2009/2010 MONITORING PROGRAM ANNUAL REPORT

USDA FOREST SERVICE

LAKE TAHOE BASIN MANAGEMENT UNIT

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Chapter I – Introduction

This report contains a summary and analysis of monitoring activities implemented on the Lake Tahoe Basin Management Unit during the field season of 2009 into early 2010.

The Lake Tahoe Basin Management Unit (LTBMU) Monitoring Program provides information to decision makers about the outcome of forest management activities on desired conditions for LTBMU resources. The goal of the Monitoring Program is to provide direction needed for the Forest Plan Revision, the Forest Environmental Management System (EMS), and NEPA decision documents. The Program has evolved to follow monitoring guidelines established in FSH 1901.12, CH. 19 and 20 (Land Management Plan and Adaptive Planning Process); FSM 1331 (EMS directives); the Adaptive Management Strategy (AMS) as described in Appendix E of the Sierra Nevada Forest Plan Amendment (SNFPA); and from the strategy developed by the National USFS Monitoring and Evaluation Team (MET).

The LTBMU continues to work with our partners in the Basin to ensure that a coordinated and prioritized Monitoring Program is developed that meets both the particular needs of the LTBMU as well as the larger Lake Tahoe Basin community.

The LTBMU Monitoring Program addresses four main categories of information needs:

- **Implementation monitoring**: Determines the degree and extent to which application of standards and guidelines met management direction and intent (what, when, where, and how management direction has been followed).

- **Status-and-change monitoring** of ecosystem conditions and management activities: Assesses important biophysical and socio-cultural conditions, to gauge if desired conditions are being achieved and to describe correlative relationship between management activities and conditions to identify potential causal factors for observed changes.

- **Effectiveness monitoring**: Provides a better understanding of how ecosystem components, structures, and processes respond to management activities, and how ecosystem components interrelate.

- **Research**: Designed to support land management by generating new information to address key information gaps related to the fundamental workings of ecosystem processes, interrelationships between processes, development and testing of different management approaches, and development and validation of habitat relationships, ecological indicators, and thresholds.

This report describes the 2009 monitoring accomplishments and key findings from the analysis conducted during the following fall and into early 2010, as it relates to the four above described categories of information. Many of the analysis reports

identified can be found at the following website:
http://www.fs.fed.us/r5/ltbmu/publications.

This report is organized by key resource issue areas which include some of those identified in the Region 5 AMS, as well as resource issue areas unique to the Lake Tahoe Basin. The issue areas are listed below:

1. Lake Tahoe Clarity
2. Aquatic, Riparian, and Meadow Ecosystems
3. Old Forest Ecosystems /General Forest Ecosystems (includes WUIs)
4. Fire and Fuels
5. Invasive Species (formerly referred to as Noxious Weeds)
6. Recreation/Social Resources.

Desired conditions, management strategies, management approaches, and objectives will be identified in the LTBMU Forest Plan revision, due to be completed by 2011. Monitoring strategies will evolve to track and evaluate trends and the attainment of the desired conditions established through this process. The Forest Plan revision will also present a comprehensive monitoring and evaluation program. This Plan is still being developed, and is anticipated to meet the agency requirements for monitoring as described in Forest Service Handbooks and Manuals for Land Management Planning, Adaptive Management, and Environmental Management Systems.

Chapter II – Lake Tahoe Clarity

In 2009, LTBMU Adaptive Management Monitoring Staff collected data to evaluate the effects of management activities and practices that have the potential to affect Lake Tahoe clarity through impacts to soils and water quality. These include ski resort operations, road obliteration and road best management practices (BMP) retrofit, and temporary construction BMPs. Impacts related to fuels reduction practices are presented separately, in Chapter VI.

II.1 Heavenly Mountain Resort

Effectiveness Monitoring Question:

Are watershed conditions at the resort continuing to improve as a result of ski resort management activities?

The Heavenly Mountain Resort Monitoring Plan requires a variety of monitoring elements, including water quality, BMP effectiveness, effective soil cover, and channel condition. Contractors hired by Heavenly Resort implement the monitoring and analysis. BMP monitoring is conducted through Resource Concepts Incorporated (RCI), and the remainder of the monitoring program is conducted through Entrix, Inc. The LTBMU maintains a strong oversight role in the implementation of this program. The contractors have demonstrated a high level of performance in data collection, analysis, and evaluation, particularly in the area of BMP effectiveness monitoring. Key findings from the 2009 Annual Report are presented below.

Key findings from 2009 Annual Monitoring Report for Heavenly Mountain Resort *(Entrix, 2010)*

- 2009 was the third below average winter for precipitation in a row. The 5 year rolling average is now 15/yr, which is far below the Heavenly Creek TMDL standard for suspended sediment (60 tons/yr, 5-year rolling average).

- California effluent standards for Bijou Park Creek (California Lodge parking lot) were exceeded for Turbidity, TSS, Total Phosphorus, Total Nitrogen, Chloride, Oil/Grease, and Iron. Nevada Department of Environmental Protection effluent "not to exceed" standard for turbidity, suspended solids, and total phosphorus were exceed in Edgewood Creek (below the Boulder Lodge parking lot). Not all samples exceeded these state standards. The parameters with the highest percent non-compliance occurred below the California parking lot for Total N (76%, Chloride (94%), and Iron (100%).

- In comparing data collected in 2009 to 2006 data, Stream Condition Inventories indicate that there has been an overall increase in woody debris, and channel stability within the eight reaches monitored on four streams within the Heavenly ski resort. Some of the other parameters measured appear to show changes

between 2006 and 2009 based on measurement error related to difficulties in identifying floodplain and bankfull indicators by monitoring staff. This conclusion is based on comparison to cross section data and visual observations. Monitoring staff need to be thoroughly trained prior to performing these evaluations to minimize measurement errors in the future.

- Permanent BMPs were evaluated for implementation and effectiveness at 53 sites in 2009. Implementation was rated fully successful on 90% of the sites and 91% of the site were rated successful for effectiveness. Projects that scored less than fully effective were typically due to soil cover from revegetation still being less than the objective of 70%.

- In 2000, 42 temporary BMP evaluations were conducted. Ninety percent of temporary BMP implementation scores were rated successfully implemented, and 93% were rated effective. Dust control remains and ongoing concern.

- The effectiveness of road related BMPs could be improved with better coordination regarding objectives and methods for road BMP maintenance.

II.2. Best Management Practices (BMP) Monitoring

The LTBMU has two components to its water quality BMP monitoring program. The first is a regional Best Management Practices Evaluation Program (BMPEP), which was developed in partnership with the State Water Quality Control Board and addresses permanent BMPs for forest management activities. The second component was added specifically to the LTBMU BMP monitoring program in 2006, to provide a monitoring strategy to be included as part of the Lahontan State Water Quality Control Board Stormwater Pollution Protection Plan (SWPPP) requirement for construction projects. This component addresses monitoring of temporary construction BMPs. Both of these monitoring components use a systematic qualitative assessment of BMP implementation and effectiveness.

II.2.a. Best Management Practice Evaluation Program (BMPEP)

<u>Implementation Monitoring Question:</u>

To what degree are best management practices implemented and effective in protecting soil and water resources?

The Best Management Practices Evaluation Program (BMPEP) is a qualitative monitoring program implemented throughout US Forest Service (USFS) Region 5 (Pacific Southwest Region). The objectives of this program are to: (i) fulfill USFS monitoring commitments to the State Water Resources Control Board (SWRCB), as described in the SWRCB/USFS Management Agency Agreement and *Water Quality Management for National Forest System Lands in California (USFS, 2000)*, (ii) assess and document the efficacy of the USFS water quality management program, specifically

the implementation and effectiveness of BMPs, and (iii) facilitate adaptive management by identifying program successes and shortcomings.

In 2009, the LTBMU completed 30 BMPEP evaluations, as part of the Pacific Southwest Region's effort to evaluate the implementation and effectiveness of BMPs designed to protect soil and water resources associated with timber, engineering, recreation, grazing, and revegetation activities. Of the 43 Regional targets assigned to the LTBMU, thirteen were not conducted due to a lack of qualifying projects implemented in 2009. In the future, the LTBMU will coordinate earlier with Regional office staff to ensure that reasonable targets are assigned relative to the Forests annual program of work.

Key Findings from 2009 BMPEP, revised *(Brill, Harris, and Norman 2010)*

- A significant rain on snow event occurred in May of this year, which created conditions useful for determining BMP effectiveness. In addition, a major rainfall event occurred on October 13th of this year, and 11 evaluations at seven sites other than those selected through the random BMPEP site selection process for 2009 were monitored as part of a post-storm monitoring effort.

- In 2009, twenty-seven (90%) of the regional target BMP evaluations were rated as effective. Two BMP evaluations (7%) were rated as not implemented but effective. One of these ratings occurred at Regency Road-16N93, due to not having a Forest Service gate installed at the western terminus of the road, which allows access during the winter season administrative closure period. And the other occurred at the Dollar Underburn project, due to the lack of a defined soil cover objective in the burn plan prescription.
- One evaluation (3%) for in-channel construction practices was rated implemented but not effective. This occurred at the Blackwood Phase IIIA Stream Channel/Floodplain Restoration project, due to the failure of the temporary grade control constructed at the end of the project reach completed in 2008, to effectively pass flows and sediment during the 2009 spring runoff event. The completion of the entire restored reach in 2009 has since resolved the geomorphic instability created at the temporary grade control structure.

- Eight of the eleven additional BMPEP evaluations conducted as part of the October storm monitoring effort were rated as implemented and effective, and three evaluations (within the Angora Hazard Tree Project) were rated and not implemented and not effective. The LTBMU has identified a number of recommendations to address the implementation failings that occurred at this site.

II.2.b. Temporary BMP Monitoring

Temporary Best Management Practices are required during all construction in the Tahoe Basin that involves soil disturbance. Temporary BMPs differ from permanent BMPs as they are designed to remain effective only until construction is complete and permanent BMPs can be applied. Depending on the nature of the activity and site characteristics, a variety of different BMPs may be employed to keep sediment from being mobilized. The LTBMU's Temporary BMP Monitoring program is designed to monitor BMPs applied to forest construction and restoration projects that have the potential for short-term adverse

impact to soil and water quality. Patterned after the Region 5 BMPEP process, protocols were developed in 2006 to systematically assess and document whether temporary BMPs were implemented, maintained, and effective at preventing adverse impacts to water quality. These protocols were slightly modified in 2009.

Six projects implemented by the Engineering and Ecosystem departments were monitored, including post project monitoring after a major rain on storm event in October 2009.

Key Findings from 2009 TBMPEP *(Brill, Harris and Norman, 2010)*

- Minor deficiencies were documented at four sites. Major deficiencies were documented at two sites (Tallac Creek Bridge and Valhalla Pier) which allowed sediment to be transported to an SEZ/waterbody.

- BMP effectiveness failure at the Tallac Creek bridge replacement project resulted from a failed diversion pipe. Stream channel turbidity increased from 4 NTUs above the project to 584 NTUs below the project during the storm event.

- At the Valhalla Pier Project appropriate materials were not available on site to protect disturbed soils. The emergency use of plastic sheeting during the October storm event resulted in concentrating flows and the formation of a gully next to the beach.

- An overall procedural deficiency occurred related to the continued implementation of projects past the October 15th grading deadline without a grading exemption, resulting in the LTBMU not complying with winterization requirements specified in Lahontan water quality permits.

II.3 Roads and Trails Monitoring

Three separate components have typically been included in the roads and trails monitoring program. These efforts include monitoring protocols for roads, trails, and Off-Highway Vehicle (OHV) routes. The roads monitoring program was reported on in the annual report from last year, and there has been no roads retrofit work to report on in the past year. The OHV monitoring program is funded through the California state "green sticker" program, funded through OHV licensing. In 2009 the state OHV commission directed that the past trail condition monitoring be replaced with winter OHV use monitoring program to asses user conflict and compliance issues. This discussion is presented in Section VII of this report.

Therefore the only component reported on this year is the trails monitoring program.

II.3.b Trails Decommissioning and BMP Upgrades Monitoring

Implementation Monitoring Question:

Has the implementation of trail decommissioning and BMP upgrades reduced the potential for water-quality impacts?

Effectiveness Monitoring Question:

What impacts do forest trails have on sediment loading to Lake Tahoe, and how successful are BMP retrofits and decommissioning in mitigating those impacts?

Trails monitoring in the 2009 included the North Shore (post-project) and East Shore Beaches (pre-project) trails. Post-project monitoring of East Shore Beaches is scheduled to be performed in the summer of 2010, soon after spring runoff.

From a total of 61 miles of trails located in the North Shore transportationshed, a total of 8.7 miles of trail were identified for post project monitoring based on an evaluation of pre-project data and identification of those segments that posed the greatest risk. This 8.7 miles of trail, rated moderate to high risk, contained a combined total of 41 Chronic Erosion Features (CEFs) and 1 Stream Crossing (SC).

Only 1.7 miles of these trails were treated in 2008, so these were the only trail segments monitored in 2009. Trail upgrades included decommissioning, increasing the number of drainage features to reduce connected length, armoring of the trails surface, and reducing gradient to less than 10% where possible.

Key Findings from 2000 Trails Monitoring Report *(Brill, Harris and Norman, 2010)*

- Pre-project monitoring indicates that overall the 61 miles of trails in the North Shore tranportationshed present a relatively low risk to water quality. The total trail network will be reduced to 54 miles once all upgrades and decommissioning is completed. For the 1.7 miles of North Shore trails receiving post-project evaluation, risk to water quality dropped from a pre-project average of 40% (moderate risk) to a post-project average of 6% (low risk).

- Pre project monitoring of the 4.5 miles of trails accessing the East Shore Beaches Trails, indicate that all the trails present high to moderate risk to water quality based on WQRAP assessment, however the WEPP predictions of annual sediment yield from these segments range from between 64 to 0.14 lbs.

- WEPP analysis predicts greater than 90% reductions in sediment yields at stream crossings by decreasing trail slope, and increasing water diversions to reduce connected length.

- Because of the low risk trails present to water quality it is recommended that the LTBMU trails monitoring program only be continued for one more year, utilizing the

WQRAP protocol. Post project implementation monitoring will be conducted on the East Shore Beaches trails soon after spring runoff in 2010, along with WEPP modeling using actual post project implementation data. An update to this report will be produced at the conclusion of that monitoring effort.

- Future monitoring will consist of routine trail condition surveys conducted by LTBMU engineering department staff, and used internally by engineering staff to assess and schedule trail maintenance needs. For the purposes of TMDL and other monitoring reporting, the metrics will consist of miles of trails upgraded and maintained on an annual basis.

II.4 Urban Erosion Control Grant Program Monitoring

Effectiveness Monitoring Question:

What is the effectiveness of specific urban stormwater treatment best management practices (BMPs) in treating particulates, fine sediments, and dissolved nutrients?

The LTBMU Erosion Control Grants program has awarded $2,412,000 of grant funding from the Southern Nevada Public Land Management Act (SNPLMA) to local governments for Comprehensive Urban Runoff Treatment Effectiveness Monitoring (CURTEM) since 2000. During the time period for this annual report, there were only two active CURTEM projects. The results of previous efforts are presented on the LTBMU web site and in previous annual monitoring reports. The two active projects are described below.

The Lake Village Monitoring Project funded under SNPLMA Round 6 is being conducted by the Nevada Tahoe Conservation District (NTCD). Water quality data was collected to determine the effectiveness of the implementation of residential and roadway erosion control BMPs in the Lake Village subdivision in Douglas County. Data collection started in 2003 and ended in April of 2008. The final report was due to be completed by the end of 2008; however, unexpected changes in staffing at NTCD delayed the completion. The final report was received in September 2009. (See key findings below)

The Lower and Middle Rosewood Creek Monitoring Projects funded under SNPLMA Round 7 are also being conducted by the NTCD. The lower reach is being monitored to evaluate the effectiveness of SEZ restoration efforts (completed in 2006 and 2008). The Middle Rosewood Creek reach is being monitored to provide better estimates for hydrology and hydraulics for channel and floodplain design. Monitoring on both reaches is ongoing. Monitoring of Lower and Middle Rosewood Creek is planned to continue for two years beyond construction in order to completely characterize the changes in water quality due to the improvements.

In addition, the LTBMU Erosion Control Grants Program has been continuing to increase its support of regional water quality monitoring programs. In 2009, the USFS provided

$250,000 in funding to the US Geological Survey to support the Lake Tahoe Interagency Monitoring Program (LTIMP) of Basin tributaries. In 2009, the LTBMU also provided $250,000 to the Lake Tahoe Regional Storm Water Monitoring Program (RSWMP). The funding for RSWMP is being provided to UC Davis and Desert Research Institute through an interagency agreement between the LTBMU and the USFS Pacific Southwest Research station. Funding for RSWMP in 2009 is being used to develop a comprehensive basin-wide strategy for monitoring urban stormwater runoff to evaluate urban stormwater treatment project effectiveness. LTBMU also allocated $250,000 in funds from FY 2010 funds to initiate implementation of the program.

Key Findings from Lake Village Stormwater Investigation Final Report (NTCD, 2009)

- Data from this study concerning particle size supports "the Lake Tahoe TMDL findings that fine sediment primarily originates from road runoff". (Roberts and Reuter 2007). The catchment with road runoff as main flow source had an average particle size of 61 microns with 25% being under 14 microns. The catchment with drip line flow contributions had an average particle size of 130 microns with 25% being under 27 microns.
- The runoff in this study was rich in bio-available phosphorus, higher than would be expected, but the study yielded results suggesting that "red cinders (used as traction material), do not appear to be a greater source for phosphorus compared to local soils".
- Armoring the roof drip lines, even with pine needles, significantly reduces TSS concentration according to the drip line data. But the average particle size remained relatively unchanged, even when the concentration of particles was reduced. Particle distribution is likely controlled by soil type.
- TRPA thresholds for TSS and DP were routinely exceeded.
- The study attempted to conduct a paired watershed comparison between three sites: a control, a residential area with public right of way BMPs applied, and a residential area with public right of way and residential BMPs applied. Water quality analysis comparisons between catchments ended up not being possible because of:
  - Problems encountered related to differences in watershed characteristics, differences in catchment instrumentation, and controls over implementation of private BMPs.
  - Not enough storm events occurred and/or were successfully sampled to obtain statistically sufficient sample sizes.

II.5 Meyers Landfill Monitoring and Maintenance

<u>Implementation Monitoring Question:</u>

Does the administration of the Meyers Landfill hazardous waste clean up site meet mandatory health and safety standards and environmental regulatory standards?

Effectiveness Monitoring Questions:

Does the Meyers Landfill hazardous waste clean up site pose a significant threat to drinking water sources?

What is the extent of the plume of groundwater contamination originating from the Meyers Landfill?

The Meyers Landfill site (MLF) is a closed municipal landfill located on Federal land that is administered by the Forest Service. In the mid-1990s, contaminants in groundwater aquifers were identified as originating from the site. The primary Constituent of Potential Concern (COPC) is vinyl chloride.

The site is currently administered under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). Multiple litigations initiated by Potentially Responsible Parties (PRP) remain ongoing. An Administrative Record file containing site related information is available for public review at the Forest Supervisor's Office, Lake Tahoe Basin Management Unit.

A Remedial Investigation and Feasibility Study (RI/FS) to characterize the nature and extent of risks posed by hazardous waste on site and to evaluate potential remedial actions was completed in May of 2007 for Operable Unit -1 (OU-1(landfill waste mass)).

A final Record of Decision (ROD), which presents the selected remedial action for OU-1, was finished in November of 2007. The selected remedial action described in the ROD includes a multilayer cap and cover system to isolate and eliminate direct contact with refuse, reduce or eliminate erosion and surface water infiltration through the waste mass and reduce or eliminate potential surface contaminant migration.

A site specific engineering and design contract for the OU-1 cap was awarded to Engineering/Remediation Resources Group, Inc., in May of 2008. The cap design was completed in January of 2009. A bioremediation pilot study and the installation of three additional down-gradient monitoring wells was completed in the summer of 2009. Actual land fill cap work is now expected to start in the summer of 2010.

Monitoring which occurred in 2009 included on-going groundwater investigations focused on delineation of the contaminant plume and better understanding of site-specific ground water flow characteristics. This monitoring includes collection and analysis of groundwater samples from monitoring wells. These activities provide data used in decision making with regards to the remedial design for both OU-1 and OU-2 (ground water).

Recent analyses of groundwater samples collected from the furthest down-gradient monitoring wells have returned detectable levels of vinyl chloride. Currently, the contaminant plume extends beyond the existing wells, therefore the extent of the plumes

movement down-gradient is not known. The furthest down-gradient wells are approximately 1800 feet north of the landfill. The plume is known to be advancing down-gradient slowly but its velocity is not known. Samples collected from two new monitoring wells, installed in May, 2010, should serve to delineate the vinyl chloride plume and may help determine the rate at which the plume is advancing down gradient.

Chapter III – Aquatic, Meadow, and Riparian Ecosystems

In 2009, monitoring associated with aquatic, meadow, and riparian ecosystems included status and trend biological monitoring and restoration effects monitoring on species and hydrologic function (floodplain connectivity, sediment transport regimes, and channel stability). Hydrologic function monitoring described under this resource area is also closely linked to the Lake Tahoe clarity resource area. Restoring hydrologic function (reconnecting channels to floodplains) results in multiple ecosystem benefits including reducing stream channel erosion, increasing fine sediment deposition and nutrient uptake within the floodplain, and improving conditions for many riparian-dependent plant and animal species.

III.1 Aquatic Amphibian, Reptile, and Plant Status and Trend Monitoring

III.1.a Aquatic Multi-Species Inventory and Monitoring

Status and Change Monitoring Question:

What is the current status of aquatic amphibians, reptiles, and habitat condition at lentic sites throughout Lake Tahoe Basin and how have populations or habitat conditions changed?

What are current habitat/environmental associations of amphibians/reptiles in the Lake Tahoe Basin?

No comprehensive surveys for aquatic amphibians and reptiles were conducted on the LTBMU during 2009.

III.1.b Aquatic Associated Animal (SNYLF) and Plant (Fen) TES Status and Trend Monitoring

Status and Change Monitoring Question:

What is the current status of Sierra Nevada (mountain) yellow-legged frog populations in the Lake Tahoe Basin and how are they changing over time?

Implementation of the Sierra Nevada Yellow-Legged Frog Habitat Restoration Project began in October 2008. The goal of the project is to expand the localized range of Sierra Nevada (mountain) yellow-legged frog (SNYLF) in the Desolation Wilderness by reclaiming 69 acres of lake habitat. The objective of the project is to provide aquatic habitat that will allow SNYLF to fulfill all required life history stages. Another objective of the project is to increase basking habitat along wetland and stream channel margins in Trout Creek (Hell Hole).

In order to meet the objective the LTBMU conducted manual removal of introduced, non-native fish (brook trout) using monofilament gill nets. Gill nets were deployed in

LeConte, Jabu, Margery, Lucille, Tamarack, Ralston and Cagwin lakes. Gill nets were fished from August-September (2009) over a time period varying from 2-5 days. The total number of fish captured and size (length) is recorded and yearly accomplishment reports are produced. Gill nets are also deployed in late October/early November and are fished through the winter and spring months prior to retrieval. Logs were placed along wetland and channel margins to increase basking opportunities in Trout Creek.

During fiscal year 2009 gill nets were deployed in all 7 lakes (69 total acres). All lakes are adjacent to known SNYLF populations on the Eldorado National Forest. Populations extirpated or reduced as a result of fish introduction can recover to pre-disturbance levels after fish are removed. Restoration of frog populations following fish removal has been documented in the Sierra Nevada and indicates that manual fish removal, as a management action, can be successfully implemented. Prior to the 1890s, alpine lakes in the Desolation Wilderness were fishless and supported viable populations of SNYLF. Although no stocking has occurred in at least eight years for the majority of lakes in Desolation Wilderness, there is a need to assist in the restoration of SNYLF habitat by removing an undesired/introduced predator and competitor. It is expected that SNYLF currently residing in the Aloha/Pyramid lake complex (Eldorado NF) will naturally repopulate these treatment lakes. In addition, restoration of habitat occurred within the Helhole meadow where one existing population of SNYLF occurs. Logs were strategically placed in approximately 8 acres of habitat within Trout Creek within Hellhole meadow.

Key Findings, Sierra Nevada Yellow-Legged Frog Surveys *(Sarah Muskopf, LTBMU Aquatic Biologist, 2009)*

- A Visual Encounter Survey was conducted in the headwaters of Trout Creek (Hellhole Meadow) July 2009. One subadult was detected. This speciman was swabbed for *Bd* and the sample was sent to CDFG for testing. Three subadults and five larvae were detected in August 2008, 11 larvae in 2007, five subadults in 2006, and 36 subadults found in 2005. This survey information implies that this population may be declining at an alarming rate with the potential to go extinct. An incidental siting of adult *Rana sierrae* was reported in a meadow less than 0.5 mile north east of Hellhole proper. Additionally, a dead juvenile *Rana sierrae* was detected August 2009 in the stream. It is recommended a full inventory occur over several days of this area in 2010 in order to assess the current trend in the population.

- *R. sierrae* were detected in a small pond near Cagwin Lake in Desolation Wilderness in 2004-2006, however none were found in 2009. The pond contained approximately 10-15 tadpoles and three subadults in 2006. Fish removal efforts began in Cagwin lake in 2008 as well as six other lakes in Desolation Wilderness. Based on 2009 fish survey/removal efforts, it is presumed that Cagwin Lake is fishless or will be fishless at the end of the 2010 field season.

III.x *What is the current status of special status aquatic plant communities and associated TES plant species (fens, bogs, marshes)?* *(Shana Gross, LTBMU Botanist / Ecologist, 2009)*

Fen Inventory:
In 2006, The LTBMU botany program became involved in the R5 fen assessment to determine the presence and type of fens present primarily in forests within the Sierra Nevada region. Since 2006, a total of 125 potential fens have been assessed on land managed by the LTBMU. Approximately 105 potential fen stands were visited and assessed in 2009. Thirty-four fen stands have been identified on FS land, in Caples Lake, Echo Lake, Emerald Bay, Freel Point, Glenbrook, Mt. Rose, Rockbound Valley, South Lake Tahoe, Quadrangles.

Fens stands range from 0.02 acres (Big Meadow stand) to over 120 acres (Grass Lake) with an average of 5 acres. Data from fen assessments was entered into the regional fen geodatabase to aid in the regional conservation assessment. In addition, all field data has been processed for LTBMU reference. A LTBMU known fen shapefile was completed. It is expected that during the 2011 field season, twenty potential fen stands will be visited. These twenty stands consist of stands that 1) have never been visited or 2) we need additional data to confirm if the site is a fen or wet meadow. Once the remaining potential fen stands are assessed, a fen assessment/report will be completed that will identify future restoration and conservation targets for fens managed by the LTBMU.

TES Plant Species associated with Fens:
Lake Tahoe Basin Management Unit botany staff monitored Threatened / Endangered / Sensitive (TES) and special interest plant species that occur in both fen and wet meadow habitats. In 2009, monitoring of Forest Service sensitive species: *Helodium blandowii* (Blandow's bog moss), *Meesia triquetra* (meesia moss), and *Meesia uliginosa* (meesia moss) occurred. In addition, monitoring of LTBMU special interest genus, *Sphagnum* spp. occurred. Rare plant monitoring in fens consisted of revisits to all rare plant populations. The area of the population was quantified and an ocular cover estimate was provided. Revisits provided a way to assess presence/absence of previously identified populations. The ocular cover estimates provides some insight into population trends. However, cover estimates vary between observers as well as time periods. For this reason, trends beyond presence/absence are not available. Future monitoring should involve permanent markers and the use of survey techniques to provide more quantitative trend data.

Personal observations suggest that the *Sphagnum* spp. often associated with fens have been drying out. Several of the sites visited could not be identified as fens due to hydrology; however appeared as if they were at one point a fen. *Sphagnum* spp. have the ability to promote fen development through the accumulation of peat and increased water holding capacity. These sites need to be monitored because *Sphagnum* spp. could be an important indicator of climate changes by responding to both hydrologic and temperature changes. As fens dry out an increase in CO_2 will be released into the atmosphere as a result of the peat decomposing.

Population status of Forest Service Sensitive Plant/Special Interest Plant populations on Lake Tahoe Basin Management Unit Land.

Species	FS Sensitive / LTBMU Special Interest	Total Element and Sub-Element Occurrence	New 2009	Population Present	Population Absent
Helodium blandowii	Sensitive	3	3	0	0
Meesia triquetra	Sensitive	22	9	11	2
Meesia uliginosa	Sensitive	2	0	2	0
Sphagnum spp.	Special Interest	19	4	15	0

Grass Lake

In 2009 Grass Lake Research Natural Area (floating fen "bog") monitoring was continued. Grass Lake was designated as a "Research Natural Area" by the Forest Service to preserve a representative Sphagnum bog type in the Northern Sierra Nevada physiographic province of the Pacific Southwest Region. Grass Lake is the largest and best example of a Sphagnum "bog" (fen) in California. In addition, the Tahoe Regional Planning Agency has additional protection for Grass Lake under Vegetation Threshold V2 – Uncommon plant communities (see the Threatened Endangered and Sensitive Plant Species Monitoring section of the annual monitoring report).

Hydrologic change is predicted to be the largest threat to this community, which could be exaggerated by climate change. Long term vegetation monitoring was initiated in 2004. Monitoring consists of three components: 1) three long-term trend transect meadow plots were established during 2000 and 2004 following the USFS Region 5 Range Monitoring protocol; 2) ten photopoints were established; 3) *Meesia triquetra* and *Sphagnum* spp. cover monitoring was conducted. *Meesia* and *Spaghnum* monitoring was conducted by walking parallel transects throughout the entire RNA to assess cover and area of both species. These species were selected as indicators for the health of this system. During 2009, all three components were reassessed. A report specific to Grass Lake vegetation monitoring will be completed in late summer 2010 and posted to the LTBMU publication website.

Preliminary analysis shows a 50% decline in area of *Meesia* and approximately a 20% decline in *Sphagnum* area. This rapid decline in *Sphagnum* and *Meesia triquetra*, two fen indicator species, was unexpected. This decline may be linked to hydrologic changes. [Additional information is presented in the TES plant species monitoring portion of this annual monitoring report about rare plant community monitoring, which includes Grass Lake.]

III.2 Range Allotment Monitoring

Implementation Monitoring Question:

Are USFS range utilization standards and State fecal coliform standards being achieved at the Baldwin grazing allotment?

The Baldwin Grazing allotment was officially closed to all grazing activities in September 2009. No grazing occurred on National Forest Land and, therefore, no monitoring efforts were implemented.

III.3 Aquatic, Meadow, and Riparian Ecosystem Restoration Monitoring

Several variables are monitored as part of the effort to determine the effects and effectiveness of restoration projects in aquatic and riparian ecosystems. These include physical components related to geomorphology and habitat, as well as biotic components including fisheries, macro-invertebrates, and wildlife species monitoring.

III.3.a USFS Hydrologic/Geomorphic Restoration Monitoring

Implementation Monitoring Question:

Are state sediment and turbidity standards being achieved during the first three years post-construction, for channel restoration projects?

Effectiveness Monitoring Question:

To what degree have restoration efforts been successful in restoring floodplain connectivity, stabilizing stream banks, and re-establishing natural sediment transport regimes?

Blackwood Creek Channel Restoration

The Blackwood Creek Channel Restoration is a three-phase project designed to enhance and restore stream and floodplain function. Phase I, removal of the fish ladder and construction of a sequence of step pools and riffles, occurred in 2003. Phase II, construction of a new bridge, floodplain, and stream channel where Barker Pass Road crosses the creek, occurred in 2006. In 2009, restoration was completed on Phase IIIA (1/3 of this project was constructed in 2008). This restoration involved reconstructing the stream channel within 2,800 feet of deeply incised channel and floodplain located below the Barker Pass Road crossing. Design plans for channel restoration above the restored fish ladder under Phase IIIB was completed this past spring, with implementation planned over two seasons during the for summer of 2010 and 2011.

Photo points were established at the Phase I site in 2003 and Phase II site in 2006, and have been repeated annually. Sampling for macro invertebrates was initiated at all restoration sites in 2004, and repeated in 2005, 2006, and 2007 (see section II.3.d for more details). Pre-project wildlife trend surveys in support of Phase III restoration actions were conducted in 2004, 2006, and 2007 (see section III.3.c for more details). In 2007, the LTBMU and LRWQCB developed

TMDL compliance parameters based on the geomorphic function. A monitoring plan has been prepared for all three phases of Blackwood Creek Restoration, to evaluate both short long term restoration effectiveness, to include the TMDL compliance parameters of channel sinuosity, floodplain vegetative cover, and stream bank stability (Blackwood Creek Restoration Monitoring Plan, updated 2010).

Photopoints, cross sections, longitudinal profiles, and an as-built survey were established in the fall of 2009 upon completion of the Phase IIIA project. Turbidity sampling was conducted during implementation, and visual observations (including photos) were documented during spring runoff of 2009, and a storm event in fall of 2009. An implementation monitoring report was completed in 2009, and submitted to the Lahontan Regional WQ Board as required by the NPDES permit for this project.

Key findings from the Phase IIIA peak flow and implementation monitoring are presented below.

Key Findings, 2009 Peak Flow and Geomorphic Monitoring Field Notes for Blackwood Creek Restoration Phase IIIA: Stream and Floodplain Restoration Project *(Oehrli & Norman, May 2009):*

In spring 2009, four peak flow events occurred in the Blackwood Creek Watershed that exceeded the bank full capacity of approximately 175 CFS for the completed 30% of restored channel constructed in the Phase IIIA project. Flows peaked at 600 cfs, considered to be between the 5 to 10 flow frequency event for this stream. The following describes channel responses that were observed during these events.

- Starting with the upstream end of the project area, approximately 4 to 6 feet of coarse bed load filled an entire pool left within the main channel.

- Two installed log root balls caused the formations of two scour pools. Large lake-run rainbow trout were observed in these pools formed adjacent to the in-channel fish habitat structures.

- Overall the constructed base flow channel performed as expected and overbank flows deposited large volumes of coarse and fine grained sediment on adjacent constructed floodplains. From visual estimates, coarse grain sediment deposits were approximately 2 to 4 feet deep, and approximately .5 to 1 foot of fine grained sediment was deposited.

- The temporary grade control channel constructed at the end of the reconstructed reach filled in with coarse bed load sediment and flows cut a new channel next to the constructed stream channel. This caused the fill around a woody structure location just upstream to erode and a log in the woody structure to float up and shift its position across the channel, which then deflected all surface flow into the side channel, creating a 4'-deep by 30'- wide straight channel for approximately 400 feet. This project was evaluated through the regional BMPEP program (see section II.2.a) for in channel construction practices, and received a not-effective rating because the constructed channel was not able to withstand these spring runoff events without failure. Project designers believe that if the whole

planned restored reach had been constructed prior to the 2009 spring runoff events, this failure would not have occurred.

- Below the channel reach restored in 2008, and within the channel reach later restored in 2009, a total length of 300 feet of fine grained exposed high terrace cut banks were estimated to have eroded approximately 4 to 8 feet in width.

Key findings, Blackwood Phase 3A Stream Channel and Floodplain Restoration Project 2009 Implementation Monitoring Report *(Oehrli & Norman, December 2009):*

- Application of BMPs was successful in managing turbidity levels the majority of the time that construction activities occurred. There were however, several periods when the 3 NTU limit established in the permit was exceeded (turbidity was generally lower than 5 NTUs however and never exceeded 20 NTU). Some of this was caused from beavers plugging diversion pipes overnight, but most of the problems occurred due to increased levels of intercepted subsurface and ground water flow. These interception problems increased throughout the duration of the project as the project was immediately effective in raising ground water levels through the reach.

- On October 13, 2009 a nearby gaging station (NRCS-Ward Creek #3) recorded 7.6 inches of precipitation over a 24-hour period. This event eventually triggered a rapid rise of Blackwood creek flow volumes, rising from 32 to 110 CFS in a fifteen minute period late in the day (inflow turbidity peaked at 20 NTU, and outflow turbidity at 139). Flows were contained in the channel and it responded as expected with a combination of outer meander scour balanced by point bar formation, and some fine sediment deposition along the channel margins. The project was successful in preventing erosion along the high floodplain terrace cut banks, a stated goal of the project design.

Cookhouse Meadow Restoration Project

The Cookhouse Meadow Restoration Project was designed to raise groundwater table levels, reduce seasonal groundwater fluctuations, reestablish over-bank flooding, and reestablish natural sedimentation patterns by abandoning the existing incised channel and constructing a new channel with characteristics of a Rosgen "C/E" channel type. New channel construction was implemented in 2005. In the summer of 2006, flow was completely diverted from the old channel to the new channel. A series of earth dams capped with native vegetation were constructed to block tributary flow from entering the old channel and to create a series of ponded areas that fill from intercepted ground water.

A variety of parameters have been monitored at this site to document project effectiveness, including channel cross sections, longitudinal profiles, Weixelman plant community plots, sod bank monitoring, macroinvertebrate surveys, pebble counts, groundwater levels, water stage recorder, turbidity levels, wildlife surveys (see section III.3.c), a low scale air photo, and photopoints. A comprehensive interim monitoring report for this project was completed in 2009/2010 and posted on the LTBMU website. A summary of key findings from this report is presented below:

Key Findings, Interim Monitoring Report for the Big Meadow Creek in Cookhouse Meadow Restoration Project *(Immeker and Norman, 2009)*

- Prior to restoration, out of bank flows had not occurred in this meadow for approximately 30 years. During the three spring snowmelt seasons that have passed since completion of the restoration work (2007-2009), overbank flooding has occurred. All three of these post project years were considered to be below average precipitation years, based on SNOTEL data.

- The restoration project has resulted in dramatic increases in late season groundwater levels (average of 4 feet), increasing the duration of available water for meadow vegetation substantially. Photo points indicate that the meadow vegetation is already responding favorably to both increased groundwater levels and over bank flooding, although an analysis of quantitative data measuring vegetation response is not available at this time.

- Quantitative data on stabilizing vegetation planted or salvaged as part of the project (sod harvesting, willow staking, willow mats) was obtained, and indicates a high success rate (approximately 90% survival). This is partially due to initial irrigation efforts during the dry season, as well as changes in groundwater and surface water hydrology.

- Channel survey measurements (cross sections and longitudinal profiles) as well as visual observations indicate that the channel is maintaining both horizontal and vertical stability, and is maintaining the desired channel stability and habitat characteristics of a "C" Rosgen stream channel type. Visual observations note that lateral and point bar formation, as well as the development of scour and corner pools are occurring. The desired gravel dominant channel substrate is also being maintained (Rosgen class "4").

- An analysis of quantitative data collected to measure both wildlife and vegetation response is scheduled to be completed in 2011.

Cold Creek/High Meadows Project

The acquisition of the High Meadows property by the Forest Service was finalized during the winter of 2003. The LTBMU is planning extensive restoration efforts within this property including stream channel/meadow restoration, rehabilitation of roads and trails, and fuels reduction. These efforts are scheduled to begin in 2010 with channel/meadow restoration work to continue through 2012.

Two water quality monitoring sites were established on Cold Creek, one immediately below the meadow (43-21) and one at the lower LTBMU property boundary (43-22). Samples obtained at these sites between 2003 and 2007 were analyzed for a full complement of sediment and nutrient water-quality parameter, which provides five years of pre-project data, containing a variety of water year types**.** As provided in the High Meadow Restoration Project Environmental Assessment (EA), pre-project monitoring demonstrates a general increase in sediment and nutrient concentrations. No further water quality monitoring data will be collected until after the project is implemented.

Other pre-project data collected at this area include a qualitative Roads Water Quality Risk Assessment (2004), and macroinvertebrate sampling (2005 and 2006). Additional data collected in 2008, to establish a baseline for evaluating project effects, include a complete

stream condition inventory (SCI) and photopoints. SCI data include woody debris tally, pebble count, cross sectional data, habitat measurements, and stability ratings.
Ten groundwater piezometers were also installed in the lower and middle meadow in July 2007. Measurements were taken monthly in 2008 and 2009 from May through December.
An automated water stage recorder was also installed in August 2007 to measure discharge. One or two measurements have been recorded daily since the installation of the stage recorder. Discharge measurements (immediately adjacent to the stage recorder) are collected whenever data is downloaded to establish a stage/discharge relationship.

Taylor Creek and Tallac Creek

Taylor and Tallac Creeks are located on the south shore of Lake Tahoe in El Dorado County, 4.5 miles west of the City of South Lake Tahoe. The Taylor and Tallac Creek analysis area include complex shoreline wetlands and riparian ecosystems established within a unique hydrologic and geologic setting. The majority of the analysis area is on Forest Service land with the exception of a 20-acre private in-holding along Tallac Creek. Historically, these two wetland complexes provided approximately 400 acres of wetland and meadow habitat. The wetland conditions are influenced by processes occurring on variable time scales. Changes in streamflow and lake levels over the past several thousand years has formed the geologic framework of moraine ridges, outwash fans, beach ridges and the underlying soil complex.

An Ecosystem Assessment Report (EAR) was completed in 2005 for the Taylor and Tallac Watershed (USDA 2005). The purpose of the EAR was to determine historic conditions, currents conditions which could be used to develop desired conditions. Using information from the EAR as well as additional information gathered from Lake Tahoe Basin Management Unit (LTBMU) staff, restoration options have been developed for the analysis area and are presented in the 2009 Taylor Tallac Restoration Plan (Muskopf 2009). The restoration options were designed to meet overall goals and objectives for the project area as well as desired conditions for the meadow and wetland complex.

III.3.b Fisheries Restoration Monitoring

Status-and-Change Monitoring Questions:

What is the current status of native and non-native fishes in Lake Tahoe tributaries? *(Maura Santora and Richard Vacirca, Aquatic Biologist, 2009)*

In 2007, aquatic biologists initiated a Basin-wide Native Non-game Fish Assessment. The objective of the assessment is to document native non-game fish distribution and habitat indices in tributaries on the Lake Tahoe Basin Management Unit.

In 2008, nine streams were surveyed in the west and north shores. These streams were: McKinney Creek, Quail Creek, Homewood Canyon Creek, Madden Creek, Blackwood Creek, Ward Creek, Burton Creek, Watson Creek, and Griff Creek. All streams were sampled continuously from the mouth to endpoints such as the headwaters or natural barriers. Five species were native, including Lahontan redside shiner, Paiute sculpin, Speckled dace, Tahoe sucker, and Tui chub. Three species were non-native trout including brook trout, brown trout and rainbow trout. The native fish species were generally uncommon and non-native trout were the most common members of the fish communities in all creeks. Fish native to Tahoe

and historically present in the tributaries that were not found in 2008 include the Lahontan cutthroat trout and mountain whitefish.

In 2009, south shore tributaries on the California side of Lake Tahoe were the primary focus. These included Trout Creek, Cold Creek, Saxon Creek, and Cascade Creek. Third Creek, a tributary on the northeast shore was also surveyed this season. Four species were native including Lahontan redside shiner, Paiute sculpin, speckled dace and Tahoe sucker. Five species were non-native including brook trout, brown trout, rainbow trout, brown bullhead catfish and a goldfish. Native fish species were generally uncommon and non-native trout were the most common members of the fish communities in all creeks except Trout Creek. Native fish tended to be concentrated in downstream reaches near the lake, decreasing as one goes upstream. Fish native to Tahoe and historically present in the tributaries that were not found in 2009 include the Lahontan cutthroat trout, mountain whitefish and Tui chub.

Current information suggests further sampling by the Forest Service is necessary on the Nevada side of Lake Tahoe.

Effectiveness Monitoring Questions:

***Key findings - Effectiveness of Blackwood Creek**:*

The objective of the project is to restore channel bank and bed stability, floodplain connectivity and aquatic habitat in Blackwood Creek. To meet this objective the project will increase channel sinuosity, bank stability, and riparian vegetative cover as established in the Blackwood TMDL by the Lahontan Regional Water Quality Control Board. The Blackwood Creek Watershed delivers the largest volume of fine sediment, per square mile, of any of Lake Tahoe's tributary watersheds. These conditions are the result of historic land use activities such as canalization, in-channel gravel mining, road building, and logging. The cumulative effects from these activities, combined with a series of floods in the 1960s, initiated channel and floodplain instability along the lower 3.5 miles of Blackwood Creek's main stem. Upland streams and hill slopes are recovering and are continuing on that trajectory; however, the main channel of Blackwood Creek continues to be unstable with excessive bank erosion. The result has been chronic stream bank erosion, a lower floodplain water table, sparsely vegetated unstable floodplains, and a shift from a cottonwood-willow to a conifer dominated floodplain.

The following were conducted in Blackwood Creek (0.25 miles within the Phase III restoration reach): reshaped in-channel bars to deflect flow away from vulnerable channel banks and terraces, strengthened the heads of the flow deflection points with a combination of imported river boulders and logs, reshaped portions of the existing channel to increase sinuosity, add roughness / stability elements, and constructed floodplain features (examples: seasonally wet depressions or large wood roughness structures).

The result will be a channel that is more resistant to excessive bank erosion and better connected to the adjacent floodplain, resulting in increased spreading of peak flows and filtering of fine sediments and nutrients within the floodplain. The Blackwood Creek restoration project will also restore the riparian tree and shrub structure within the floodplain and channel banks, consisting of cottonwood stands with a willow and grass understory.

Increased vegetation along with channel morphology improvements will provide higher quality aquatic habitat.

***Key findings - Effectiveness of brook trout removal in the Upper Truckee River**:*

Brook trout eradication by means of electrofishing occurred along six miles of the Upper Truckee River. Fish removal efforts were led by FS and California Department of Fish and Game (CDFG) and supported by volunteer organizations during implementation (September-October 2009). Electrofishing crews that were mobilized in the Upper Truckee River had conducted brook trout removal at previously defined treatment reaches in Meiss Meadows. Brook trout removal in newly delineated treatment reaches continued in the Lahontan cutthroat trout (LCT) expansion area. No brook trout were sampled in the Meiss Meadow treatment area (3rd consecutive year). Three-pass depletion methods were used in the treatment reaches within the expansion area; 100 brook trout were removed in 16 reaches. LCT were noted as occupied most of the 16 reaches which is a strong indicator of out-migration from Meiss Meadows.

III.3.c Riparian Terrestrial Wildlife Restoration Monitoring

Status-Trend Monitoring Question***:***

What are existing conditions for wildlife at restoration project sites and how might they help us identify opportunities for improving ecological conditions at restoration sites*?(Victor Lyon and Shay Zanetti, Wildlife Biologists, 2009)*

In 2004, the LTBMU initiated planning for the restoration of ecosystem function in seven areas within the Lake Tahoe Basin (i.e. Cookhouse Meadow, High Meadow, Blackwood Creek, Upper Truckee River Sunset Reach, Meeks Creek Meadow, Taylor/Tallac Marsh, and Ward Creek). For a full description of the restoration monitoring completed for these sites, please refer to reports by Borgmann and Morrison (2004, 2005, 2006, 2007, and 2008) and the LTBMU (Annual Wildlife Report 2009) – all are posted on the LTBMU publication website. Implementation of restoration activities has been completed at only Cookhouse Meadow; the other restoration sites are in varying stages of planning and implementation (e.g. Sunset Reach restoration has been planned but not implemented). Cookhouse Meadow and Sunset Reach and their control sites (Big Meadow and Trout Marsh, respectively) were monitored for wildlife species richness and abundance in 2009 as part of an effort to collect three years of pre- and post-implementation data at each restoration site. A mix of independent protocols were conducted for songbirds, butterflies, herpetofauna, bats and small mammals and meadow wetness at each site.

Wildlife restoration monitoring surveys conducted in 2009.

	Passerine Point Counts	Passerine Nest Monitoring	Butterflies	Small Mammals	Herpetofauna	Bats	Meadow Wetness
Cookhouse Meadow	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Big Meadow (control)	**X**	**X**	**X**	**X**	**X**	**X**	
Sunset Reach		**X**		**X**	**X**		**X**
Trout Marsh (control)		**X**		**X**	**X**		

Key Observations from Restoration Wildlife Monitoring in 2009

- Desired bird species have continued to occur (e.g. calliope hummingbird) or move into (e.g. Swainson's thrush) Cookhouse Meadow since it was restored in 2006.
- Bird nesting success continued to be low at all sites because of predation and nest parasitism.
- Butterfly species richness and abundance at Cookhouse Meadow was 50% greater after restoration (2007-2009) than before restoration (2004-2006) and greatest in 2009.
- Herpetofauna diversity was low at all sites in 2009 relative to previous years, but slightly greater at Cookhouse Meadow in the years after (2007-09) restoration than before (2004-06).
- Meadow wetness transects showed that Sunset Reach (not yet restored) was dry by the middle of June, but Cookhouse Meadow (restored) was still wet at end of August.

Effectiveness Monitoring Question:

How effective will the restoration efforts by LTBMU staff be at restoring ecosystem function within the project areas to achieve the desired historic conditions for wildlife species? *?*
(Victor Lyon and Shay Zanetti, LTBMU Wildlife Biologists, 2009)

The LTBMU is following a 10-year monitoring plan for nine restoration sites (i.e. Cookhouse Meadow, High Meadows, Taylor Marsh, Tallac Marsh, Upper Truckee River, Blackwood Creek, Big Meadow, Meeks Creek, and Ward Creek) and their respective control sites. The monitoring plan includes three years of pre-restoration and three years of post-restoration surveys and is expected to inform managers about the causation (e.g. inter-annual variability or management activities) of fluctuations or changes in status and trend. The monitoring information collected will be used as part of an adaptive management framework to modify restoration implementation and improve management activities to benefit wildlife and ecosystems.

III.4 Water Rights Program Monitoring

Status and Change Monitoring Question:

What is the current status of Forest Service water rights in the Lake Tahoe Basin in terms of compliance with state laws and regulations?

The Forest Service is required to protect water rights owned by the United States on NFS lands. Our goals are to ensure 1) the water rights are maintained in accordance with State forfeiture or abandonment laws and regulations. 2) water is applied to the purpose of use and in the manner specified in the water right permit, license, or decree, and 3) water use is monitored under special use authorization. The Forest Service began its water rights field verification program during the summer of 2004 to ensure that all water rights are being put to the stated beneficial use and all documents are updated and recorded in NRIS (Natural Resource Information System). The 2008 field verification was focused on the remaining water rights that were not field verified in previous years, which included all recreational residences under Special Use Permit (SUP). Final field verification of these water rights and claims was completed in 2008. Some of the current water rights information on Forest Service database, and in the filed

documentation with the state, is incorrect, outdated, or missing and does not reflect current water uses based on field verification. Many points of diversion and use have changed without updating the records. In the spring of 2010, the LTBMU identified the steps and timelines for correcting current water rights documentation, following the state water rights filing process.

Chapter IV - Old Forest Ecosystems and General Forest Ecosystems (includes WUIs)

In order to engage in a more comprehensive monitoring strategy for the Lake Tahoe Basin Management Unit, the Ecosystem Conservation Department has continued to broaden its scope of monitoring biological resources. Efforts have focused on providing better information on the overall health of the Basin's biological resources, the impact of various restoration activities in restoring habitats and populations, and the effects of ecosystem fragmentation and other anthropogenic disturbances.

IV.1 TES and Threshold Wildlife Species Monitoring

Status-and-Trend Monitoring Questions:

What is the status and trend of presence and what is the reproductive status of identified TES species in the Sierra Nevada?

What are the status and trend of species composition and richness for wetland birds, and is the TRPA standard for 18 sites with occupancy being met?

Lake Tahoe Basin Management Unit (LTBMU) Wildlife Staff in cooperation with other federal, state, academic and private organizations conduct an ongoing status and trend monitoring program for the following TES species:

- California spotted owl (*Strix occidentalis occidentalis*)
- Northern goshawk (*Accipiter gentili*s)
- Osprey (*Pandion haliaetus*)
- Willow flycatcher (*Empidonax traillii*)
- Bald eagle (*Haliaetus leucocephalus*)
- Golden eagle (*Aquila chrysaetos)*
- American peregrine falcon *(Falco peregrinus anatum)*
- Townsend's big-eared bat (*Corynorhinus townsendii).*

In 2009, LTBMU personnel and cooperators monitored a total of 33,262 acres of California spotted owl habitat; 54,045 acres of northern goshawk habitat; 156 acres of willow flycatcher habitat; 17,411 acres of suitable osprey habitat including 77 nest sites; 26 locations for bald eagle including one nest site; one golden eagle nest site; three peregrine falcon cliff sites; and two mines and one abandoned building containing roosting bats.

Key Findings, 2009 Wildlife Program Annual Report (Shay Zanetti, LTBMU Wildlife Biologist, 2009)

California spotted owl - Approximately 33,262 acres (13,460 hectares) were surveyed for California spotted owl by the LTBMU and its partners in the Lake Tahoe Basin in 2009. Acreage was calculated based the average area effectively surveyed (0.25 mile radius) from call stations during spot-calling surveys and a one mile radius around active nests. LTBMU wildlife crews surveyed 25,328 acres (10,450 hectares). Hauge Brueck Associates surveyed 3,422 acres (1,385 hectares) at Heavenly Ski Resort, Insignia Environmental surveyed 3,980 acres (1,610 hectares) along power lines north of Tahoe City and Kings Beach, and Nevada Department of Wildlife (NDOW) surveyed approximately 1,215 acres (492 hectares) between two survey routes along the east shore area of the Tahoe Basin. Sixteen individual spotted owls (an increase of over 45% from 11 in 2008) and four active nests (an increase of75% from 1 in 2008) were detected in the Lake Tahoe Basin in 2009.

Northern goshawk – The LTBMU and partner agencies conducted broadcast surveys within 65 survey areas for a total of 54,045 acres (21,871 hectares) in 2009 (Table 4). Acreage was calculated based on the area of survey polygons plus (in the case of survey points provided by Insignia Environmental) the effective area encompassed within a 200 meter radius of call points. The LTBMU surveyed a total of 45,597 acres (18,857 hectares). Hauge Brueck Associates surveyed 1,800 acres (728 hectares). Insignia Environmental surveyed 5121 acres (2072 hectares). NDOW surveyed 527 acres (213 hectares). The LTBMU and its partners recorded 57 goshawk detections (up 40% from 23 in 2008), 14 active territories (up 28% from 10 in 2008), 11 reproductively active territories (up 550% from 2 in 2008), 7 known reproductively active territories that fledged young (up 350% from 2 in 2008), and 14 known juveniles fledged (up 700% from 2 in 2008) in 2009

Osprey – The LTBMU, NDOW, and CDPR surveyed 17,411 acres (7,046 hectares) of suitable osprey habitat and made initial visits to 77 historic nest sites. One nest tree confirmed to have broken at or near the base was assigned 'tree gone' status and not subsequently re-visited. Over the course of the 2009 field season, nine additional trees were observed to contain new osprey nests, to which visits continued for the remainder of the summer. NDOW observed osprey activity at Secret Harbor, Tunnel Creek, Bonpland Creek, Slaughterhouse Canyon, and Memorial Point throughout the 2009 season. It is now assumed, due to consistency in observing an osprey pair soaring over Marlette Lake, that there is likely a nest in neighboring Hobart Canyon, just outside the Tahoe Basin. In total, the LTBMU and its partners surveyed 85 nest sites and detected 45 intact nests, 24 (53%) of which were active. However, there were nine nests that had activity early in the season but later were inactive (likely failed or no reproductive effort). All of these nests were still classified as active, to be consistent with analysis methods in previous years. In total, the LTBMU and its partners detected 45 osprey nests (up 47% from 35 in 2008), 24 of which were active nests (up 8% from 22 in 2008).

Bald eagle – Thirty-six participants, stationed at 26 survey points around the Basin, observed 16 bald eagles (13 adults and 3 immatures) at 14 locations during the January 9, 2009 official mid-winter bald eagle count. During the second visit on January 16, 27 participants surveyed the same 26 points and observed only 10 adult bald eagles (no immatures) at 8 sites, with the total count being 38% less than that of the first visit. The number of bald eagles detected during the mid-winter count increased in 2009 (n= 16, up 45% from 11 in 2008). The nest in Emerald Bay (BAEA01/EMB16) was the only active nest observed in the Lake Tahoe Basin in 2009 and it did not fledge any young. The number of active bald eagle nests detected (n=1) is

consistent with that of 2008, however the juvenile survivorship is less than that recorded during the 1997-2008 period.

Golden Eagle – Golden eagles were detected in April-May 2009 at Angora Peak during the first two peregrine falcon surveys of the year. This golden eagle territory continued to be monitored under the same protocol, survey time periods and vantage points as for peregrine falcon. A single adult golden eagle was first detected at Angora Peak in late April, where it was observed perching high on a ledge and catching prey on a snow field nearby. During the second visit in mid-May, a single adult golden eagle was observed around sunrise flying overhead into a recessed ledge in the cliff, where it disappeared and remained for the duration of the survey. A nest was confirmed here, due to the fresh nesting material that could be seen jutting out from this location. However, no activity was witnessed in mid-July and we concluded that the nesting effort had failed. The historic golden eagle nest located on a bluff of Round Lake was unable to be monitored in 2009 by LTBMU. There was an additional incidental detection of two golden eagles flying overhead in the Eagle Lake area on May 16 but no follow-up surveys were done in the area.

American Peregrine Falcon –Three sites were surveyed by the LTBMU for presence and/or nesting peregrine falcon in 2009: Luther Rock, S. Maggie's Peak, and Angora Peak. Luther Rock was the only site that resulted in detections of peregrine falcon. This site contained a nesting pair that resulted in two fledglings. The Angora Peak site was occupied by at least one golden eagle who built a nest. It is not known if this nest was active but failed or if it was an alternate nest.

Willow flycatcher –The LTBMU and its partners surveyed an estimated 156 acres (63 hectares) of willow flycatcher habitat. The LTBMU surveyed 63 acres (25 hectares). The Tahoe National Forest Willow Flycatcher Demography Study surveyed 77 acres (31 hectares). Hauge Brueck Associates surveyed 17 acres (7 hectares). We calculated the area surveyed using 50 meter buffers around each survey point. Willow flycatchers were detected in Blackwood Canyon, Tallac Creek marsh, Taylor Creek, and at the Uppermost Upper Truckee sites. There were active nests at Tallac Creek Marsh and Taylor Creek.

Townsend's Big-eared Bat – Three sites were surveyed for bat presence in 2009: Both Tahoe Treasure mine openings, both Mountain Top mine openings and the historic Newhall House in Skunk Harbor. All three sites resulted in the detection of bats. Data analysis is still in the preliminary stages so species identification cannot be certain. Newhall House had the largest number of detections, while the two Tahoe Treasure mine openings had significantly less. The two Mountain Top mine openings resulted in only a few detections.

IV.2 Threatened Endangered and Sensitive (TES) Plant Species Monitoring

<u>Status-and-Trend Monitoring Question:</u>

What is the status and trend of FS TES and TRPA rare plants? *(Shana Gross, LTBMU Botanist / Ecologist, 2009)*

Lake Tahoe Basin Management Unit botany staff monitored Threatened/Endangered/Sensitive (TES) plant species and rare plant communities in cooperation with other federal, state and county agencies and non-governmental organizations. In 2009, monitoring occurred for Tahoe Regional Planning Agency (TRPA) special interest plant species and Forest Service sensitive plant species: *Arabis rigidissima* var. *demota* (Galena Creek rockcress), *Botrychium ascendens* (trianglelobe moonwort), *Botrychium crenulatum* (scalloped moonwort), *Botrychium minganense* (Mingan moonwort), *Bruchia bolanderi* (Bolander's candle moss), *Draba asterophora* var. *asterophora* (Lake Tahoe draba), *Draba asterophora* var. *macrocarpa* (Cup Lake draba), *Epilobium howellii* (Yuba Pass willowherb), *Lewisia longipetala* (long-petaled lewisia), and *Rorippa subumbellata* (Tahoe yellow cress). [Monitoring of Forest Service sensitive species: *Helodium blandowii* (Blandow's bog moss), *Meesia triquetra* (meesia moss), and *Meesia uliginosa* (meesia moss) is presented in the special aquatic habitat section of the annual monitoring report.]

Rare plant monitoring consisted of revisits to all rare plant populations. For vascular plants a census was completed at each population. The counting unit was defined as the individual stem or rosette, depending on species. For non-vascular mosses the area of the population (meters) was quantified and an ocular cover estimate was provided rather than an individual stem count. Monitoring utilized a systematic search with pin flags to identify macroplots as well the total population area. In addition, classes were used for census counts to remove some of the counting errors associated with large population size, the small stature of the target species, and the variation in stage classes at time of monitoring. The classes used for monitoring were: 0-99 was a count of the actual number of plants, 100-249, 250-499, 500-999, 1000+. For analysis the median of each size class was used.

Additional monitoring work focused on *Draba asterophora* and *Lewisia longipetala*. In 2006 a Memorandum of Understanding (MOU) was established to provide guidance for the implementation of conservation measures for *Draba asterophora* var. *asterophora* and *Draba asterophora* var. *macrocarpa*. Efforts are continuing to understand the variation between and within populations by researchers at Brigham Young University. Preliminary genetic results demonstrate that these plants are indeed very rare and that there is a need to protect individuals and populations through the development of conservation measures. Long-term monitoring plots were visited that had been established by Brigham Young University; however the original transects lines and plot locations could not be re-located. Long term monitoring will be re-established in 2010 using revised protocols. Permanent *Lewisia longipetala* monitoring plots were established at LTBMU element occurrence LELO1a (near Dicks Lake). Three transects with 18 plots were established with permanent markers. The intent of this long term monitoring is to determine the status and trend of the population. This species may be susceptible to changing climate due to its habitat correlation with late melt snow banks. A monitoring plan will be completed in 2010.

Population status of Forest Service Sensitive Plant/TRPA Special Interest Plant populations on Lake Tahoe Basin Management Unit Land.

Species	**FS Sensitive/ TRPA Special Interest**	**Total Element and Sub-Element Occurrences**	**New 2009**	**Stable**	**Increasing**	**Decreasing**

Species	FS Sensitive/ TRPA Special Interest	Total Element and Sub-Element Occurrences	New 2009	Stable	Increasing	Decreasing
Arabis rigidissima var. demota	FS, TRPA	17	0	?	?	3?
Botrychium ascendens	FS	5	0	0	0	5
Botrychium crenulatum	FS	2	1	0	0	1
Botrychium minganense	FS	2	0	0	0	2
Bruchia bolanderi	FS	7	6	0	0	1
Draba asterophora var. asterophora	FS, TRPA	34	8	23	2	1
Draba asterophora var. macrocarpa	FS, TRPA	7	0	4	1	2
Epilobium howellii	FS	5	1	0	0	4
Lewisia longipetala	FS, TRPA	8	1	3	1	3

*Total sub-element and element occurrences are equal to the sum of new 2009, stable, increasing, decreasing. The population status was determined by comparing the total number of plants from the date the population was first observed to the total number of plants observed in 2009. All site visits were within two weeks of the date the population was first observed.

Rare Plant Communities

Five rare plant community threshold sites, identified by TRPA to serve as indicators of ecological health for similar rare plant communities in the Basin, were monitored. The purpose in monitoring these sites is to document the trend and influence of disturbances and/or management practices on rare plant communities in order to develop more sustainable management strategies. The five TRPA rare plant communities monitored in 2009 were: Grass Lake (fen), Hell Hole (fen), Osgood Swamp (fen), Pope Marsh (marsh), Taylor Creek (meadow). Freel Peek (cushion plant community) which is also a TRPA plant community threshold site was not visited in 2009. In August 2006, the Global Observation Research Initiatives in Alpine Environments (GLORIA), with the help of the Forest Service, established three monitoring plots on Freel Peak and surrounding ridges. The GLORIA plots may be utilized to replace the threshold monitoring plots that were established in 2004. GLORIA plots will be read every five years to monitor the trend of the Freel Peak cushion plant communities through time and changing conditions.

The five threshold sites of Hell Hole, Osgood Swamp, Taylor Creek Marsh, Pope Marsh, and Grass Lake, which contain rare plant communities, have at least one permanent trend transect monitoring site within them. The data collected in 2004 and 2005 established a baseline for future monitoring to classify the ecological status of each community into high, medium, and low condition classes. At Grass Lake additional monitoring was established: ten photopoints were established; and *Meesia triquetra* and *Sphagnum* spp. cover monitoring was conducted. Data collected in 2009 will begin to identify community trends. Community data analysis has not yet been completed, this will occur in 2010. [Monitoring of Forest Service sensitive species: *Meesia triquetra* (meesia moss), and special interest genus *Sphagnum* (peat moss) at Grass Lake is presented in the special aquatic habitat section of the annual monitoring report.]

Cause-and-Effectiveness Monitoring Questions:

How effective is the LTBMU Tahoe yellow cress outplanting project at increasing the population of Tahoe yellow cress in the Lake Tahoe Basin? *(Shana Gross, LTBMU Botanist / Ecologist, 2009)*

The public multi-agency and private land owner partnership effort to implement the Conservation Strategy of *Rorippa subumbellata* continued in FY 2009. Additional experimental reintroductions, to test the best planting times for Tahoe yellow cress, occurred at 4 sites with 800 container grown plants along Lake Tahoe beaches. Every 4 weeks 50 plants were planted at each site. In addition, there were plantings to test the success rates of naturally occurring translocants versus greenhouse container grown outplanting. There were 300 plants planted at 3 sites using a paired design. This consisted of 50 naturally occurring translocated plants with 50 container grown plants totally 100 at each site. Four temporary fences were utilized on Forest Service beaches to protect these experimental plantings. The annual September lake wide survey identified 47 occupied sites; this was an increase of 4 sites from the 43 identified in 2008. Low lake levels provided increased habitat, compared to 2006-2008. In particular the Taylor Creek core ranked site including the permanent three sided enclosure numbered over 4,500 stems. For specific details see Implementation of Tahoe Yellow Cress, 2009 Annual Report by Stanton and Pavlick (in prep).

How effective is the transplanting of Tahoe draba to protect individuals and maintain population size? *(Shana Gross, LTBMU Botanist / Ecologist, 2009)*

Draba asterophora var. *asterophora* (Tahoe draba)

In general, *Draba asterophora* var. *asterophora* populations are stable. The 34 occurrences are found at three element occurrences. One occurrence is found around Freel Peak and Star Lake (element occurrence DRASA1), one is found around Heavenly Ski Resort (element occurrence DRASA2), and the other occurrence is found around Mount Rose proper (element occurrence DRASA3). Populations found at DRASA1 are stable. One population found at DRASA2 is decreasing, while one is increasing. One population at DRASA3 is increasing. The population that has decreased at DRASA2 is found along the main access road at Heavenly Ski Resort. The decrease may be a response from traffic impacts, even though protective fencing is installed annually. Additional fencing may need to be installed. Despite the development of methods to ensure complete counts, the decrease and increase seen in populations may also be an artifact of census counts. Census counts are often incomplete (Elzinga et al. 1998). Future monitoring will focus on establishing long term monitoring plots in the seven sub-element occurrences with population numbers greater than 1000. In addition, revisits will occur for the populations where an increase or decrease was detected.

Draba asterophora var. *macrocarpa*

In general, *Draba asterophora* var. *macrocarpa* populations are stable. One of the decreasing populations could not be relocated. In 2004, this population (DRASM1a) was a small (45 plants) occurrence where the habitat was borderline suitable due to high levels of litter. This population may have disappeared due to the marginal habitat, or it may have been difficult to locate. It will be revisited in 2010. The other population that decreased (DRASM1b) was the largest population found in 2004. In 2004, many of the plants were scattered throughout the rocks. Despite the development of methods to ensure complete counts, this decrease may be

due to surveying methods. This population will be revisited in 2010 and long term monitoring will be established. The increase of DRASM1e may be due to census methods. In 2004, census counts had to be cut short due to time therefore the 2009 counts may provide a more accurate baseline for this population.

IV.3 Aspen Restoration Wildlife Monitoring

Status-and-Change Monitoring Question:

What is the current status or condition of aspen stands in the Lake Tahoe Basin, with particular attention to avian and small mammal community composition? *(Victor Lyon, LTBMU Wildlife Biologist, 2009)*

In 2009, the LTBMU prioritized which aspen stands would be restored first following completion of the Aspen Community Restoration Project Decision Memo in July of the same year and administered a contract with Dr. Will Richardson of the University of Nevada at Reno to conduct pre-implementation bird monitoring. Dr. Richardson monitored bird communities in 21 aspen stands not monitored as part of Dr. Michael Morrison's (Texas A&M University) earlier (2004-06) small mammal and bird monitoring effort and in the Fallen Leaf (FL20) aspen stand treated in 2004. Bird species richness, mean bird abundance, and community composition at these 22 stands are discussed in Dr. Richardson's final report.

The LTBMU also conducted small mammal monitoring at one site in Blackwood Canyon and two sites near Fallen Leaf Lake (FL20 and A06) in 2008 and at the latter two sites in 2009 to supplement Dr. Morrison's 2004-06 data. Small mammal monitoring was not conducted at the Blackwood site in 2009 during Blackwood Creek Restoration (Reach 6) Project implementation. Fuel reduction projects that benefited aspen were implemented at the Fallen Leaf Lake (Cathedral Meadows; FL20 and A06) sites in 2004 and at the Blackwood site in 2005. Post-implementation data will be pooled with data from other sites (e.g. aspen stands restored along Ward Creek and Cold Creek in 2009) as vegetation responds and used to analyze the effects of aspen restoration on small mammals. While thorough quantitative analysis must wait until the sample size of post-implementation sites increases and vegetation (and the wildlife community) has time to respond, we were encouraged as the number of flying squirrels and yellow-pine chipmunks, both potentially vulnerable species associated with aspen, peaked in 2009.

The wildlife monitoring information collected by Dr. Morrison, Dr. Richardson, and the LTBMU will be used as part of an adaptive management framework that will modify implementation and improve management to benefit wildlife in restored aspen communities. Current management guidance regarding benefits to wildlife comes from previous research such as that conducted by Dr. Richardson and Sacha Heath of Point Reyes Bird Observatory who found that "bird species richness and abundance were positively correlated with lower percent conifer cover, increased herbaceous cover, and lower shrub-class aspen cover." The Aspen Community Restoration Project is moving restored aspen stands toward these conditions to benefit wildlife communities.

What is the current distribution and condition of aspen stands within the Lake Tahoe Basin, and which of these stands should be a priority for restoration? *(Victor Lyon, LTBMU Wildlife Biologist, 2009)*

The Aspen Community Mapping and Condition Assessment Project (2002-2007) identified that approximately 1,600 acres (64%) out of a total 2,500 acres of aspen on the forest are currently at moderate or greater risk of loss from the landscape and should be a priority for restoration. Risk of loss is an assessment of the probability that an aspen stand may not persist on the landscape based on stand conditions such as conifer encroachment and aspen regeneration. Moderate, high, or higher risk aspen stands located on Forest System lands are fairly evenly distributed across the Basin. An estimated 1,115 acres (70%) of the moderate, high, or highest risk aspen stands on the LTBMU are located outside other planned, proposed, and current vegetation treatment project areas and/or outside Wilderness Areas (where treatments are largely prohibited) and may be treated, as funding permits, by the Aspen Community Restoration Project.

Key factors used to determine which aspen stands to restore in 2009-10 included, but were not limited to, risk of loss from the landscape, proximity to other at-risk stands (improving implementation economics of scale), location of other project work (co-locating with synergistic sites, such as the Blackwood Creek Restoration Reach 6 Project, and avoiding others), previous investment (e.g. where wildlife survey work was completed in 2004-06 and/or 2008-09), value to science (e.g. pile burning studies in stream environment zones, or SEZs, and in aspen), and ecosystem health (e.g. high value to botany and wildlife). A total of 83 acres of aspen were treated as part of the Aspen Community Restoration Project in 2009, including stands located along Ward Creek (45 acres), Blackwood Creek (16 acres), Cold Creek (17 acres), and at Kiva Point (5 acres). An estimated 93 acres of aspen treatments located in the Upper Truckee River, Taylor Creek, Tallac Creek, and Secret Harbor Creek watersheds are planned as part of the Aspen Community Restoration Project in 2010.

<u>Effectiveness Monitoring Question:</u>

Is aspen restoration effective at restoring expected avian and small mammal communities within aspen stands in Lake Tahoe Basin? *(Victor Lyon, LTBMU Wildlife Biologist, 2009)*

The wildlife monitoring completed to date has established baseline, pre-implementation conditions for comparison against post-implementation conditions. Post-implementation wildlife monitoring will occur after aspen stands have had approximately five years to respond (e.g. grow and mature) to the restoration treatments. Changes in vegetative structure (e.g. aspen to emerge and contribute to an understory canopy) and community composition (e.g. habitats to become suitable for and colonized by new species) require years to occur and become detectable by a monitoring program. Aspen stands in Cathedral Meadows were restored five years ago and have responded favorably to restoration. Anecdotal observations of Cathedral Meadows aspen community response such as the increase in the spatial extent of the herbaceous understory are evident and encouraging, yet a scientifically rigorous comparison of pre- and post-implementation conditions in restored aspen stands will be deferred until a sufficient sample size is available for analysis. The wildlife monitoring information collected by this project will be used as part of the project's adaptive management framework to modify implementation and improve management to benefit wildlife in restored aspen communities.

Chapter V – Invasive Species Monitoring

Status-and-Trend Monitoring Question:

What is the status and trend of the number of acres of noxious weeds located adjacent to roads, trails, and along the wildland/urban interface within the Lake Tahoe Basin?

Effectiveness Monitoring Question:

How effective are the efforts by LTBMU staff at reducing the number of acres of noxious weed infestation in the Lake Tahoe Basin?

The LTBMU noxious weed program, in coordination with other federal, state and county agencies and non-governmental organizations, conducts both effectiveness monitoring of treated infestations and status and trend monitoring of noxious weed primarily around roads, trails, and along the wildland/urban interface within the Lake Tahoe Basin. This year the noxious weeds department and the urban lots department monitored and treated known invasive plant sites. The Noxious Weeds Coordinator monitored 53 projects for invasive plants of which 48 contained invasive plants and were added as treatment sites; eleven gravel and fill operations were inspected for invasive plants and a report was generated to inform other departments of suitable sources for materials. In response to concerns of introduction of aquatic invasive species into Fallen Leaf Lake, the shore zone was surveyed by kayak and no invasive species were discovered during the survey.

Results from 2009 monitoring are presented in the 2009 Botany Year End Accomplishment Report. Key findings are presented below.

Key Findings, 2009 Botany Year End Accomplishment Report (Reed, 2009)

- There were a total of 258.39 gross acres and 4.22 infested acres of invasive weeds in 2009 on general NFS lands administered by the LTBMU (does not include urban lots). Even when excluding the Angora Burn area, the gross area increased by 92.38 acres and infested area increased by 2.06 acres. The increase in gross and infested acres in general forest (without Angora or urban lots) could be attributed to a combination of factors including the fact that 76 new sites were discovered, more sites were visited this season as compared to last due to having a larger crew then previous years, and some species that don't respond to manual treatment expanded (including a large increase in the ox-eye daisy site at Prey Meadows).

- Basin wide status and trend monitoring discovered 76 new invasive weed sites and for a total of 310 weed sites on general NFS lands administered by the LTBMU (does not include urban lots). The majority of new sites were found along roads, trails and within recreation sites. Many of the sites are infested with multiple species, totaling 397 different species occurrences/infestations monitored by the invasive weeds program. 13 sites were dropped this year as a result of eradication and 44 sites were dropped for other reasons or passed on to other agencies for control. A total of 205 sites have been dropped since the initiation of the invasive weed program. Ox-eye daisy

(*Leucanthemum vulgare*) is leading in the most prevalent weed due to an increasing population at Slaughterhouse Canyon.

Chapter VI – Fire and Fuels Monitoring

Various monitoring efforts were implemented to evaluate the impacts of fuels reduction activities on ecosystem components such as soil quality, water quality, fuel loading, vegetation structure and diversity, and wildlife habitat.

VI.1 Programmatic Fuels Reduction Project Soil Monitoring

To quantify the impacts of fuels reduction projects on soils, the LTBMU began monitoring these projects in more detail in 2005. A Soil Quality Monitoring Plan was initiated to measure pre- and post-project soil characteristics that include saturated hydraulic conductivity, bulk density, soil cover, and soil disturbance. This monitoring plan is updated annually to identify current monitoring sites and add or modify protocols as necessary. Primary soil characteristics such as saturated hydraulic conductivity and bulk density are measured to estimate the amount of compaction and the associated reduction in soil infiltration rate and porosity as a result of fuels reduction projects. Measured soil characteristics are used in the Watershed Erosion Prediction Project (WEPP) model to predict potential runoff and erosion impacts from changes in soil parameters. Previous annual reports describe the efforts conducted in past years at Ward, Heavenly SEZ, and the Roundhill fuels reduction projects.

In 2009, a pile burn monitoring component was added to the Soil Quality Monitoring Plan, as described in last years report. The only soil quality monitoring conducted in 2009/2010 was a continuation of the pile burn monitoring initiated last year, described below.

<u>Cause and Effect Monitoring Question</u>

What are the impacts to soil quality and vegetation recovery from burning the slash piles that result from fuel thinning activities, and how do these effects correlate to pile size, fuel size, and soil moisture condition?

An initial inventory of units on the priority list for pile burning in FY2009 was conducted between October and November of 2008. This inventory documented basic information on site characteristics such as slope, location, average pile size and spacing between piles.

Of this sample pool, five burn pile units were chosen for effects monitoring, with preference given to areas with larger and/or more closely spaced piles, larger size fuels (for longer burn times and thus greater soil impact), and steeper slopes. The average pile diameters range from 10 to 17 feet, height 3 to 4.5 feet, and spacing between piles ranges between 15 to 30 feet. Slopes range from 2 to 40%. These five units are located on the south and west shore of Lake Tahoe (USFS Pile Burn Monitoring Plan, 2009).

In each unit, a transect was established that contacted eight piles in the area with the greatest pile density. Soil samples were taken near the time of burning to characterize soil moisture at the time of burning. Post implementation measurements included hydrophobicity and vegetation cover. Hydrophobicity measurements were taken during the 2009 field season and the first measurements of vegetation cover will occur the second year after burning.

Of the five transects being monitored, the following have been burned or mostly burned by spring of 2010: Sierra Creek (above Rubicon Bay) (six of eight piles burned); Cold Creek at High Meadows (all piles burned), and Meeks Creek North Unit (all piles burned). Soil moisture was measured at the time the piles were burned. Post project hydrophobicity was measured at Sierra Creek and Cold Creek in late summer of 2009. Hydrophobicity will also be measured again at these sites in 2010 along with vegetation recovery monitoring, as well as first year hydrophobicity monitoring at Meeks Creek. It is anticipated that the remaining piles/transects will be burned in 2010. An interim monitoring report of results will be produced in winter 2010/2011.

VI.3 Fuels and Vegetation Fuels Reduction Project Monitoring

Cause and Effect Monitoring Question:

What are the effects and effectiveness of fuels reduction practices on vegetation, fuel loads, and wildlife?

The LTBMU did not fund post-project effectiveness monitoring or analysis in 2007/2008, to follow-up on pre-project monitoring funded by the USFS and described in last year's annual monitoring report. However, funding was provided for post-project monitoring by the Nevada Division of State Lands through the Nevada State License Plate grant funds. Information about the post-project monitoring effort can be obtained from Nevada Division of State Lands, CTC, the principal investigators at BMP Ecosciences, or the USFS Pacific Southwest Research Station.

VI.4 Angora Wildfire Effects and Restoration Monitoring

The Angora Wildfire that began in July 2007 burned approximately 2736 acres of National Forest land. The majority of the burned area (~2500 acres) is in the Angora Creek drainage which drains into the Upper Truckee River. Following the Angora Wildfire, the LTBMU established a post-fire monitoring strategy to assess post-fire conditions for an assessment of restoration needs, as well as establish a baseline for monitoring long-term recovery of the burn area. This monitoring strategy will be updated as part of the NEPA process for the Angora Long Term Restoration Project, currently underway. The following describes the components of the current draft monitoring strategy.

Vegetation and Fuels

Cause and Effect Monitoring Question:

What was the effect(s) of the Angora Wildfire on vegetation, fuel loads, and wildlife and how do these ecological components change over time in areas that are actively managed as well as those areas left to recover on their own?

The purpose of this monitoring component is to establish repeatable monitoring transects to quantify the current condition of the Angora fire area as it relates to vegetation condition and regeneration, fuels, tree mortality, snag retention, and effects of hydromulch treatment on understory vegetation. This project will also serve as a data source for wildlife habitat on the

fire perimeter and as a data source for future modeling efforts to better understand the role and impacts of wildfire on LTBMU ecosystems.

The specific monitoring parameters include:

1. vegetation succession
2. fuels accumulation
3. snag retention
4. postfire conifer regeneration
5. effects of hydromulch treatments on understory vegetation
6. long-term mortality of trees still alive after fire
7. aspen regeneration

Monitoring will be based on a spatial sampling grid across the fire, and stratified by fire severity. Some plots will be sampled outside of the fire area as controls. Standard Forest Service protocols were employed where available, and data entered into corporate databases. Funding agreements to conduct this study were established with the Regional Ecologist (Hugh Safford) and the University of Montana, and the first year of data collection was implemented in 2008 and continued for a second year in 2009. Monitoring is expected to continue into 2010. The preliminary reports for each year are posted on the LTBMU publication page.

Soil and Water

Cause and Effect Monitoring Question***:***

What was the effect of the Angora Wildfire on soil stability and hydrophobicity, and when will soil hydrophobicity recover to background levels?

The Angora Wildfire soil burn severity ranged from low to high, with 24% of the area experiencing low severity burn, 42% moderate severity, and 34% high severity (Weaver, Biddinger and Rust, 2007). One of the potential results of the fire was an increase in the hydrophobicity (water repellency) of the soil, which may increase the potential for runoff and erosion.

A monitoring effort was initiated in 2007 to provide repeatable measurements of hydrophobicity changes, using the Mini Disk Infiltrometer (MDI) method. Hydrophobicity measurements are categorized as high, low, or none. Slopes represented by sites rates as none or low are expected to result in minimal increases in runoff. Slopes represented by sites rated as high, have the potential for significant increases in runoff from those sites, if high intensity precipitation events occur. Six different sites were selected for monitoring in the project area. The sites were selected based on characteristics that have been correlated to hydrophobicity in soils. These characteristics are 1) burn severity, 2) aspect (north or south facing), and 3) position on the slope (upper or lower).

The first year of monitoring data was collected in the summer of 2007. Monitoring continued in the summers of 2008 and 2009 for the three sites that were rated as hydrophobic in 2007 (Upper and Lower Angora Ridge sites, and Boulder Mountain). The results of all three years of monitoring are posted on the LTMBU website and the 2009 results are summarized below.

Key Findings,2009 Angora Wildfire Hydrophobicity Field Monitoring Report (Tolley and Norman, 2010)

- There has been no change in hydrophobicity since 2007. All three sites remained hydrophobic in 2009. Soil conditions in terms of soil moisture were also very similar in each of the sample years.
- A walking survey was conducted in 2008 and 2009 along the length of Angora Ridge in the burned area. No signs of erosion were observed in July 2008. More precipitation and greater runoff occurred in 2009, resulting in a small area of rills that was observed during the initial survey conducted in June. In October 2009, a significant rain event produced runoff in the area so another walking survey was conducted. This survey revealed more widespread rilling covering approximately 0.6 acres in total. Deposition occurred behind logs, in vegetation, in depressions, and where the slope significantly decreased, and erosion did not reach any stream channels.
- Visual observations conducted in June 2009 note that vegetation continues to rebound vigorously. In areas of high severity burn, vegetative cover of young shrubs, forbs, and brush is approximately 50 percent. The aerial application of hydromulch in 2007 is still present, although now only providing only approximately 20 percent soil coverage. In moderate severity burn areas, soil is almost 100 percent covered with needle castings, and vegetation covers approximately 25 percent.

Channel Condition Monitoring (Angora Meadow above Lake Tahoe Blvd)

Cause and Effect Monitoring Question**:**

What was the effect of the Angora Wildfire on Angora Creek channel condition, and how will channel condition improve as a result of restoration actions?

The purpose of this component is to assess the impacts of the Angora Wildfire as it relates to stream channel and floodplain condition. In October 2007, we established a 300-meter long monitoring reach just above Lake Tahoe Boulevard. This area was judged to best reflect cross-sectional response and channel adjustments to fire-related sediment loading. Within this reach, we documented baseline conditions for bank-full cross-sectional area, locations of existing woody debris complexes, and the position of the longitudinal profile. We also installed three cross-sections with bank erosion pins to quantify bank erosion rates. Additionally, the TRPA installed six sediment traps on the floodplain to evaluate post-fire floodplain sedimentation characteristics. Floodplain sedimentation data collection has yet to occur.

We will analyze the baseline data in 2009 to evaluate departure from desired condition and the data will be used as part of the NEPA analysis and design for restoration of the creek through the meadow. We will resurvey cross sections, longitudinal profile, and sediment traps following the occurrence of significant flood (bank-full level or greater) events prior to implementation of restoration activities. However so far, no over-bank flows have occurred since the fire. Visual observations conducted in spring of 2009 note that erosion pins along the cross section did not exhibit any signs of excessive scour. Monitoring of erosion pins will occur again after spring peak flows in 2010. There were no notable changes in the shape of the

thalweg profile, woody debris complexes remained in place, and riparian vegetation is flourishing due to shallow depth of meadow ground water throughout the growing season. Nearby uplands surfaces, areas where direct sediment inputs could have occurred, showed no signs of excessive erosion and upland shrub vegetation is recovering rapidly. The LTBMU hired a contractor in 2009 for analysis and restoration design development scheduled to occur in 2010. Post-project evaluations will occur following restoration activities scheduled for 2013.

Stream temperature in Angora Creek was also monitored in 2007 and 2008 with the objective of looking at effects from increased solar input resulting from the Angora Fire, specifically loss of stream-side vegetation. Long-term continuous stream temperature data loggers (Onset Stowaways) were installed in locations inside and outside the fire area. Data loggers were installed in August and removed in October. Stowaways were completely submerged and put in an area of the stream that was shaded at least 80% of the time during sunlight hours (i.e. undercut bank). Stream temperature monitoring will continue in 2009.

Chapter VII – Recreation and Social Resources

Recreation monitoring continues to be an ongoing activity in the LTBMU recreation programs. These are performed by wilderness staff and OHV patrollers who are primarily assigned the duty of providing education to the public and enforcing USFS regulations regarding recreation use.

Wilderness Recreation Social Encounter Monitoring

In 2009 the LTBMU has been and will continue into 2010 conducting multiple social monitoring surveys within the Desolation Wilderness, using volunteers and students from both Sierra Nevada College and Lake Tahoe Community College and assistance from recreation Professor William Finch of CSUS. The purpose of the monitoring was to meet a key objective of the Chief's 10-Year Wilderness Stewardship Challenge to "ensure this wilderness has adequate direction, monitoring and management actions to protect opportunities for solitude or primitive and unconfined recreation." During the summer months of 2009, following a training session conducted by LTBMU Wilderness staff, 4 groups of outdoor recreation students made multiple journeys into the Desolation and conducted both observational (e.g. where people were camping; how close to each other; how many people were camping) and personal monitoring interviews (asking questions such as: "did you feel you had the opportunity to get away from the sights or sounds of other campers? Or "Why did you choose to camp in this location?"). The Desolation Wilderness Management Plan also contains direction to annually monitor such social issues as encounters and solitude. Using the "Limits of Acceptable Change" (LAC) process, the Desolation is divided into 4 Opportunity Classes, and within each are a defined target for numbers of people that would ideally be "encountered" while on a given trail segment, and also the ideal maximum number of occupied campsites within sight or sound of each other. In recent years, including 2009, wilderness rangers and volunteers have actively been monitoring encounters within the Desolation Wilderness. The established range of group encounters ranged from 0.5 groups per day (Class 1) to 15 groups per day in Class 4.

In addition, because of its unique accessibility, the Eagle Lake Management Area had its own LAC standard of 35 groups per day being deemed an "acceptable" maximum. Since then wilderness staff have annually monitored the numbers of group encounters during their wilderness patrols. These numbers have been summarized by management staff. In 2009, the LTBMU had a reported forty-one volunteers contributing 3,300 hours of volunteer time in support of the Desolation Wilderness (monitoring and providing public education and information).

Wilderness Campsite Monitoring

Beginning in 2008, and continuing into 2009 and into 2010, the LTBMU has been and will continue to evaluate the condition of all campsites within the Basin portion of the Desolation Wilderness. This was also in response to the guidance contained within the Chiefs 10-Year Stewardship Challenge for all wilderness areas in the nation. LTBMU wilderness staff applied the Frissell and Cole "Code-A-Site Evaluation Method." The goal is to evaluate every identified campsite within the Desolation according to 28-criteria and a final summary recommendation made whether to obliterate the campsite, to maintain it or simply continue to monitor it. Data is being entered into a GIS-based data summary with overlapping mapping and surveys so that in the future, managers can evaluate any differing pre and post campsite treatments. Beginning in 2009, under a Fee Program Grant (FDAS) unwanted campsites (because of location, condition, resource impacts etc.) are being obliterated.

That effort will continue into 2010.

OHV/OSV Recreation Monitoring

Monitoring the Off-Highway Vehicle program is also an ongoing activity on the LTBMU. Both summer and winter monitoring occurs because of the varying nature of this activity (summer use is primarily on designated routes and trails by off-road vehicles (OHVs) including ATVs and winter use is area-based and vehicles are motorized over-snow vehicles (OSV) such as snowmobiles). Until 2008, the LTBMU, using grant funding from the State of California had been focusing on a restoration program rather than monitoring. That has now changed as grant funding is now being focused on OHV/OSV Law Enforcement.

Throughout the summer period patrols were conducted by OHV Forest Protection Officers with support from Law Enforcement Officers to determine if intrusions into areas closed to OHV use were occurring. Focal areas for monitoring within the LTBMU included the McKinney-Rubicon Route, Corral Trail, Genoa Peak Road, Sand Pit and Tahoe Mountain. Active coordination was maintained with such groups as the Rubicon Trail Association, Tahoe Hi-Los, and cooperators at the Sand Pit. In 2009, the monitoring effort was primarily assumed by LTBMU LEO staff with assistance from a recreation-dispersed specialist as primary OHV staff were detailed to engineering staff-trails program

Key findings from reports generated from the OHV summer period (May-October) and the OSV winter period (December-April) are presented below.

Key finding from 2009/2010 OHV/OSV Monitoring Report (USFS OHV Program, 2009)

<u>Summer Period</u>

- Visitor Counts: 3329 motorcycle/ATV/4WD operators
- Riding in a closed area violations reported: 104, Resource Damage violations reported: 44
- Citations issued for non-compliance with State of California Green Sticker Requirements:
  - Citations Issued. 14
  - Written Warnings: 8
  - Verbal Warnings: 72
- Need for increased monitoring of McKinney-Rubicon & Sand Pit areas was affirmed (will be done in 2010). Extreme popularity of areas and also increasing concerns with resource impacts and need for oversight of OHV activities.
- Need for focused OHV staffing that can be dedicated to monitoring and enforcement.
- No observed change in number of OHV recreationists, encounter points or violations from pervious monitoring periods. Observed resource damage was similar to past years.

<u>Winter Period</u>

- Urban interface intrusions continue to occur (individuals riding directly from their homes into the adjacent forest). Overall winter OSV use is similar to past years.
- Frequent (1x/week) reports from individuals reporting OSV incursions into closed areas around Tahoe Meadows. Patrol monitoring also indicates frequent illegal intrusions by OSVs into High Meadows area. This has resulted in concentrated patrol monitoring in that area by LTBMU OHV/OSV staff. Accordingly, 80% of winter monitoring time was focused in these two locations.

- 10 citations were issued for intrusion into a closed area, 24 written warnings were issued, and 42 verbal warnings were issued. A total of 122 violations were observed (tracks were observed, but no individuals observed) There were 5 observations of resource damage.

Tahoe Rim Trail Big Meadow Crossing Monitoring

Monitoring of the effects of the Tahoe Rim Trail maintenance project in Big Meadow was required as part of a Lahontan Regional Water Quality Basin Plan Prohibition Exemption. The purpose of this monitoring is to determine if the trail impedes lateral surface water flow after implementation of the project. The project consisted of short extensions of causeway sections and recrowning of settled trail sections. The monitoring approach is through visual observations and photopoints. Post-project effectiveness monitoring has been conducted in May and September of 2008 and 2009, and will continue through summer of 2012 as required by the Water Board. Key findings from required reporting to Lahontan are presented below.

In addition, an analysis of alternatives to the current trail location through Big Meadow was prepared and submitted to Lahontan for review in September of 2009. At this time, there has been no reply.

Key Findings from Big Meadow Trail Monitoring Report to Lahontan, December 18, 2009. (USDA, 2009)

- Monitoring efforts have shown consistent and even water depth and vegetation growth at both monitoring sites in both spring and summer conditions, and that trail users are staying on the trail.

References

Borgmann, K. L., J. Groce, and M. L. Morrison. 2004. Wildlife restoration and monitoring report. Submitted to USDA Forest Service Lake Tahoe Basin Management Unit.

Borgmann, K. L., J. Groce, and M. L. Morrison. 2005. Wildlife restoration and monitoring report. Submitted to USDA Forest Service Lake Tahoe Basin Management Unit.

Borgmann, K. L., J. Groce, and M. L. Morrison. 2006. Wildlife restoration and monitoring report. Submitted to USDA Forest Service Lake Tahoe Basin Management Unit.

Borgmann, K. L., J. Groce, and M. L. Morrison. 2007. Wildlife restoration and monitoring report. Submitted to USDA Forest Service Lake Tahoe Basin Management Unit.

Borgmann, K. L., J. Groce, and M. L. Morrison. 2008. Wildlife restoration and monitoring report. Submitted to USDA Forest Service Lake Tahoe Basin Management Unit.

Brill N. and J. Harris. 2010. 2009 Temporary Best Management Practices Evaluation Program Report. USDA Forest Service, Lake Tahoe Basin Management Unit.

Brill N. and J. Harris. 2010. 2009 Trails BMP Retrofit Monitoring Report. USDA Forest Service, Lake Tahoe Basin Management Unit.

Brill N. et al. 2010. 2009 Best Management Practices Evaluation Program Report. USDA Forest Service, Lake Tahoe Basin Management Unit.

Entrix, Inc. 2010. Heavenly Valley Water Quality Environmental Monitoring Program Annual Report for Water Year 2008. Entrix, South Lake Tahoe, CA.

LTBMU OHV/OSV Program. 2010. 2009/2010 OHV/OSV Monitoring Report. USDA Forest Service, Lake Tahoe Basin Management Unit.

LTBMU. 2009. Big Meadow Trail Monitoring Report to Lahontan, December 18, 2009. USDA Forest Service, Lake Tahoe Basin Management Unit.

Muskopf, S. 2009. Mountain Yellow Legged Frog Survey Data. Lake Tahoe Basin Management Unit.

NTCD. 2009. Lake Village Stormwater Investigation Final Report, A Study of Pre- and Post-CIP and BMP Implementation, Reporting Period: October 2003 – March 2008. Nevada Tahoe Conservation District. Stateline, NV.

Oehrli C. and S. Norman. 2009. Blackwood Creek Phase I and II Restoration Monitoring Report, USDA Forest Service, Lake Tahoe Basin Management Unit.

Oehrli C. and S. Norman. 2010. Blackwood Phase 3A Stream Channel and Floodplain Restoration Project 2009 Implementation Monitoring Report. USDA Forest Service, Lake Tahoe Basin Management Unit.

Reed, C. 2009. 2009 Botany Year End Accomplishment Report, USDA Forest Service, Lake Tahoe Basin Management Unit.

Tolley, T. 2009. 2009 Angora Hydrophobicity Monitoring Report USDA Forest Service, Lake Tahoe Basin Management Unit.

Zanetti, S. 2009. 2009 Annual Wildlife Monitoring Report. Lake Tahoe Basin Management Unit. South Lake Tahoe, CA.