MEMORANDUM

Date: May 13, 2014

To: Dean Prat, Senior Engineering Geologist, Northern Timber Unit
Rebecca Fitzgerald, Senior Environmental Scientist, TMDL Unit
KNF Sediment and Temperature Monitoring Plan File

Subject: Klamath National Forest (KNF) Sediment and Temperature Monitoring Plan Reference Watershed Audit

From: Thomas R. Williams, P.G., Engineering Geologist, Northern Timber Unit

The KNF Sediment and Temperature Monitoring Plan and Quality Assurance Project Plan (QAPP) dated September 28, 2010, identified a network of long-term stream monitoring sites to monitor sediment impacts across the Forest. A Forest-wide pool of possible sample streams was created by identifying a "response reach" for every 6th field watershed on the Forest. Response reaches usually have the lowest stream gradient in the watershed, and are the locations most likely to accumulate fine sediment in response to increased sediment supply. Response reaches are typically located near the mouth of the stream and reflect the cumulative effect of sediment input from all sources in the watershed. Each watershed in the Forest-wide pool of response reaches is designated as either a managed watershed or a reference watershed. Managed watersheds are divided into the management activities that have a specific monitoring requirement in the TMDLs and Categorical Waiver (NCRWQCB 2010, 2009a, b, 2004).

Reference streams are located in watersheds with the least amount of human influence and represent the natural range of conditions resulting from environmental variation within the watershed. Reference watersheds are used to define desired conditions and serve as benchmarks to measure effects of activities being conducted in managed watersheds. Reference watersheds on the KNF were identified using the SWAMP guidance for establishing and managing reference streams (Ode, 2009). Watersheds were considered a candidate reference watershed if they met the criteria listed below.

Reference Watershed Criteria:
Road density – Less than 0.19 km/km^2 (0.30 mi/mi^2) with no significant road failures.

Grazing – On-site best management practice evaluations show no significant discharges from areas disturbed by grazing. Most have no grazing.
Mining – No significant sediment input or point sources (metals or pH). Most have only prospects.
Timber harvest – A road density of less than 0.16 km/km^2 is used for a surrogate for past harvest intensity.
Wildfire and other natural disturbance – Natural disturbance must be included in the reference pool as a component of natural variability. A watershed may be temporarily removed from the reference pool in extreme circumstances where a significant portion of the watershed is severely burned.

Candidate reference watersheds that meet the criteria listed above were screened by local biologists and hydrologists to validate watershed conditions using field observations and best professional judgment. A total of 20 candidate reference watersheds were identified. Of these, 11 are considered near-pristine because they have no roads and most are located in wilderness areas. The other 9 are considered minimally disturbed with road densities of less than 0.19 km/km^2. The reference watersheds have a similar range of watershed characteristics as managed watersheds and are representative of background conditions of the managed watersheds.

Reference watershed criteria were evaluated as a part of the review and approval process for the KNF Sediment and Temperature Monitoring Plan and QAPP. Sediment impacts were evaluated by Thomas Williams, Engineering Geologist. Bryan McFadin, Senior Water Resource Control Engineer, evaluated temperature and shade impacts. Richard Fadness, Engineering Geologist, evaluated the QAPP. The reference watershed criteria proposed by KNF was approved by the Executive Officer and staff prior to the finalization of the Sediment and Temperature Monitoring Plan and QAPP.

KNF Reference Stream Audit

Thomas Williams, Engineering Geologist visited the KNF Supervisor's Office in Yreka, California on February 6, 2014, and conducted an audit of the KNF reference stream selection. The audit consisted of the following:

1. KNF staff providing written responses to RWB staff questions regarding reference reaches;
2. RWB staff verifying how KNF staff used GIS and aerial photographs to ensure the watersheds met the thresholds for reference streams; and
3. RWB staff conducting field validation of the GIS and aerial photograph review to ensure the reference watersheds selected are supporting beneficial uses.

The following list of questions was transmitted by RWB staff to KNF staff regarding the reference reaches:

1. The KNF used GIS to look at roads, timber harvest, grazing, and mines to assure that they meet the thresholds for reference streams. How many years of GIS layers did they look at? What year was the most recent layers?
2. Field validation of the GIS exercise for sediment. Did they go to all of the identified reference streams and perform field validation.
3. The QAPP says reference streams that contain grazing will be reevaluated once in-stream data is available. What does this sentence mean exactly, and have they reevaluated the streams that have some grazing? Also, which streams/watersheds have no grazing and which have some?
4. The temperature exercise reviewed aerial photos to ensure no human alteration. How many years of aerial photos did they look at? What was the process/threshold to determine no anthropogenic effect?

KNF staff responded to the questions above in a letter dated February 3, 2014. A copy of this letter is attached (KNF, 2014).

During the February 6, 2014 audit, Thomas Williams of the RWB met with Greg Laurie, KNF Forest Hydrologist and reviewed the KNF letter response dated February 3, 2014 and discussed how KNF staff used GIS and aerial photographs to ensure the candidate watersheds met the thresholds for reference streams. The audit verified that the KNF had successfully followed the criteria for selecting reference streams detailed in the KNF Sediment and Temperature Monitoring Plan and QAPP.

RWB staff also conducted field validation inspections to ensure the selected reference watersheds are supporting beneficial uses. Field validation has included visiting a number of reference watersheds over the four and a half years since the KNF Monitoring Plan was adopted. Field validation inspections of the Fort Goff Creek and Portuguese Creek watersheds were conducted on March 6, 2013, and an inspection of the North Fork Salmon River was conducted on July 20, 2009. The reference watershed inspections verified that these watersheds appear to be supporting beneficial uses and are suitable as reference watersheds. Field evidence supporting that beneficial uses are being supported included the lack of roads and the presence of healthy riparian vegetation and shading and the lack of significant sediment filling of pools for the perennial streams inspected within the reference watersheds inspected.

References Cited:

Klamath National Forest, 2014. Forest Service response to Regional Water Board questions regarding the process used to determine reference streams in the KNF Monitoring Plan, QAPP, and Temperature Monitoring Report, dated February 3, 2014.

North Coast Regional Water Quality Control Board, 2004. Waiver of Waste Discharge Requirements for Timber Harvest Activities on Federal Lands Managed by the US Forest Service in the North Coast Region. North Coast Region Order No. R1-2004-0015.

North Coast Regional Water Quality Control Board, 2009a. Scott River memorandum of understanding between California Regional Water Quality Control Board North Coast Region and U.S. Forest Service Klamath National Forest Pacific Southwest Region.

North Coast Regional Water Quality Control Board, 2009b. Salmon River memorandum of understanding between California Regional Water Quality Control Board North Coast Region and U.S. Forest Service Klamath National Forest Pacific Southwest Region.

North Coast Regional Water Quality Control Board, 2010. Waiver of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Federal Land Management Activities on National Forest System Lands in the North Coast Region. North Coast Region Order No. R1-2010-0029.

Ode, P. 2009. Recommendations for the development and maintenance of a reference condition management program (RCMP) to support biological assessment of California's wadeable streams. Report to the State Water Resources Control Board's Surface Water Ambient Monitoring Program (SWAMP), SWAMP Aquatic Bioassessment Laboratory/Water Pollution Control Laboratory, California Department of Fish and Game.

Attachment:

KNF, 2014. Forest Service response to Regional Water Board questions regarding the process used to determine reference streams in the KNF Monitoring Plan, QAPP, and Temperature Monitoring Report, dated February 3, 2014.

Forest Service response to Regional Water Board questions regarding the process used to determine reference streams in the KNF monitoring Plan, QAPP, and temperature Monitoring Report.
February 3, 2014

Question 1: The KNF used GIS to look at roads, timber harvest, grazing, and mines to assure that they meet the thresholds for reference streams. How many years of GIS layers did they look at? What year were the most recent layers?

Answer: The analysis used GIS layers from 2010 which were current at the time of the assessment. The current roads layer contains information from multiple years including all system roads and most of the unauthorized roads that are no longer part of the road system. The GIS layer for timber harvest includes all past logging on Forest Service lands including partial cuts as well as older regeneration harvest. The layer for mining contains known mines but is missing older historical mining activity such as placer and hydraulic mines. The grazing layer contains all current allotments on Forest Service lands but does not contain information on historic grazing. Air photos extending back to 1944 were used to identify disturbance that that are not in the GIS layers such as unauthorized routes and historic mines.

Question 2: Field validation of the GIS exercise for sediment. Did they go to all of the identified reference streams and perform field validation?

Answer: Every reference reach was visited in the field look for evidence of human-caused disturbance that may have been missed by the GIS and air photo analysis. The field visits looked for visible signs of human disturbance adjacent to the monitoring reach such as roads, stumps, skid trails, bank trampling, diversions, or hydraulic mining. Some candidate reference streams were eliminated based on the field validation. For example Morehouse Creek in the Salmon River qualified as a reference using the GIS exercise, but was eliminated after a field review found evidence of bank disturbance by mining.

Question 3: The QAPP says reference streams that contain grazing will be reevaluated once in-stream data is available. What does this sentence mean exactly, and have they reevaluated the streams that have some grazing? Also, which streams/watersheds have no grazing and which have some?

Answer: Reference streams were reevaluated using in-stream sediment data to confirm that grazing has not altered streambed sediment. Watersheds with and without grazing and their sediment data are shown in Figure 1. When grazed watersheds are compared to non-grazed watersheds there is no statistically significant difference for any of the four sediment metrics (Fig.2, Mann-Whitney at $\alpha = 0.05$). The results confirm that the reference streams identified in the QAPP meet the State criteria for minimally disturbed conditions, which are defined as conditions in the absence of “significant” human disturbance (Ode,2009; Stoddard et al. 2006).

Question 4: The temperature exercise viewed aerial photos to ensure no human alteration. How many years of aerial photos did they look at? What was the process/threshold to determine no anthropogenic effect?

Answer: Aerial photos and NAIP imagery from 1999, 2008, and 2009 were used to evaluate human-caused alteration of riparian vegetation and stream shade. The 1999 photos were emphasized because they capture channel alteration after the 1997 flood. Channel alteration in the 1997 flood reported by de la Fuente and Elder (1998) was the primary evidence used to justify impairment listing in tributary streams (Klamath TMDL Staff Report, pg. 2-59).

The process for determining anthropogenic effects used air photo interpretation of shade loss at inventory points located every 100 meters along all perennial streams on the Klamath National Forest GIS streams layer. Streams on private lands, along the Klamath River, and streams draining to the Butte Valley were excluded. The current stream shade at each point was interpreted as either unaltered with no visible shade loss, natural shade loss (wildfire or natural debris scour), human caused, or possibly human caused. Disturbance is identified as human-caused where there is a direct or indirect loss of shade due to human influence, such as debris flows that originate in the vicinity of a road-stream crossing, harvest units, skid trails, roads, or mine tailings. Disturbance is identified as possibly human-caused where both natural and human-caused sources are present and the photo evidence is not clear.

The altered channels mapped for the 1997 flood report (de la Fuente and Elder, 1998) were re-examined to identify the land use in the area of the disturbance, and the effect of the channel alteration on stream shade. Although the 1998 report mapped debris flows resulting from the flood, it did not evaluate their source. Also, the 1998 report did not map all areas of the Forest and there are gaps in the altered channel layer. To fill in the gaps, altered channels were mapped on 1999 color resource photography (scale 1:16,000). Criteria for mapping altered channels are any one of the following: a) the channel bed exhibits an unusual color or texture relative to similar adjacent channels (usually lighter), which may be caused by recent bed mobilization, scour, or deposition; or b) the channel corridor appears to have lost a considerable amount of vegetation in 0-3 years prior to the date of the air photos. Altered channels were digitized and attributes applied to all segments. These features were then intersected with GIS coverages for roads, timber harvest, and other management to assess their proximity to management activities. Altered channels within 1000 ft. of any management were recorded as human-caused, although the actual cause was not investigated on the ground. Some of these sites are actually natural-caused but were counted as human-caused due to their proximity to a management activity. Likewise, human-caused shade loss that is too small to detect from air photos may have been missed. Altered channels mapped from the 1999 photos were then evaluated using the current vegetation and the Shade-a-lator.

Further information on the results of the shade assessment can be found in the 2010 stream shade report (Laurie and Reichert, 2011), and the 2010 stream temperature report (USFS, 2011). Both of these reports are available on the KNF website:
http://www.fs.usda.gov/detail/klamath/landmanagement/resourcemanagement/?cid=stelprdb5312713

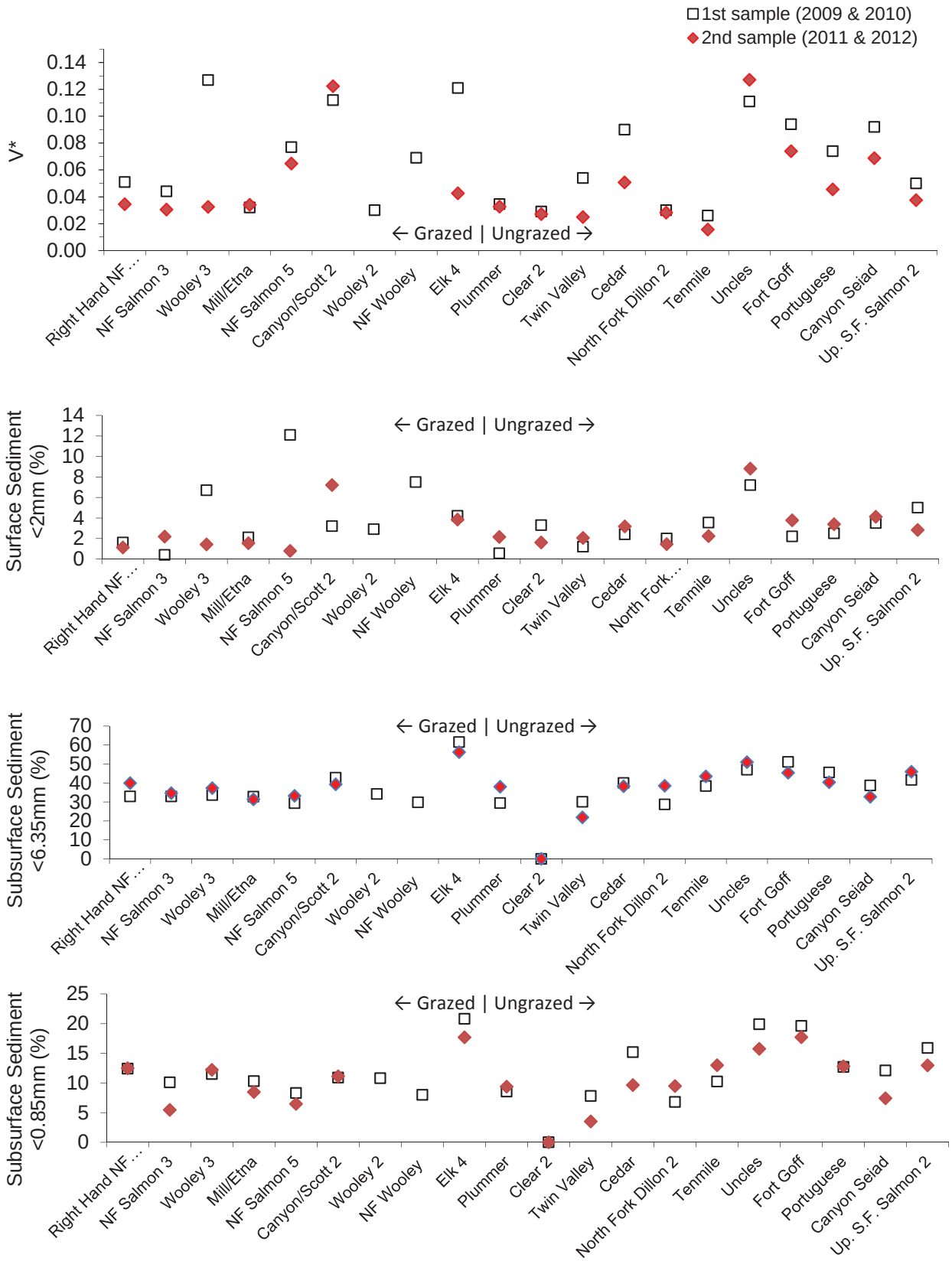

Figure 1. Streambed sediment in reference streams.

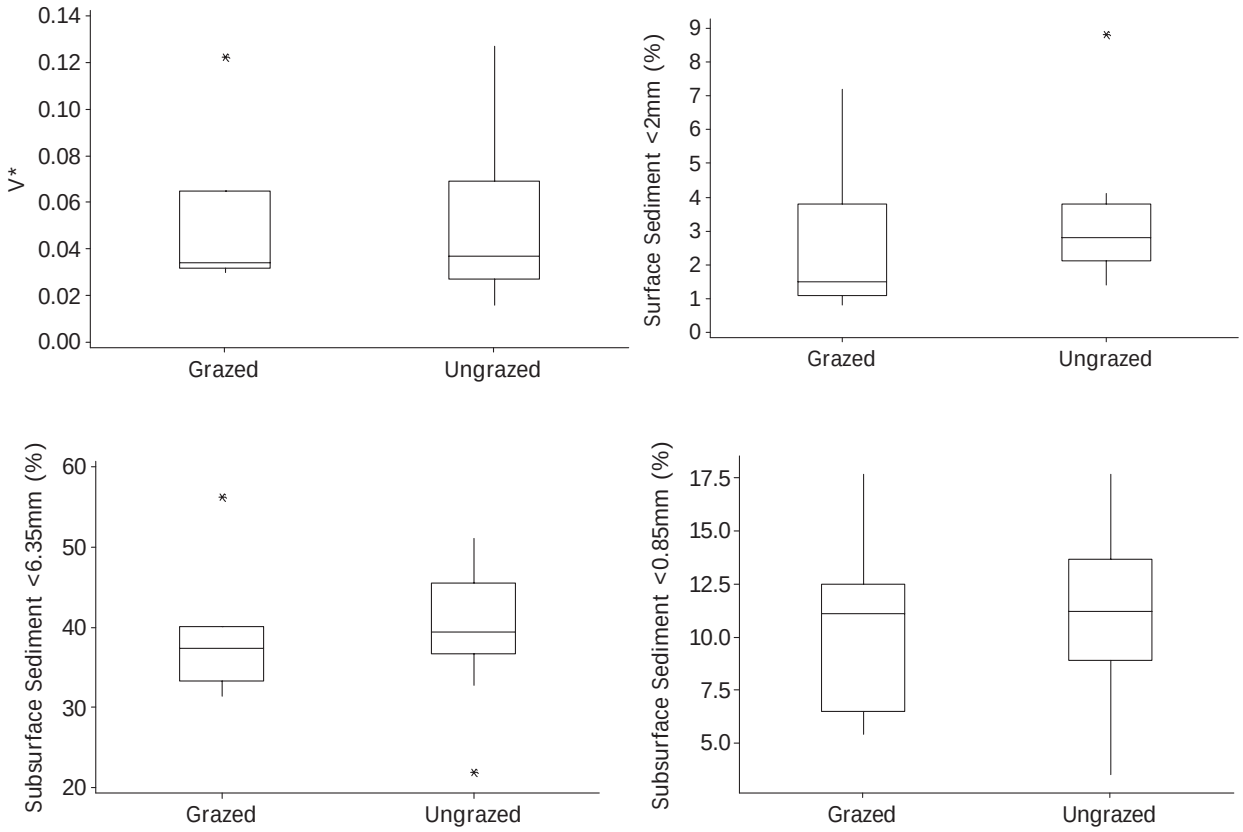

Figure 2. Streambed sediment in grazed and ungrazed reference streams on the Klamath National Forest. Data from 2nd sample (2011 & 2012).