March 4, 2024
TO: Cooperative Monitoring Evaluation and Research (CMER) Committee
FROM: Eastside Type N Riparian Effectiveness Project Team
SUBJECT: Reduced ENREP Extension Recommendation

The Eastside Type N Riparian Effectiveness Project (ENREP) is collecting data "to determine if, and to what extent, the prescriptions found in the Type N Riparian Prescriptions Rule Group are effective in achieving performance targets and water quality standards, particularly as they apply to sediment and stream temperature in eastern Washington" (ENREP Project Charter). The study consists of 5 sets of watershed pairs using a before-after, control-impact (BACI) experimental design with a minimum of 2 years of pre- and post-harvest data. The post-harvest period concludes this spring at two of the watershed pairs (Springdale and Tripp's Knob). The project team is recommending a limited project extension with a reduced suite of variables that balance critical information with cost efficiency to accomplish the core objectives of the original study. The objective of this memorandum is to provide a draft set of recommendations and approximate cost estimates for discussion. If there is interest in the reduced extension, the project team will work with the WA DNR to draft a formal workplan and refine and parse the budget by fiscal years. The rationale for the recommendations includes the following:

1) Preliminary data suggest that summer stream temperatures at Tripp's Knob have remained elevated (~ +2 to +6 °C) above baseline conditions in the second year following harvest, consistent with similar studies (e.g. Hardrock, Softrock, Mica Creek). Although stream temperatures initially increased at Springdale (~ +3 to +4 °C), by the second-year post-harvest they recovered to below (~ -1 to -2 °C) baseline conditions. Post-harvest canopy density at Tripp's Knob and has remained consistently ~35% below pre-harvest conditions whereas at Springdale, canopy density fully recovered in the second year after harvest. The specific reasons for the variations and the duration of the temperature increases are unclear given the relatively short post-harvest period. We hypothesize that elevated temperatures at the Tripp's Knob basin should exhibit a declining trend toward baseline once low herbaceous vegetation is established in the riparian zone. We hypothesize that the temperature decline below baseline noted at the relatively arid Springdale site may be due to relatively large changes in stream discharge post-harvest. Temperatures are hypothesized to trend upwards toward baseline as vegetation re-establishes throughout the watershed, evapotranspiration increases, and streamflows subsequently decline. Sustained temperature changes are likely to affect aquatic life, therefore the project team recommends continued monitoring of the response variables detailed in Table 1.

2) Conditions in the watersheds suggest that low-growing vegetation at Tripp's Knob is beginning to establish which may contribute to the mitigation of temperature increases in the upcoming years. Conversely, the long-term integrity of the overstory buffers may experience mortality due to lack of support from surrounding vegetation – similar to the 2021 limited blowdown event at the Tripp's Knob study site – which affects temperature, sediment delivery, and flow regime. We hypothesize that temperature, turbidity, and flow changes will continue to moderate as vegetation continues to establish across the study

sites, but the rates of recovery are unknown, and the trends may be interrupted in the event of an episodic disturbance such as a windthrow or major rain-on-snow event. Continued monitoring of canopy density, shade, turbidity, and flow regime will more effectively indicate the rates and stability of recovery trends and mechanisms contributing these trends as harvested areas regenerate.

3) A 5-year extension period is proposed because similar studies on nonfish-bearing streams in the region (Mica Creek) have shown thermal recovery to baseline to take 10 years (Gravelle, unpub. data), with the majority of recovery occurring within 5-10 years. Extending the post-harvest period to approximately 7 years is therefore expected to encompass most of the recovery period. Due to the harvest delay at Fish Creek, the team recommends a 4-year extension period for Fish Creek to balance inter-site comparability and with cost efficiency.

4) Post-harvest monitoring for the Hardrock and Softrock studies was extended to 9 and 6-7 years, respectively. Limited extension of ENREP will therefore increase the comparability of the 3 studies to better inform forest management across Washington.

Substantial investment in monitoring infrastructure (stream gauging stations, automated temperature monitoring networks, and hydrometeorological stations) has been made to date, but continued operation of the automated data collection equipment is relatively inexpensive. The watersheds have also been well-characterized with manual surveys, minimizing the need for additional extensive surveys. The proposed reduced suite of variables therefore focuses on parameters that provide a high value of critical information relative to cost.

Table 1. Proposed Reduced Suite of Response Variables

ENREP	**ENREP Limited Extension**
Streamflow (continuous)	Streamflow (continuous)
Suspended sediment concentration (SSC) (event based)	
Turbidity (continuous)	Turbidity (continuous)
Effective shade (annually)	
Canopy density: Water surface and waist height (annually)	Canopy density: Water surface and waist height (annually)
Stream temperature: all reaches (continuous)	Stream temperature: all reaches (continuous)
Subsurface water temperature: all reaches (continuous)	Subsurface water temperature: dry reaches (continuous)
Wetted channel extent (2x annually)	Wetted channel extent (1x annually, dry season)

Tree stocking (pre- and post-harvest)	Tree stocking (Year 5*)
Large wood (annually)	Large wood (Year 5*)
Sediment pathway analysis (annually)	Sediment pathway analysis (Year 5*)
Stream cross-sections (annually)	
Aquatic life (3x annually)	Aquatic life (1x annually)
Hydrometeorology – automated (precipitation, air temperature, humidity, wind speed, snow depth, soil temperature)	Hydrometeorology – automated (precipitation, air temperature, humidity, wind speed, snow depth)

*Stocking, large wood, and sediment pathways may be re-measured earlier if a major episodic event occurs (e.g. extensive blowdown, major flood), and only at Year 4 for Fish Creek.

Variables, Proposed Changes, and Rationale

1. Streamflow – automated
   Proposal: Continue without change
   Rationale: Critical response variable, inexpensive to maintain, substantial investment in existing infrastructure

2. Suspended sediment concentration (SSC) – automated, manually analyzed
   Proposal: Eliminate
   Rationale: Can be approximated with turbidity based on existing correlations, relatively expensive (lab costs, power management for automated samplers, limited sample storage requiring more frequent field visits)

3. Turbidity – automated
   Proposal: Continue without change
   Rationale: Correlated with critical response variable (SSC), empirical turbidity-suspended sediment concentration curves developed for all sites, relatively inexpensive to maintain, substantial investment in infrastructure

4. Effective shade – manual data collection and analysis (hemiphotos)
   Proposal: Eliminate
   Rationale: Reasonably indexed by canopy density. Data collection and processing are time-consuming and hence relatively expensive

5. Canopy density: Water surface and waist height – manual data collection and analysis (densiometry)
   Proposal: Continue without change
   Rationale: Provides reasonable index of critical response variable (effective shade), relatively inexpensive data collection and analysis procedures.

6. Stream temperature – automated
   Proposal: Continue without change
   Rationale: Critical response variable, inexpensive to operate

7. Subsurface water temperature – automated
   Proposal: Reduce to dry reaches only
   Rationale: Critical response variable in seasonally dry reaches, relatively uninformative in perennially wet reaches.

8. Wetted channel extent – manual
   Proposal: Reduce from 2x to 1x per year during late season when flows are lowest
   Rationale: Critical response variable (aquatic habitat), relatively inexpensive to collect

9. Tree stocking – pre- and post-harvest
   Proposal: Conduct final sampling in Year 5.
   Rationale: Largest changes immediately after harvest, small expected inter-annual changes, relatively expensive data to collect.

10. Large wood – manual
    Proposal: Conduct final sampling in Year 5.
    Rationale: Systems are well characterized, largest changes immediately after harvest, small expected inter-annual changes, align sampling with stocking and sediment pathway analysis

11. Sediment pathway analysis – manual
    Proposal: Conduct final sampling in Year 5
    Rationale: Systems are well characterized, largest changes immediately after harvest, small expected inter-annual changes, align sampling with stocking and sediment pathway analysis

12. Stream cross-sections – manual
    Proposal: Eliminate
    Rationale: Method only detects large changes, channels have exhibited high degree of stability, expensive data to collect and analyze.

13. Aquatic life (algae and benthic invertebrates) – manual
    Proposal: Reduce sampling from 3x to 1x per year
    Rationale: Critical response variables: Algae and invertebrates are critical components of stream food webs, but sample collection and invertebrate sample processing is relatively expensive. One-time, annual sampling of each study stream during mid-summer or fall will allow us to track algal and invertebrate responses to thermal recovery.

14. Hydrometeorology
    Proposal: Continue without change
    Rationale: Very useful for diagnosing specific events and climatic effects on stream

systems, inexpensive to maintain, helpful for field safety, substantial investment in infrastructure.

Approximate Budget

An approximate projection of additional costs for general planning purposes is provided below. The primary expense for the U of I is for a reduced team comprised of a 1.0 FTE staff member and 0.11 FTE Project PI to manage the project and data analysis. A seasonal field crew (2 personnel) is required to maintain equipment and complete reduced surveys. Expenses for USU are primarily for a part time staff member to collect and analyze data and for laboratory fees. The budget does not include cost estimates for data analysis and report preparation. The estimate will depend on the desired scope, magnitude, and format of the final product that will need to be determined in consultation with WA DNR. Projected costs also include demobilization in years 6 and 7. Data analysis and report preparation would begin during Years 6 and 7 to reduce out-year data analysis and reporting costs and expedite preparation of the project report.

If there is interest in pursuing a limited extension of the project a detailed workplan and budget parsed by fiscal year can be developed once variables and sampling frequency have been approved, and all project cooperators confirm that basin pairs will meet the science objectives and that continued monitoring will be permitted.

Approximate Projected Additional Costs ($1000s)

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
$18	$41	$53	$127	$182	$318	$334