jeff Prancevic | Fee Subtotal |
|---|--------------------------------------|------|--------------|----------------|-----------------|
| Coordinate with Key Stakeholders | | | | | |
| 1 | Working Master Plan | | 12 | | \$ 1,440 |
| 2 | FOSC Meetings | | 16 | | \$ 1,920 |
| 3 | General Project Management | | 18 | | \$ 2,160 |
| 4 | Contracting Administration | | 20 | | \$ 2,400 |
| Expenses | | | | | \$ 1,160 |
| | Mileage | 1200 | | | \$ 660 |
| | Lodging & Meals | 3 | | | \$ 450 |
| | Misc. Equipment & Document Allowance | | | | \$ 50 |
| Total | | | | | \$ 9,080 |

REVIEW EXISTING STUDIES

Objective: mine existing reports for relevant information and data

Task

The Squaw Valley Public Services District has several studies related to the hydrology and groundwater conditions in Squaw Valley. This task will review those reports to identify any existing data and/or studies that may be relevant to the restoration project.

Deliverable

A brief technical memo outlining the results of our review.

Task Budget

| | # | Mike Liquori | Jeff Prancevic | Fee Subtotal |
|--------------------------------|--------------------------------------|-----------------|-------------------|-----------------|
| Review Existing Studies | | | | |
| 1 | Review Reports | 10 | | \$ 1,200 |
| 2 | Action Plan & Memo | 2 | | \$ 240 |
| | Expenses | | | \$ - |
| | Mileage | | | \$ - |
| | Lodging & Meals | | | \$ - |
| | Misc. Equipment & Document Allowance | | | |
| | Total | | | \$ 1,440 |

STREAMFLOW MONITORING STATIONS

Objective: Maintain essential data collection systems in support of restoration design and monitoring objectives

Task

Three important stream gages have been operated by the Squaw Valley Public Services District, but the district has ceased funding for these important gages. In order preserve access to this critical data SWC is coordinating with several parties to support this gage network. The parties include Placer County Flood Control, Department of Water Resources, Lahontan RWQCB, Squaw Valley Public Services District and others.

Note: This task requires the cooperation of multiple parties and there remains several outstanding uncertainties regarding how all the elements for this task will come together. As such, the budget for this task may require revision.

The preliminary scope includes:

Negotiate Transfer Agreements – SWC will negotiate with the Squaw Valley Public Services District and its former contractor to acquire the equipment and existing data related to these stations.

Quarterly Site Maintenance – SWC will conduct quarterly site visits to each gage to clean and maintain equipment. During each site visit, we will also directly measure stream discharge to maintain the rating curve for each site.

Quarterly Data Workup – SWC will review the data from each station, make appropriate corrections, and will develop summary plots and tables for each station.

Station Re-design – SWC will review the existing data flow between the recording instruments, dataloggers and SVPSD servers to develop a system

for integrating real-time data capacity to an online password-protected database repository. This will allow for rapid notification of emergency repair issues, and easy data distribution to project partners.

Emergency Repairs – instrumentation failures often occur in response to large storms or other disturbances. As needed, SWC (or associated partners) will coordinate emergency site repairs.

Stage-Flow Rating Curve – the existing instrumentation only measures flow depth. To convert depths into discharge values, a streamflow rating curve must be developed and maintained. This sub-task will collect the necessary data and maintain these curves.

Annual Reporting – SWC will perform an annual QA/QC of data by performing a series of validation and verification evaluations. A summary memo will be developed that notes any corrected values and provide annual data summaries.

OPTIONAL: Online Database Repository - With additional funding of approximately \$5-8K, we can establish a real-time, online repository for data that can be accessible with or without password authorization.

Deliverable

Our deliverables will be a quarterly and annual summary reports that will be made available on a project website. Detailed data can be made available upon request.

Task Budget

| | # | Mike Liquori | Jeff Prancevic | Subs | Fee Subtotal |
|---------------|--------------------------------------|--------------|----------------|-------------|------------------|
| Task # | | | | | |
| | | | | | \$ - |
| 1 | Negotiate Transfer Agreements | 8 | | | \$ 960 |
| 2 | Quarterly Site Maintenance | 16 | 16 | | \$ 3,184 |
| 3 | Quarterly Data Workup | 16 | | | \$ 1,920 |
| 4 | System Redesign | 12 | | | \$ 1,440 |
| 5 | Server & Website Setup | | | \$ 5,000 | \$ 5,000 |
| 6 | Annual QA/QC | 12 | | | \$ 1,440 |
| 7 | Reporting | 8 | | | \$ 960 |
| | Expenses | | | | \$ 1,065 |
| | Mileage | 800 | | | \$ 440 |
| | Lodging & Meals | 1 | | | \$ 150 |
| | Misc. Equipment & Document Allowance | | | | \$ 475 |
| | Total | 72 | 16 | 5000 | \$ 15,969 |

WATER DETENTION STORAGE FEASIBILITY

Objective: Identify and prioritize opportunities for developing water storage using existing creek infrastructure.

Task

During the Floodplain Technical Workshop, we identified that restoration actions alone may not provide sufficient late-season water flows. To promote late seasonal flows in the upper meadow, we've recommended the development of on-channel and off-channel storage sites and associated discharge mechanisms including channels and associated constructed wetland systems. Additional opportunities may be to connect existing tributary flows to the meadow. Several preliminary sites have been identified, and include:

- Searchlight Pond
- Upwelling near Well 18-3R
- Confluence Delta
- North Fork Storage Sites
- Trapezoidal Channel Storage
- Lost Lake
- Hidden Lake
- Valley tributaries

This task will evaluate the feasibility and develop conceptual alternatives for these sites. We will review existing reports, drawings, surveys, and plans; perform field investigations of each site; develop calculations based on site configurations; and will engage appropriate landowners, regulators and other stakeholders.

Deliverable

We will provide a technical memo describing that identifies and describes the opportunities, constraints, potential features, and benefits associated with developing the each potential site as a summer water storage facility. These descriptions will include planform maps, site drawings, schematics, and typical cross-sections as appropriate and as basemap drawings (or data) are available.

Task Budget

| | | # | Mike Liquori | Jeff Prancevic | Fee Subtotal |
|--|--------------------------------------|-----|-----------------|-------------------|-----------------|
| Water Detention Storage Feasibility | | | | | |
| 1 | Review Existing Drawings & Plans | | 12 | 8 | \$ 2,072 |
| 2 | Field Inspections | | 12 | | \$ 1,440 |
| 3 | Conceptual Alternatives | | 24 | 12 | \$ 3,828 |
| Expenses | | | | | \$ 370 |
| | Mileage | 400 | | | \$ 220 |
| | Lodging & Meals | 1 | | | \$ 150 |
| | Misc. Equipment & Document Allowance | | | | |
| Total | | | | | \$ 7,710 |

CONTINGENT TASKS

The following 3 tasks could be pursued with the cooperation of the associated landowners. Each project was selected to promote rapid on-the-ground actions in support of overall project goals.

At the present time, additional funding and/or other preliminary landowner commitments are required

The ability to pursue the following three (3) tasks will depend on the ability of each landowner to meet certain desired commitments (described below). These commitments are intended to ensure that public monies will be spent in ways that ultimately lead to beneficial projects. The commitments will also help to establish priorities for the proposed scope of work given the currently limited availability of funding.

SELECT BANK STABILIZATION DESIGN

Objective: Protect existing golf course infrastructure from streambank erosion while meeting other project objectives for habitat and geomorphic creek restoration.

Landowner: Resort at Squaw Creek

Desired Commitment: a collaboratively developed plan to pursue permitting and construction in 2010, including contingency funding plans.

Task

This task will develop preliminary designs sufficient to support permitting activities at 1-2 select, high-priority bank stabilization locations located along the Golf Course in Reach 5. These sites have a high potential to erode the existing golf-cart path and/or golf course unless controlled.

The conceptual design for these sites will be to install a biotechnical solution consisting of rock, woody debris, vegetated soil lifts, slope regrading, flow diversion structures, and planted rooted vegetation.

Deliverable

The deliverable will include a preliminary bank stabilization design, including a brief technical report describing the design, including planview maps and appropriate typical drawings. The document will support permitting and will position construction activities in 2010.

Task Budget

| | | # | Mike Liquori | Jeff Prancevic | Fee Subtotal |
|---------------|---------------------------------------|-----|-----------------|-------------------|------------------|
| Task # | | | | | |
| 1 | Preliminary Bank Stabilization Design | | | | \$ - |
| 2 | Detailed Field Survey | | 16 | 24 | \$ 3,816 |
| 3 | Site Hydrology & Hydraulics | | 2 | 4 | \$ 556 |
| 4 | Biotechnical Analysis | | 8 | 12 | \$ 1,908 |
| 5 | Conceptual Alternatives | | 24 | 16 | \$ 4,144 |
| 6 | Preliminary Design Drawings | | 16 | 16 | \$ 3,184 |
| 7 | Reporting | | 12 | 4 | \$ 1,756 |
| | Expenses | | | | \$ 995 |
| | Mileage | 400 | | | \$ 220 |
| | Lodging & Meals | 2 | | | \$ 300 |
| | Misc. Equipment & Document Allowance | | | | \$ 475 |
| | Total | | 78 | 76 | \$ 16,359 |

SEARCHLIGHT POND ALTERNATIVES

Objective: develop conceptual approach for using Searchlight Pond as water storage for the benefit of Squaw Creek

Landowner: Ski Corp

Desired Commitment: a good-faith effort to collaborate toward environmentally beneficial solutions that work within the economic, legal, and operational constraints of the landowner.

Task

To promote late seasonal flows in the upper meadow, we've recommended the development of on-channel and off-channel storage sites and associated discharge mechanisms including channels and associated constructed wetland systems.

Squaw Valley Ski Corporation has offered access to their Searchlight Pond, which is about 1800 feet west-southwest of the head of the Olympic

Channel. This pond can store up to 2 million gallons (approx 6 ac-ft) of water, which is sourced from a small watershed of approximately 44 acres in size. Modifications to the impoundment will be required to provide sufficient controls over flow releases. We understand that existing infrastructure capable of routing flows near the head of Olympic Channel is currently available, however the capacity of this infrastructure to modify flow releases is not evident.

Field Inspection – SWC will inspect the existing site condition for the pond, and its existing drainage infrastructure, including its outfall. We will also survey & map the existing Olympic Channel conditions.

Review Existing Drawings & Surveys – SWC will coordinate with Ski Corps to review As-Built drawings for the existing pond infrastructure to determine opportunities and constraints.

Site Hydrology– using the information identified above, SWC will develop quantitative estimates for the timing, volume and routing potential of water released from Searchlight Pond.

OPTIONAL: It is desirable to perform and monitor a test release from Searchlight Pond to evaluate the fate of delivered water and to provide essential information regarding the surface and floodplain hydrology downstream of the outfall. Such a test release and monitoring activity would cost an additional \$6-12k, and will require full cooperation of all associated landowners.

Deliverable

Our deliverable will be a technical report that summarizes the results from each of the activities described above. The report will characterize the viability of using the Searchlight Pond as a late-season water source and will clearly describe, including the use of appropriate figures, the condition of the existing facilities and likely needed modifications. The report will identify and describe the opportunities, constraints, potential features, and benefits associated with developing one or more alternatives for using the Searchlight Pond as a summer water storage facility.

Task Budget

| | | # | Mike Liquori | Jeff Prancevic | Fee Subtotal |
|--------------------------------------|--------------------------------------|-----|-----------------|-------------------|-----------------|
| Searchlight Pond Alternatives | | | | | |
| 1 | Field Inspections | | 4 | 4 | \$ 796 |
| 2 | Review Existing Drawings & Surveys | | 2 | 8 | \$ 872 |
| 3 | Site Hydrology & Hydraulics | | 8 | | \$ 960 |
| 4 | Alternatives & Reporting | | 20 | 11 | \$ 3,269 |
| Expenses | | | | | \$ 890 |
| | Mileage | 800 | | | \$ 440 |
| | Lodging & Meals | 3 | | | \$ 450 |
| | Misc. Equipment & Document Allowance | | | | |
| Total | | | | | \$ 6,787 |

REACH 6A IMPROVEMENT ALTERNATIVES

Objective: Develop Conceptual Alternatives for Reach 6A that supports the integration of Searchlight Pond, achieves water supply and habitat objectives, and meets the needs of associated landowners.

Landowner: Poulsen Properties

Desired Commitment: a good-faith effort to collaborate toward environmentally beneficial solutions that work within the economic, legal, and operational constraints of the landowner.

Task

We intend to utilize \$10,000 of the requested funds to develop conceptual designs for integrating Searchlight Pond as an off-channel storage site. This task will support the evaluation of: 1) Searchlight Pond as a source of late-season water, 2) Olympic Channel as a receiving area for that water, and 3) additional infrastructure and restoration needed for implementation. To support this evaluation, we've identified the following tasks:

Field Survey – SWC will inspect the existing site condition for the channel and associated features, and will develop detailed cross-sections, longitudinal profiles, and site opportunity/constraint maps.

Soil & Groundwater Investigations – SWC will evaluate the existing soil and groundwater conditions in the receiving area to estimate the amount of flow that will be needed to retain a perennial channel.

Site Hydrology & Prelim Hydraulics – using the information identified above, SWC will develop quantitative estimates for the following:

- the existing and potential infiltration capacity in the Olympic Channel receiving area
- the typical range of seasonal water table depths in the Olympic Channel receiving area
- flow depths and velocities within the Olympic Channel

Conceptual Design – SWC will develop a conceptual restoration design that will include wetland construction and/or channel restoration along the Olympic Channel between the outlet with Searchlight Pond and the confluence of Squaw Creek.

Deliverable

Our deliverable will be a technical report that summarizes the results from each of the activities described above. The report will characterize the site, and will clearly describe, including the use of appropriate figures, the condition of the existing facilities and likely needed modifications. The report will identify and describe the opportunities, constraints, potential features, and benefits associated with developing one or more alternatives.

Task Budget

| | | # | Mike Liquori | Jeff Prancevic | Fee Subtotal |
|--|--------------------------------------|-----|-----------------|-------------------|-----------------|
| Reach 6A Improvement Alternatives | | | | | |
| 1 | Field Survey | | 8 | 16 | \$ 2,224 |
| 2 | Soil & Groundwater Investigations | | 6 | 14 | \$ 1,826 |
| 3 | Site Hydrology & Prelim Hydraulics | | 12 | | \$ 1,440 |
| 4 | Conceptual Design | | 20 | 11 | \$ 3,269 |
| Expenses | | | | | \$ 890 |
| | Mileage | 800 | | | \$ 440 |
| | Lodging & Meals | 3 | | | \$ 450 |
| | Misc. Equipment & Document Allowance | | | | |
| Total | | | | | \$ 9,649 |

OTHER PRIORITY TASKS

The following tasks outline several additional tasks that may be substituted for the above recommendations as needed to balance available funds or meet stakeholder priorities. Other potential tasks can also be added from the Conceptual Refinement or Additional Technical Tasks described in the Working Master Plan section (see pages 15-24).

CASE STUDIES OF SIMILAR PLUG & POND PROJECTS

Objective: Learn about opportunities and methods from similar projects.

Task

Several recent plug and pond type restoration projects have occurred within the Truckee and Feather River watersheds. These projects can be studied and monitored in detail to provide insights into restoration design and construction activities in Squaw Creek. This task would:

Obtain & Review Design Plans – including relevant GIS data, reports, drawings, and/or other information available from existing projects

Site Visits – review a select number of recently constructed sites to explore opportunities and methods for design

Project Interviews – with key scientists and engineers associated with these projects.

Deliverable

A brief technical memo describing some of the key lessons from associated projects.

Task Budget

| | # | Mike Liquori | Jeff Prancevic | Fee Subtotal |
|---|---|--------------|----------------|-----------------|
| Case Studies of Similar Projects | | | | |
| 1 | Obtain & Review Design Plans | 6 | 8 | \$ 1,352 |
| 2 | Site Visits | 12 | 12 | \$ 2,388 |
| 3 | Project Interviews | 6 | | \$ 720 |
| 4 | Reporting | 8 | | \$ 960 |
| | Expenses | | | \$ 575 |
| | Mileage | 500 | | \$ 275 |
| | Lodging & Meals | 2 | | \$ 300 |
| | Misc. Equipment & Document Allowance | | | |
| | Total | | | \$ 5,995 |

BANK STABILIZATION PRIORITIES

Objective: develop priorities for bank stabilization treatments throughout the project area

Task

This task will map, classify, characterize and prioritize all existing bank failures, and rip-rap sites found within the existing channel, with a focus on reaches 3-6. The results of this task will be used to identify conceptual bank

stabilization treatments and/or restoration activities. Particular focus will be placed on those projects that can occur independent of the planform improvements (and thus may be implemented on a faster timeline).

Field Inventory & Classification for Bank Conditions

Mapping – the data will be compiled into a GIS database that will include the spatial location and characteristics

Priority Listing – banks will be evaluated for stability and a priority listing will be developed with general recommendations for treatment types. Treatment types will be characterized by the method and mode of restoration activities that may be suitable to each site.

Deliverable

Our deliverable will be a map and brief memo that will characterize and prioritize all existing bank failures, and rip-rap sites found within the existing channel, with a focus on reaches 3-6.

Task Budget

| | | # | Mike Liquori | Jeff Prancevic | Fee Subtotal |
|--------------------------------------|--------------------------------------|-----|-----------------|-------------------|-----------------|
| Bank Stabilization Priorities | | | | | |
| 1 | Field Inventory | | 16 | 20 | \$ 3,500 |
| 2 | Mapping | | 2 | 8 | \$ 872 |
| 3 | Priority Listing | | 12 | 2 | \$ 1,598 |
| 3 | Reporting | | 8 | 4 | \$ 1,276 |
| | Expenses | | | | \$ 575 |
| | Mileage | 500 | | | \$ 275 |
| | Lodging & Meals | 2 | | | \$ 300 |
| | Misc. Equipment & Document Allowance | | | | |
| | Total | | | | \$ 7,821 |

WORKING PREFERRED ALTERNATIVE

The preferred alternative involves partially or fully reconnecting Squaw Creek with its relict channel system in reaches 1-3, and developing a similar meandering floodplain channel design along the northwestern portion of the meadow downstream of the golf course (reaches 3 & 4). The existing channel in the areas that will be evacuated by the new channel will be partially to completely filled and/or converted into swales, wetlands or localized pond features. A number of other features will be added to remove failed rip-rap, provide localized grade controls, stabilize banks, create inset floodplain features, reconnect wetlands, and connect to detained surface water storage sites. The project area will be extended to include the confluence of the North Fork and South Fork, and sufficiently upstream to accommodate processes that directly impact the delta at the confluence. Finally, more detailed strategies to address high bedload supply rates and the effects of the Trapezoidal Channel will be developed. These key components are described in additional detail below.



Figure 1) Project Reach Breaks

KEY CONCEPTUAL DESIGN COMPONENT DESCRIPTIONS

This section provides brief descriptions of the various conceptual design components currently included within the Preferred Alternative. Approximate locations for these features are displayed in the attached map

(see next page), and are subject to refinement in both location and configuration with additional design work.

DETENTION STORAGE AREAS

The Floodplain Technical Workshop identified several key areas that may provide surface storage or detention to support dry season flows in the upper portion of the meadow. The areas include the Ski Corp's Searchlight Pond, the Trapezoidal Channel, the confluence delta area, select valley tributaries, and possibly upslope areas within the North Fork and South Fork drainages. Additional work is necessary to establish the feasibility of using these areas for such purposes.

BEDLOAD MANAGEMENT ZONE

The Creek Technical Workshop identified the need to establish controls to manage coarse bedload sediment (mostly cobbles and coarse gravels) that are currently routed into reaches 4 and 5 by the current configuration of the Trapezoidal Channel reach. Such controls may consist of bedload sediment traps, hydraulic controls, or maintenance structures in or upstream of Reaches 5, 6 and 8. The conceptual approach for any Bedload Management Zone has not yet been addressed.

INSET FLOODPLAIN

Inset floodplain structures will help to locally reconnect the floodplain to the creek by increasing the duration of overbank flows, and by diffusing peak flow velocities and shear stresses that cause excessive erosion and sediment transport. The

WETLAND/POND IMPROVEMENT AREAS

Several sites capable of storing water for delivery to Squaw Creek within the meadow reach have been identified. Water delivery may occur via direct delivery conveyances (e.g. channel, culverts, gates, weirs, etc), or may be involve indirect support (e.g. via groundwater and/or infiltration mechanisms). Storage may occur in the form of open ponds, wetlands, or pond/wetland complexes. These features will be located in Reaches 2, 3, 4, 5, 6, 6A, and potentially in upstream areas (e.g. along the lower reaches of the North Fork and/or South Fork areas). Additionally, some of the ponds may be developed as part of a 'plug and pond' type restoration strategy.

OLYMPIC CHANNEL IMPROVEMENTS

Reach 6A (the Olympic Channel) is a small spur channel that connects effluent from Searchlight Pond, runoff from the parking lot and adjacent areas, and natural surface runoff from upslope areas to Squaw Creek at a confluence point about 325 feet downstream of the Trapezoidal Channel.

This channel will be redesigned to present a meandering profile, connected with the floodplain, and including various habitat features for aquatic and terrestrial wildlife. It will also repair several existing (and non-functional) erosion control features.

SEARCHLIGHT POND CONVEYANCE IMPROVEMENTS

This element includes improvements designed to better control the outflow of Searchlight Pond for the benefit of dry season discharge to Squaw Creek through Reach 6A.

BANK STABILIZATION

A large number of bank stabilization opportunities exist throughout the project area. Locations typically include areas with existing failed rip-rap, active erosion, or areas where potential erosion could compromise existing infrastructure. A comprehensive inventory of such sites does not yet exist, although several specific areas are already known. Stabilization approaches will generally include methods that are more ecologically and geomorphically effective (e.g. biotechnical).

SETBACK FLOODWAY CONTROLS

One of the key strategies associated with the restoration design is to allow the channel some flexibility to naturally migrate. However, in areas along the golf course, the risk to existing infrastructure must also be considered. The Setback Floodway Controls will allow the river some ability to meander and migrate, while protecting key lands from erosion. Controls will consist of setback levees, diversion structures, dispersal structures, flood controls, and similar. These controls will be concentrated in the upper part of Reach 4, all of Reach 5, and the lower part of Reach 6.

RESTORE FLOODPLAIN CHANNELS

Existing remnant channel forms are visible along portions of the meadow. The component will seek to reconnect some of these channels in ways that support hydrologic functions as well as improved vegetative and habitat diversity. The restored floodplain channels will be concentrated in the areas north of the existing channel in Reaches 2, 3 and 4.

RESTORE HISTORIC CHANNEL ALIGNMENT

One of the more exciting opportunities is the ability to integrate the natural channel alignment back into the channel network. There are two primary opportunity areas; 1) the existing relict channel almost entirely contained within Reach 2, and 2) an area north of the existing creek channel in Reaches 3 and 4.

Reconnecting the relict channel in Reach 2 could be relatively straightforward and low risk. It could proceed following hydraulic modeling work to verify the discharge and loading capacity of the existing relict channel and associated floodway. If risks are deemed to be too high, partial connection could be designed to limit (or transition) the relict channel system to more active flow conditions.

In Reaches 3 and 4, any new channel alignment will require constructing new channels. While there remains historical evidence of relict channels that can offer a reference condition, the design of new meandering stream channels is complex, and will require considerable design efforts. We recommend that restoring this section can be phased in following careful monitoring, experimentation and adaptive management.

GRADE CONTROL STRUCTURES

Grade control structures will be required to prevent further channel downcutting, and to divert existing flows into new channel alignments. These may consist of longitudinal controls (e.g. a series of channel steps, or graded riffles) or larger weir-like structures as may be determined following a more detailed hydraulic model of the meadow.

CONSTRUCTED SWALE

The current creek channel in Reach 2 and portions of Reach 3 are substantially oversized relative to the desired flow capacity for a functional meadow ecosystem. To reduce the channel size, we recommend converting these rather box-like, incised channels into constructed swales and/or modified channels that provide a more sustainable channel and meadow environment.

VARIOUS HABITAT ENHANCEMENTS

A number of instream and bank enhancements will be developed to improve habitat for both aquatic and terrestrial wildlife, as well as key plant communities within the meadow. These will be identified and developed during preliminary designs for all key features described above.

WORKING MASTER PLAN OUTLINE

This section outlines future work for this project assuming that it will proceed as an integrated, comprehensive project. While it may be possible to dis-aggregate certain components, projects of this magnitude typically follow these project phases.

- **Initial Project Studies** – this phase includes site assessment, evaluation, diagnosis and a clear identification of potential opportunities and constraints.
- **Conceptual Design** – this phase typically outlines potential solutions to the issues identified during initial project studies. Often includes feasibility studies to confirm the proposed approaches.
- **Stakeholder Facilitation** – this task seeks to coordinate cooperation from all existing stakeholders.
- **Preliminary Design** – at this stage, conceptual designs are considered in more detail to determine the spatial location, orientation, size, shape and key sub-components for each design element. It often requires additional studies and technical analysis than is necessary during previous phases.
- **Permitting and Environmental Documentation** – this phase, required under CEQA, typically involves a detailed technical, social, political and economic analysis of the project (and associated alternatives) to ensure that the project satisfies regulatory and legal requirements.
- **Detailed Design** – at this time, detailed design of each project element is developed. It typically results in detailed drawings, maps, cross-sections, specification, materials requirements, etc.
- **Project Construction & Implementation** – during this phase, construction bid documents are prepared and contractors are supervised during each implementation phase.
- **Monitoring & Adaptive Management** – following each restoration action, monitoring activities (usually required under permits) ensure the proper function and maintenance of the designs. Maintenance activities and/or adaptations of future phases may result in response to knowledge gained during this important step.

At the present time, we are about 70-80% complete with the conceptual design and entering into studies that will support Preliminary Designs and Permitting.

Given the piecemeal funding associated with this project, we are seeking to advance certain elements of this project into deeper phases of the overall project planning. This will allow faster implementation of select opportunities. For this reason, we are pursuing a few select elements for preliminary design with the intention of moving through design and implementation in 2010.

The following sections catalog an array of outstanding tasks that are associated with the Squaw Creek Restoration Project. The projects are grouped into:

- Additional Technical Tasks
- Conceptual Refinements & Preliminary Restoration Design Tasks
- Permitting & Environmental Documentation Tasks
- Detailed Design & Construction Opportunities
- Monitoring Tasks

This working list of project tasks is subject to considerable refinement as we learn more about the project site through authorized project tasks and decisions about the trend of restoration options. We will aggressively pursue additional grant opportunities to continue work on this project. Projects are presented in general order of priority, although the importance of some tasks may change in response to changes in overall project direction or focus.

All costs and task descriptions provided below are preliminary, and subject to revision during task scoping. Project cost estimates are similarly generalized, and are intended to cover a range of potential funding opportunities.

CONCEPTUAL REFINEMENTS & PRELIMINARY RESTORATION DESIGN

During the public and technical workshop phases of this project, we identified broad support for a restoration strategy similar to Alternative 2, but amended to address the trapezoidal channel, bedload risks, and potential detention storage areas. There was consistent concern that the work done to date has not sufficiently addressed these issues and potential solutions.

There is also broad agreement that additional detail is appropriate to describe this preferred alternative.

Additional conceptual refinements include (in approximate priority):

EXPAND THE PROJECT FOOTPRINT \$5-15K

This task will expand existing topographic and hydraulic analysis conducted during the preliminary conceptual analysis to include reaches 7 (Trapezoidal Channel) and 8 (confluence zone).

PRELIMINARY DESIGNS TO MITIGATE FOR THE HYDRAULIC AND BEDLOAD TRANSPORT EFFECTS OF THE TRAPEZOIDAL CHANNEL \$20-50K

This task will develop strategies for diffusing energy from the trapezoidal channel and influence the sediment transport capacity associated with peak floods (e.g. >10-yr floods). Opportunities under consideration include bedload traps, hydraulic controls, peak flow diversions, and split channel designs. Completing some of the Additional Technical Analysis Tasks described below will greatly improve the results of this task (e.g. Hydrologic Analysis, sediment studies, others).

PREFERRED CHANNEL ALIGNMENT FOR RESTORING RELICT SECONDARY CHANNELS \$12-20K

This task will use historical evidence and hydraulic model results to guide alternatives for planform alignment improvements in reach. Task will also include field validation and surveys designed to improve the resolution of channel mapping in the relict channel zone. This work will focus in Reaches 1-4, including structural elements that will support restoration of these features (e.g. plugs, ponds, grade controls, etc).

CONCEPTUAL DESIGNS FOR INTEGRATING LATE-SEASON FLOWS FROM SURFACE DETENTION FACILITIES \$??

This task will build on the Water Detention Storage Feasibility Task (see page 7) by identifying conceptual design approaches to connect these sources.

IDENTIFY WETLAND & POND RESTORATION PRIORITIES \$8-20K

This task will inventory, map and prioritize wetland and pond opportunities based on the stream alignment configuration and other criteria.

ADDITIONAL TECHNICAL ANALYSIS TASKS (\$170-300K)

Several uncertainties exist that will significantly affect the project design. The timing of the following studies can vary, but the level of understanding associated with these uncertainties affects the risk associated with the project. Specific risks depend on the selected project, so the timing of additional technical studies may vary in response to project priorities and funding opportunities.

EXTENDED PROJECT AREA TOPOGRAPHIC SURVEY \$4-15K

This task will identify and review existing survey data for the trapezoidal channel to extend our existing ground survey data into Reaches 7 and 8. Sources will include Squaw Valley Ski Corp and Carl Gustafson. If data is not compatible with existing data and current conditions, it may be necessary to augment the existing survey with a preliminary field topographic survey to identify elevations for the bed and banks through the trapezoidal channel and confluence delta (contingent on sufficient funding).

HYDROLOGIC ANALYSIS \$8-15K

This task will review and analyze existing streamflow data for the three stations maintained within Squaw Valley, and will develop comparisons to USGS Blackwood Creek station, the Tahoe City climate station, and other data sources that can be used to extend the record and validate preliminary estimates developed during Phase 1. Analysis will develop flood frequency estimates, identify peak flow regimes, and evaluate historic flow duration patterns. These data are critical inputs to support environmental documentation, permitting, and detailed project designs.

FLOW ROUTING MODEL AND WATER BUDGET \$3-10K

This task will develop a detailed analysis of flows during peak runoff periods. It will integrate 3-dimensional flow pathways from existing digital elevation models, and will calibrate these to observed runoff patterns during peak runoff. The model will develop quantitative estimates for the inputs, storage, losses, and exports within the project areas. It will also support hydraulic modeling by identifying all non-channeled inputs to the model.

BASIC HYDRAULIC MODELING \$25-40K

This task will develop more basic 1D hydraulic models (HEC-RAS) to support various aspects of the project permitting and design, including planform channel alignment. The model will establish flood extents, bed and bank shear stresses, flow velocities and flow depths throughout the project area. It will be used to identify high risk channel configurations and preliminary channel specifications.

DETAILED 2D HYDRODYNAMIC MODELING \$35-80K

Several of the alternatives depend on a more thorough understanding of hydraulic conditions under existing and design conditions. Generally, the more complex channel alignment configurations will most benefit by the additional quality of 2D modeling. This study will provide essential information about water surface elevations under various alternatives, and will establish the limits of flooding, scour potential, sediment transport characteristics, velocities, and water depths.

PRELIMINARY SEDIMENT SUPPLY EVALUATION \$10-30K

This task will coordinate with Squaw Valley Ski Corp, Lahontan RWQCB, SVPSD and others, to compile and review existing data on sediment supply for sand, gravel and cobbles. Where data is incomplete, sediment sizes, sources and supply volumes will be characterized through a) field reconnaissance of sediment sources, b) sediment transport calculations, c) hydraulic entrainment thresholds, d) empirical comparison to other local studies, and e) grain size analysis of existing gravel bar deposits.

BEDLOAD TRANSPORT STUDY \$40-75K

This study will address uncertainties regarding the characteristics of bedload supply that is delivered to the upper portions of the project area from upstream sources. Maintaining sediment transport continuity is an essential function of river restoration projects. This task will develop the necessary information for restoring the channel and developing management strategies.

IDENTIFY OPTIMAL FLOW LEVELS \$16-20K

This task will identify the flow requirements best suited to benefit fish species, using accepted techniques that integrate hydrologic, geomorphic and biologic functions.

UPDATED STREAM CROSS-SECTIONS ~\$15K

This task will take repeat cross-sections at those sites surveyed in 2005. The objective is to evaluate the rates of channel migration associated with various meander profiles.

FLOODPLAIN CHARACTERIZATION STUDY \$12-20K

This task will evaluate floodplain conditions, including infiltration capacities, compaction areas, etc. It will be used to identify opportunities for restoring floodplain storage and for designing plugs, ponds, swales and other features.

REVISE CONCEPTUAL DRAWINGS & MAPS (VARIABLE)

This task will revise existing GIS data, historical maps, survey data, and existing conceptual designs, and conceptual planform maps and drawings to incorporate additional detail as such detail is developed.

PROJECT MANAGEMENT & REPORTING (~\$10-15K/YEAR)

In addition to these technical tasks, funding will also support various other tasks including (but not limited to) meetings, grant writing, strategic development, stakeholder outreach, facilitation, document preparation, etc.

The general deliverable for funded tasks will be compiled into one or more technical reports that will contain the technical data, calculations, maps, tables, photos, sketches and restoration component descriptions.

PERMITTING RELATED TASKS

These tasks will be necessary to support various site improvement activities following CEQA.

BOTANICAL & BIOLOGICAL SURVEYS \$30-60K

The actual studies and additional tasks that will be required will depend on the results of preliminary design work, perceptions of permitting agencies, and the risk tolerance of landowners. At a minimum, surveys will be required for all endangered and threatened flora and fauna.

PERMITTING STRATEGY \$10-15K

The potential instream flow augmentation project may constitute a discretionary action under the California Environmental Quality Act (CEQA) and implementation of project actions will require acquisition of various permits and/or approvals. A first step in the environmental compliance and permitting process will develop an overall strategy for environmental document preparation and acquisition of the necessary permits during the feasibility study. The environmental compliance and permitting process will be defined based on development of the project (e.g., identification of water source, discharge method). The strategy will provide a framework to guide the process, minimize surprises and delays, and maximize timely environmental document completion and permit acquisition with acceptable permit terms. An interagency meeting conducted early in the process will be conducted to provide early input into the strategy.

ENVIRONMENTAL DOCUMENTS & PERMITTING \$225-\$600K

The strategy task described above will address whether an Initial Study / Mitigated Negative Declaration (*low cost range*) or Environmental Impact Report (*higher cost range*) will be needed. The permits that will likely be required include Lahontan Regional Water Quality Control Board NPDES permit and waste discharge requirements; Clean Water Act, Section 404 permit for wetland fill (nationwide permit) and Section 401 water quality certification; California Fish and Game Code, Section 1602 Streambed Alteration Agreement; Endangered Species Act, Section 7 Consultation (Biological Assessment and Biological Opinion); State Historical Preservation Office concurrence for Section 106 compliance (historic and archaeological resources).

DETAILED DESIGN & CONSTRUCTION OPPORTUNITIES

PHASED IMPLEMENTATION PLAN \$15-20K

This task will articulate a detailed implementation plan that will identify for each restoration component the additional design requirements, permitting requirements, cost estimates, and approximate phasing.

To the extent funding and data are available, we will extend these design tasks beyond conceptual-level designs toward preliminary designs at the 10-25% design level.

It should be noted that a Master Plan for this type of project is subject to considerable revision and refinement after each new task is completed. A comprehensive master plan can only be completed after all the technical and preliminary design elements are complete.

DETAILED DESIGN & SPECIFICATIONS \$200-400K

The detailed design and specification phase develops the detailed engineering plans, drawings and specifications necessary to build the various project features. This task will further develop existing designs to the 100% design level. The actual design fees will vary depending on the selected design approach. Detailed designs will likely be required for:

- channel and/or floodplain grading
- new channel alignment
- revegetation
- bank stabilization
- instream grade controls

- sedimentation basins
- wetland construction and/or improvements

BID SUPPORT & CONSTRUCTION SUPPORT \$30-\$100K

This task will provide bid support and construction support during project implementation. Bid support would likely include attending the pre-bid conference, answering bidders' questions and preparing bid addenda as needed. Construction support would include review of submittals, design clarifications, on-site observation for consistency with design intent. PWA can also assist with reviewing structure layout and field fitting design elements. If needed, the PWA Team could provide more extensive construction management services.

MONITORING TASKS

STREAM FLOW MONITORING \$10-15K/YEAR

This task will maintain the stream gage monitoring equipment and data associated with the three gages in the project area.

MONITORING/ADAPTIVE MANAGEMENT STRATEGIC PLAN \$30-50K

This task will develop an adaptive management protocol to support post-construction monitoring based on the implemented design. The protocol will develop detailed monitoring requirements and will define appropriate management responses if monitoring data surpasses certain thresholds.

SIGNATURE PAGE

We, the undersigned cooperators for the Squaw Creek Restoration Project acknowledge that the project scope described in this document will be executed contractually between the Truckee River Watershed Council, Sound Watershed Consulting, and the associated funding agencies, all on behalf of the Friends of Squaw Creek.

Signatures indicate acknowledgement of the task priorities and scope of work as outlined in this Recommended Task Priorities section of this working document. Signatures do not constitute legal authorization or approval of the current conceptual description, or working master plan, both of which will continue to evolve as the project proceeds.

Every effort will be made to accommodate preferences of all stakeholders, and appropriate final approvals will be obtained from relevant stakeholders prior to any actions that involve commitment of funding, construction, permitting, or other stakeholder liabilities.

for Lahontan Regional Water Quality Control Board

for Placer County

for Truckee River Watershed Council

for Friends of Squaw Creek

for The Resort at Squaw Creek

for Poulsen Properties

for Ski Corps

for Squaw Valley Public Services District