13. ANNUAL SCHEDULE OF WORK

Table 14. Annual timeline for sediment, shade, and BMP effectiveness sampling. All activities and deliverables are contingent on funding.

Activity	Anticipated Date of Initiation	Anticipated Date of Completion	Deliverable	Deliverable Due Date
Training: Sediment / Shade	June	July	Field Session	N/A
Shade Surveys	June	October	NA	NA
Sediment Surveys	July	October	NA	N/A
On-site BMP evaluations	July	November	Field Report	December
Deploy/Retrieve Temperature Loggers	May	October	Field Data	November
Mid-Season QA/QC Check	August	September	Final report	Mid-season
Data Summary and database entry	November	December	Field Report	December
Analysis	January	February	Final Report	March

14. DATA QUALITY OBJECTIVES AND MEASUREMENT VARIABILITY

14.1 Data Quality Objectives

The expected precision of substrate and shade measurements is listed in Table 15. The estimated precision of surface fines is from Olsen (2005). The estimated V* precision is from the error reported by Kiem (2002). The precision of subsurface fines is assumed to be similar to surface fines. Stream temperature precision is from the instrument manufacturer.

Acceptable levels of precision for stream survey data have been defined by Kaufmann (1999) using a signal to noise ratio (S:N). The S:N ratio compares the variance among streams (signal) with the variance between repeat measurements of the same stream (noise). Signal to noise ratios <2.0 may not have enough resolution to answer the monitoring questions and severely limit any analysis.

Table 15. Expected precision of sediment and shade measurements

Parameter	Estimated Precision
1. % Fines, Subsurface <0.85mm and <6.4mm	15%
2. % Fines, Riffle Surface <2.0mm	15%
3. Fraction of Pool Volume with Sediment (V*)	5%
4. Stream Shade (modeled from air photos)	10%
5. Stream Shade (field)	5%
6. Stream Temperature	0.2 C°

14.2 Field Quantification of Survey Variability

The ability to detect a change in sediment depends on the precision of the measurement, or the degree to which repeated measurements under unchanged conditions show the same results. The precision of each sediment indicator is determined using repeat surveys at sites randomly selected from approximately 12% of all sites in the survey. Repeat surveys will sample two sources of error:

1. Crew variability is evaluated using two successive measurements by different crews at the same site. This metric represents the variability between crews due to differences in where and how measurements are made.

2. Observer variability is evaluated using two successive measurements by the same crew at the same site. Where possible, the same individual will take both measurements.

Each pair of repeat surveys will be measured during the same year so that differences represent variation in the measurement and not year-to-year changes in the parameter. It is recognized that the variance between successive surveys represents both the precision of an individual measurement, and changes to a parameter over the course of the summer. The total measurement variation, or survey error, for each sediment indicator is calculated using the mean difference between all repeat pairs.

14.3 Procedures to Reduce Other Sources of Error

Other sources of variation will be reduced through project design and sampling methods. Variability due to spatial differences within a reach will be reduced by resurveying permanent sites at recurring intervals. Variation among streams will be reduced by stratifying by channel gradient and percent of watershed in sandy geology. Sampling methods that help to reduce variability in surface fines include the use of sampling frames, and large sample sizes of >600 particles measured over 3 riffles.

15. Quality Control

The Forest Service QA/QC procedures consist of the following elements:

- Training (survey procedures and field test). See section 15.
- Pre-Survey Preparation (equipment, data forms, field gear). Appendix A.
- Post-Survey Evaluation (review data, maps, photos). Section 19.
- Data Entry (field data review, training, oversight, data entry check). Section 16 and 18.
- Field evaluation of measurement variability. Section 13.
- Field Oversight (crew evaluations during field season).

The Field Mangers have the responsibility for reviewing the quality of data collection and the safety of field crews. Supervisors and the QA Officer will be roving between crews to periodically observe data collection and assure consistent application of QA/QC procedures. The QA Officer will have final authority to stop work or clarify protocols.

16. Training

All personnel collecting data for the Forest Service monitoring program will attend an annual training session in June or July. Training consists of both introductory and refresher sessions. Introductory sessions for employees new to the stream surveys consist of a combination of classroom discussion and field practice over a 3-day period. Refresher sessions are for personnel who have done stream surveys but who have not measured a reach in at least two years.

Refresher sessions are usually one day in the field at an established monitoring reach. Introductory training includes office and fieldwork in field measurement, sampling strategy (reaches, passes, and systematic and random selections), and data form management. Refresher training includes fieldwork and any changes to the protocols and field forms. Forest Service range and resource staff will attend training for BMP evaluation protocols, and a 3-day training session in protocols used to monitor the effects of grazing. Trainers consist of biologists and hydrologists well experienced in stream survey measurements. The Forest Service Quality Assurance Officers will provide oversight to all training sessions.

At the end of the training session all surveyors will collect data at a test reach. Each surveyor will be evaluated on their performance so that any corrections can be made before conducting actual surveys. Any surveyor not performing to the satisfaction of the QA Officer will not be certified and will not be allowed to collect data for this program. Training is documented for each surveyor on QA/QC form.

17. Sample Handling and Custody

Shade and sediment metrics of V*, surface fines, and subsurface fines are processed on-site and do not have any handling and custody procedures. Field crews shall be required to keep a field log using methods described in USFS (2003) and Cover (2008). All data fields on the form will be completed during the field visit. The field crews shall have custody of samples during field sampling.

18. Documents And Records

The final project file will contain the following documents.

1. EXCEL spreadsheet with field data
2. Field forms and QA/QC forms (scanned)
3. Digital Hemiview Photographs
4. GIS feature class of all points used for stream shade monitoring. Data for each point will include vegetation cover category (both existing and potential) as derived from EVEG and from air photo interpretation, channel width, aspect, modeled shade (both existing and potential), and notes on cause if existing does not equal potential. Field sampled points will also contain measured shade and potential shade.
5. Field report with narrative summary of the season's data collection. Include any problems encountered, significant weather events, and suggested improvements for the next year.
6. Final analysis report

19. Data Management and Storage

Sediment Data

Measurements will be entered into PDRs and/or hardcopy forms in the field. At the end of each day, data from the PDRs and cameras will be downloaded onto an office computer. For survey reaches involving overnight camping, data will be downloaded immediately upon return from the

field. After analysis of the data at the end of the season, the data and analysis will be transferred to the Forest Service on a CD or DVD.

The Forest Service QA Officers will permanently store all data at the Klamath National Forest Supervisors Office in Yreka. Electronic data will be entered into the Forest Service national database (NRIS), the Klamath Basin Monitoring Program (KBMP) web-based database, and backed-up on the Klamath National Forest server. The Forest Service Quality Assurance Officer is responsible for maintaining the database.

Stream Shade Data

On-site data will be entered on paper field forms. Field forms and Hemiveiw photos will be stored on file at the Klamath National Forest Supervisors Office.

On-Site BMP Evaluations

Hard copies of completed forms, comments, photographs, etc. are retained in the Forest's dedicated water quality data file in the Supervisor's Office. The data will be entered into the Best Management Practice Data Base (BMP-DB), which resides on the IBM in ORACLE. This system allows for flexible storage, retrieval and reporting. Detailed user instructions for this system are given in Section IV of the BMPEP Users Guide.

20. Verification and Validation Methods

Field personnel that collect the data should discuss the confidence of the data with the QA Officer and Project Leader and come to consensus on whether to accept, reject, or qualify parts of the resulting data. Once data have been entered into a spreadsheet, the spreadsheet should be printed out and proofread against the raw data. Errors in data entry shall be corrected. Outliers and inconsistencies will be flagged for further review and discussion. Problems with data quality will be discussed in the field report. As soon as possible after data collection, the data should be checked for accuracy and completeness. If quality objectives are not met, the cause should be evaluated and a decision made about whether to discard the data or apply correction factors. The cause should be corrected by retraining or by reassessing equipment and methods. Any limitations on data use shall be detailed in the final report.

21. Reports to Management

Field Reports for Sediment and Shade

A field report will be submitted by the field crews to the Forest Service QA Officer before December 1st. The field report will summarize the operations for the season including the sites sampled, any problems encountered such as access, weather, and safety, and any departures from the protocol. The report will include all data, field forms, and photos organized into the format specified by the QA Officer.

Final Reports for Sediment, Shade, and BMP On-site Evaluations

Final Reports for sediment, shade, and on-site BMP evaluations will be submitted on or before March 15 of each year. The shade report will only be submitted in years when new aerial imagery and EVEG data are available, approximately every 5 to 10 years. The final report will include an analysis of data and a determination of compliance with water quality standards. The report will identify the need for restoration in watersheds where the analysis indicates adverse impacts to channels from management activities. The report may also include an analysis of reference conditions and recommendations to revise the Categorical Waiver.

Forest Service Cumulative Watershed Effects Model Revision

The threshold of concern for the Klamath National Forest cumulative watershed effects models will be reviewed and possibly revised using the sediment data from reference streams. The model thresholds will be compared with the 75th percentile of reference sediment values to determine if the model adequately predicts impacts to beneficial uses. If necessary, the threshold of concern may be adjusted to reflect the desired conditions for in-stream sediment.

22. Reconciliation with Monitoring Objectives

The ability of this monitoring program to answer the monitoring questions depends on the continuance of consistent data collection over many years. The rotating panel design relies on a commitment to long-term monitoring because the power to detect trends increases dramatically with time (Larsen 2004). The ability to assess current conditions relies on an adequate sample size to detect differences between managed and unmanaged streams. The sample size of reference streams is particularly important because the goal of this analysis is to determine if an individual managed stream is a member of the reference population. It should be recognized that channel response to upslope disturbance is complicated by many interacting processes. The final assessment of watershed condition and trends must be tempered by the judgment of local professionals rather than relying solely on attainment of desired values.

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