

North Coast Regional Water Quality Control Board

TO: File

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PLANNING AND WATERSHED STEWARDSHIP DIVISION

DATE: August 10, 2026

SUBJECT: ELK RIVER DATA ASSESSMENT: 2026 UPDATE

Background

In 2016 the North Coast Regional Water Quality Control Board (North Coast Water Board) incorporated the *Action Plan for the Upper Elk River Sediment TMDL*¹ (TMDL Action Plan) into the Water Quality Control Plan for the North Coast Region (Basin Plan). The TMDL Action Plan states that the North Coast Water Board “shall evaluate the available information to assess the degree to which recommended health and safety, coordinated monitoring, and sediment remediation improvements have been achieved” every five years from the date of the TMDL’s adoption until 2031. The first five-year review was scheduled for 2021 but was completed in 2022 due to staffing issues and the COVID-19 pandemic. This technical memorandum fulfills the monitoring-related requirement for the second five-year review, held in May 2026. The third and final five-year review is identified for 2031.

The *Upper Elk River Sediment TMDL: Assessment of the First Five Years*² (2022 Five-Year Review Staff Report) contained trend analyses of Elk River water quality and

¹ [Action Plan for the Upper Elk River Total Maximum Daily Load \(TMDL\)](https://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/elk_river/pdf/180319/ACTION_PLAN_FOR_THE_UPPER_ELK_RIVER_SEDIMENT_TMDL.pdf)
(https://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/elk_river/pdf/180319/ACTION_PLAN_FOR_THE_UPPER_ELK_RIVER_SEDIMENT_TMDL.pdf)

² [Upper Elk River Sediment TMDL: Assessment of the First Five Years](https://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/elk_river/pdf/260408/final_TMDL_SR.pdf)
(https://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/elk_river/pdf/260408/final_TMDL_SR.pdf)

aquatic habitat data submitted by Humboldt Redwood Company (HRC), the majority landowner in the Upper Elk River watershed. These data were, and continue to be, submitted as part of the Monitoring and Reporting Plan in HRC's Waste Discharge Requirements³ (WDR) permitting HRC's timber harvest operation within the watershed. The trend analysis conducted for the 2022 Five-Year Staff Report examined three components: (1) suspended sediment concentrations (SSC) samples, (2) aquatic habitat, and (3) the Severity of Ill Effects (SEV) index (Newcombe & Jensen, 1996). Organized along these components, this technical memorandum, its attachments, and the associated data analysis are a continuation of the 2022 analysis with some modifications incorporated for the 2026 TMDL update. These modifications are explained in the components' respective sections and are largely improvements on the existing methodologies.

Suspended Sediment Concentration

Suspended sediment concentration as an ambient water quality parameter approximates the supply of sediment being delivered to the stream; this sediment supply includes both natural and anthropogenic sources. HRC collects SSC samples at each of its seven hydrologic trends monitoring (HTM) station based on the turbidity threshold sampling (TTS) method (Lewis & Eads, 2009). TTS utilizes a suite of instruments that automatically collect water samples whenever a turbidity threshold is exceeded. Water sample collection can be as frequent as every 15 minutes, becoming less frequent or ceasing once the turbidity dips below a threshold. Automatic stage measurements are also collected every 15 minutes; with field stage and discharge measurements, rating curves are developed to estimate continuous streamflow or discharge. SSC samples are datetime-matched with corresponding streamflow estimates and precipitation data, and together these variables form the basis of the SSC trends analysis.

The purpose of the SSC trends analysis is to assess whether sediment supply has changed over time. The statistical analysis for this assessment is a set of multivariate linear regression models. Each regression model produces an estimate of changes in SSC over time, after controlling for natural or otherwise nonanthropogenic factors ("covariates") influencing SSC. The relationship between these covariates and SSC may be complex (i.e., nonlinear), and the multiple models represent different mathematical relationships or formulations between the covariates and SSC. If the time coefficients in all model formulations are statistically significant, then there is sufficient evidence to conclude that for the given data record, a trend in SSC is not significantly different from zero. The sign of the time coefficient indicates the direction of this trend, and the value indicates the magnitude. That is, positive numbers for the time coefficient means that SSC is increasing over time, and negative numbers mean that SSC is

³ [Order No R1-2019-0021](https://www.waterboards.ca.gov/northcoast/board_decisions/adopted_orders/pdf/2019/19_0021_HRC_Elk_WDR.pdf)

(https://www.waterboards.ca.gov/northcoast/board_decisions/adopted_orders/pdf/2019/19_0021_HRC_Elk_WDR.pdf)

decreasing. Aside from time, the model covariates include rainfall in the form of antecedent precipitation index (API), streamflow, and seasonality unrelated to weather.

Methodology

The methodology is largely the same as found in the 2022 Five-Year Review with new modifications used in 2026 described later in this section. The analysis employs multivariate linear regression fitted using the generalized least squares (GLS) technique. Because the data are a time series, serial autocorrelation is expected and impacts the reliability of statistical inference. GLS addresses this issue by allowing the linear regression to model autocorrelation in the error term as a function of past values. After correcting for autocorrelation, statistical inference for the model coefficients can proceed. The general or default model formula is:

$$\log SSC \sim \beta_0 + \beta_q \log Q + \beta_a \sqrt{API} + \beta_s \sin(2\pi \cdot f_{doy}) + \beta_c \cos(2\pi \cdot f_{doy}) + \beta_t t + \varepsilon^*$$

Where:

- SSC = suspended sediment concentration in $\text{mg} \cdot \text{L}^{-1}$
- Q = streamflow in $\text{m}^3 \cdot \text{s}^{-1}$ or cms
- API = antecedent precipitation index in millimeters or mm
- f_{doy} = fraction of the calendar year for a given timestamp
- t = time in decimal years
- ε^* = error function that includes terms to account for autocorrelation

Modifications to the 2022 Five-Year Review methodology are as follows.

- The 2022 models did not include a cosine term. Sine and cosine together are a proxy for a Fourier analysis, typically used for analyzing trends in periodic or cyclical data (Stolwijk et al, 1999). Including these terms may explain variance due to calendar-year based seasonality.
- The 2022 Five-Year Review only examined the most downstream hydrologic trends monitoring (HTM) stations at HTM 509, 510, and 511 ([Figure 2](#)). The SSC trends analysis now includes all active HTM stations in the watershed, providing a more holistic assessment of the watershed as well as meeting the recommendations in the 2022 Five-Year Review.
- For the 2026 analysis, instead of one regression model per station, each station has four models with different formulations. These formulations are based on two factors: outlier exclusion and polynomial terms. Each factor is binary; that is, full dataset vs. outliers removed and with or without polynomial terms. The combination produces four formulations. The GLS technique remains the same for all models. A formulation with polynomial terms may look like the equation below:

$$\log SSC \sim \beta_0 + \beta_{Q_1} \log Q + \beta_{Q_2} \log(Q)^2 + \beta_3 \log(Q)^3 + \dots + \varepsilon^*$$

Instead of a single coefficient for streamflow, this formula contains coefficients for terms in a polynomial function of streamflow. Including polynomial terms allows linear regression models to fit nonlinear data patterns between the response variable and its covariates.

Because the regression diagnostics (see Appendix C of the Five-Year Review Staff Report) indicate that heteroskedasticity persists in the regression model, formulations include removing outliers identified using the initial model fits from an ordinary least squares (OLS) regression. Observations flagged for removal are chosen through regression diagnostic plots, changes to regression results (e.g., R^2), and statistical tests (Komsta, 2022). As was done in the 2022 Five-Year Review, the models are refitted after sub-setting the data to a time record encompassing HRC's ownership of Pacific Lumber Company's timberlands (2008 to present) and after the TMDL's adoption (2016 to present). Statistical significance is assessed at a significance level of $\alpha = 0.0125^4$.

Results

[Figure 1](#) and [Table 1](#) show the results of the SSC trends analysis as the number of model variations with statistically significant time trends at $\alpha = 0.0125$. Sufficient evidence of a trend in either direction is determined by whether the majority (three or more) of model variations have statistically significant trends. [Figure 2](#) shows a map of the HTM stations and the direction of their SSC trends, if any, over the HTM stations' data record.

No stations have sufficient evidence of increasing SSC in any of the time periods being assessed. For the entire data record time period, the following stations have decreasing SSC trend: 509 on the mainstem Elk River immediately after the confluence of the North and South Forks; 511 on the North Fork above the confluence; and 517 on Bridge Creek in the North Fork subwatershed. For other assessed time periods, only station 509 during the WY2008-2025 period shows a statistically significant decreasing SSC trend.

⁴ Because multiple regression models are developed, the typical threshold for statistical significance (i.e., $\alpha = 0.05$) is lowered to account for issues arising from multiple comparisons using the Bonferroni method (Mittelhammer et al, 2000).

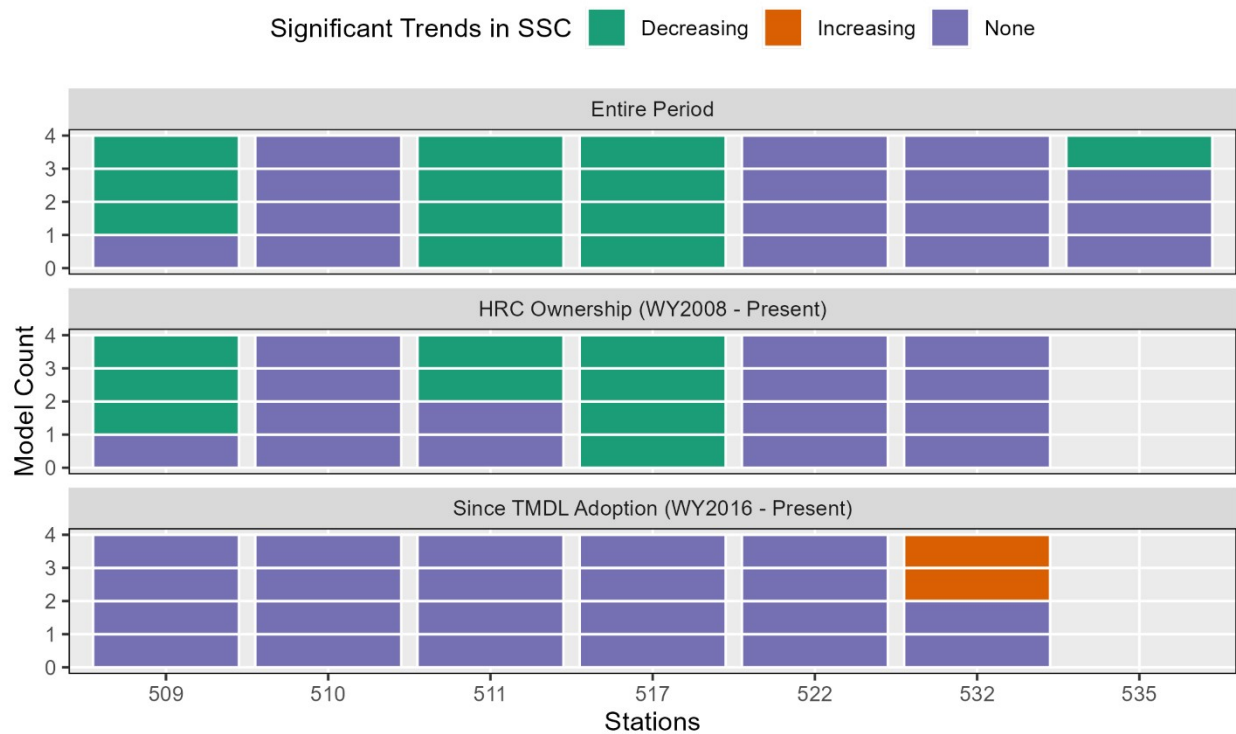


Figure 1: SSC trends by time period across four model variations with significance level $\alpha = 0.0125$. Station 535 's data record begins in WY2018.

Table 1: Models with significant ($\alpha = 0.0125$) SSC trends by time period across four variations. Corresponding with [Figure 2](#), shaded and bolded cells indicate the overall trend results (3 or more models in one direction)

Station	Period	Decreasing SSC	Increasing SSC	No Trend
509	Entire Record	3 / 4	0 / 4	1 / 4
509	WY2008-2025	3 / 4	0 / 4	1 / 4
509	WY2016-2025	0 / 4	0 / 4	4 / 4
510	Entire Record	0 / 4	0 / 4	4 / 4
510	WY2008-2025	0 / 4	0 / 4	4 / 4
510	WY2016-2025	0 / 4	0 / 4	4 / 4
511	Entire Record	4 / 4	0 / 4	0 / 4
511	WY2008-2025	2 / 4	0 / 4	2 / 4
511	WY2016-2025	0 / 4	0 / 4	4 / 4
517	Entire Record	4 / 4	0 / 4	0 / 4
517	WY2008-2025	4 / 4	0 / 4	0 / 4
517	WY2016-2025	0 / 4	0 / 4	4 / 4
522	Entire Record	0 / 4	0 / 4	4 / 4
522	WY2008-2025	0 / 4	0 / 4	4 / 4
522	WY2016-2025	0 / 4	0 / 4	4 / 4
532	Entire Record	0 / 4	0 / 4	4 / 4
532	WY2008-2025	0 / 4	0 / 4	4 / 4
532	WY2016-2025	0 / 4	2 / 4	2 / 4

Station	Period	Decreasing SSC	Increasing SSC	No Trend
535	Entire Record	1 / 4	0 / 4	3 / 4

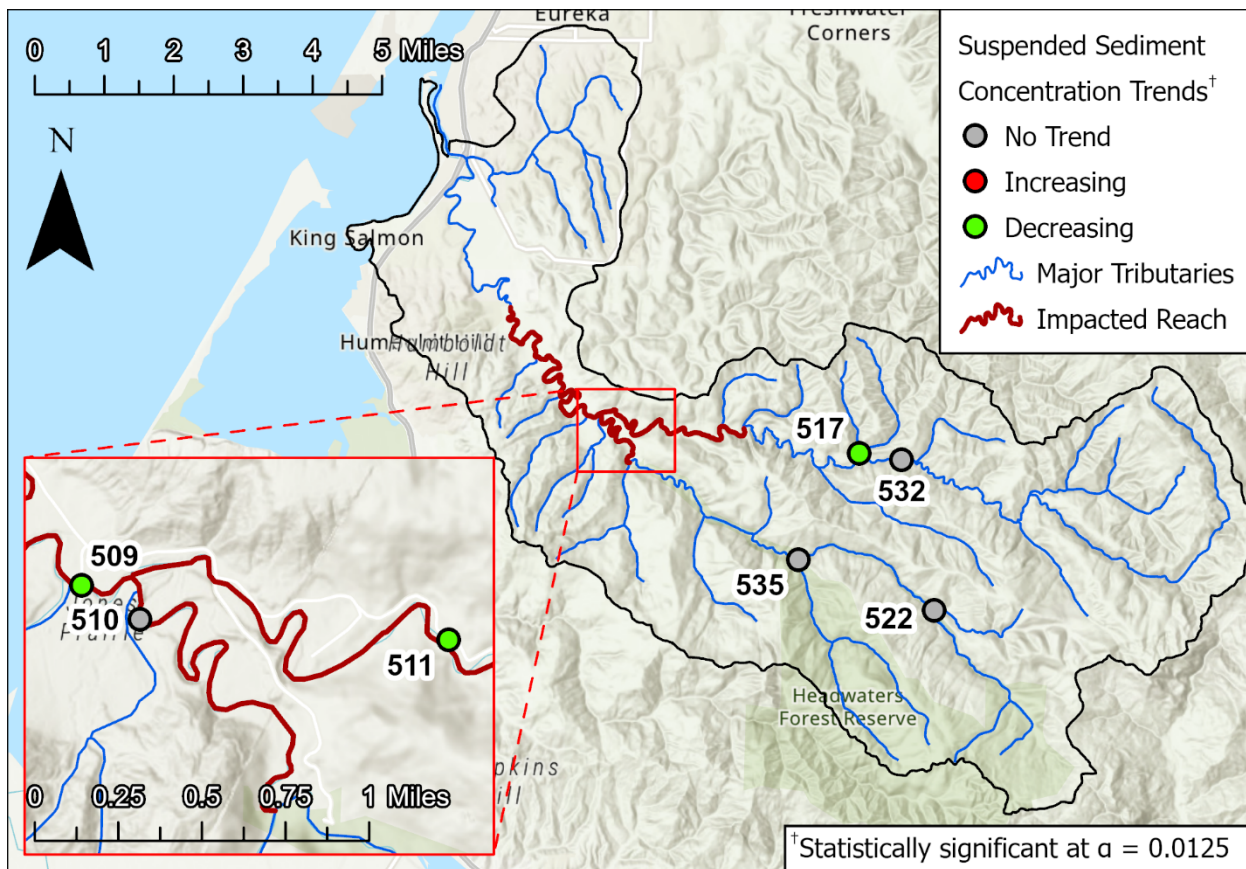


Figure 2: SSC trend results for hydrologic monitoring stations across the entire data record, corresponding with shaded and bolded cells in [Table 1](#).

Severity of Ill Effects Index (SEV)

From a meta-review of studies investigating the impact of suspended sediment on salmonids, the SEV index is a regression model taking the form:

$$SEV = a + b \cdot \log(SSC) + c \cdot \log(ED)$$

ED is the exposure duration in hours at a fixed SSC value and *a*, *b*, *c* are regression coefficients. The SEV scale ranges from 0 to 14 with 0 being no effect and 14 being greater than 80 percent fish mortality. The scale has four general groups: no effect (SEV = 0); behavioral effects (1-3); sublethal effects (4-8); and lethal effects (9-14).

[Table 2](#) provides descriptions of select SEV scores and the effects they describe.

Regression coefficients are specific to salmonid life stages (eggs/larvae, under yearling, and juvenile) and are found in Newcombe & Jensen (1996) and Bray (2000) with the latter paper's coefficients being more specific to Coho salmon.

Table 2: Select SEV scores and their associated effects on aquatic life adapted from Newcombe & Jensen (1996)

SEV Score	Effects Description
4	Shor-term reduction in feeding rates and feeding success
5	Minor physiological stress; increased respiration rate
6	Moderate physiological stress
7	Moderate habitat degradation
8	Indications of major physiological stress; long-term reduction in feeding rate
9	Reduced growth rate; delayed hatching
10	0-20% mortality; moderate to severe habitat degradation
13	>60-80% mortality

Methodology

Calculating SEV scores requires a continuous SSC time-series where an SSC value is fixed, and the maximum exposure duration is calculated from the time series. Because the SEV model has two input variables, SEV scores can be calculated from any given SSC value and its maximum exposure duration. That is, a time series may yield as many SEV scores as there are fixed SSC values. The 2022 Five-Year Review SEV analysis specified a series of log SSC values from {0.0, 0.1, 0.2, ..., 11.9, 12}, determined the maximum exposure duration for each SSC value by water year, and calculated SEV scores for each SSC. The same procedure was repeated for this 2026 analysis. Each life-stage and/or SEV regression model produces 121 SEV scores per station per year. The mean, median, maximum, and the 90th percentile SEV scores for each year and station are used in the nonparametric Mann-Kendall test for monotonic trends as well as the related Sen slope which indicates the magnitude of the trend.

Results

[Figure 3](#) shows the distribution of the SEV statistics across all HTM stations for Water Year 2025, separated by life-stage. [Table 3](#) shows the overall median SEV for each station and life stage. The eggs/larvae life-stage is the most impacted with the overall median score ranging between 7 to 9 indicating at least moderate habitat degradation. The other life stages are less vulnerable as their median scores range from 4 to 7, indicating impacts to feeding rates.

[Table 4](#) shows the statistically significant ($\alpha = 0.05$) trend results by station, life stage, and SEV statistic from 2003 and 2025 with some stations having shorter data records. While the SEV scores for the eggs/larvae at HTM station 517 are currently very high, the extreme scores are decreasing over time at a rate of approximately 0.1 SEV score units per year over the data record. HTM station 509 has increasing SEV scores for the eggs/larvae and the juvenile life stages, indicating worsening conditions over the station's data record.

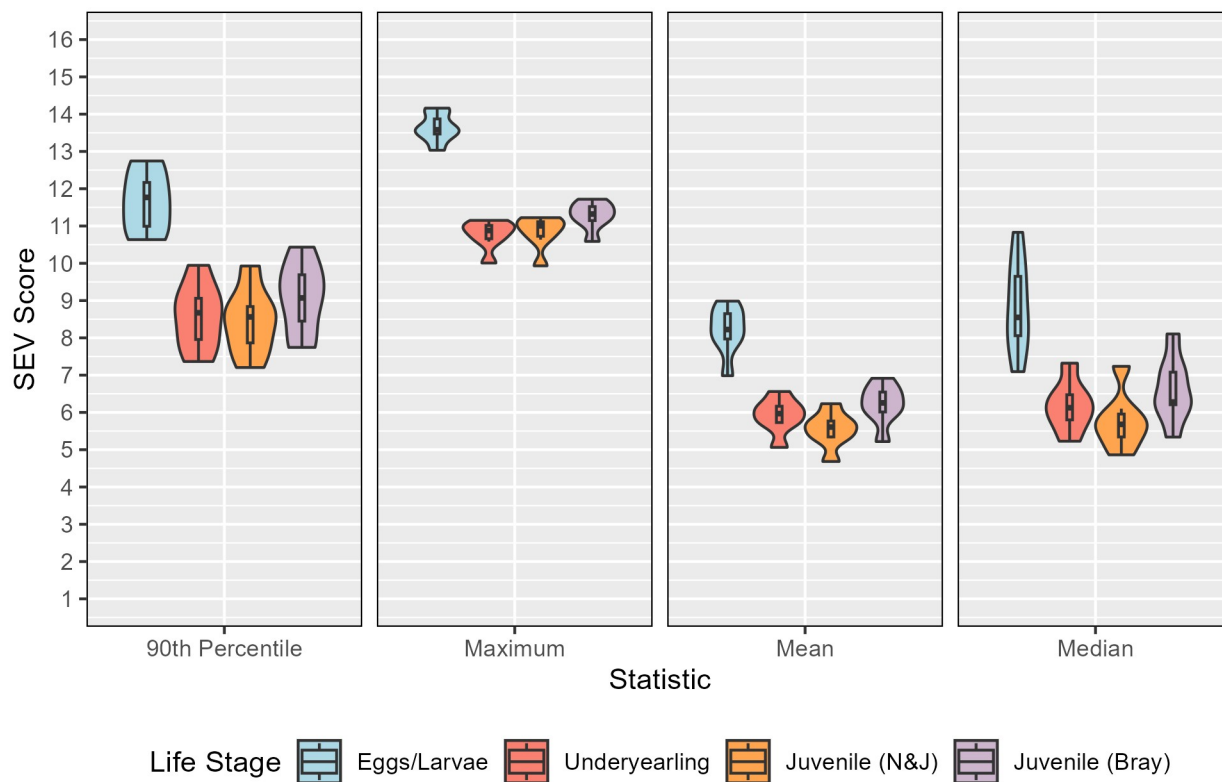


Figure 3: Box and violin plots for SEV statistics across all monitoring stations for Water Year 2025

Table 3: Overall median SEV scores by life stage across data record (2003-2025)

Station	Eggs/Larvae	Underyearling	Juvenile (N&J)	Juvenile (Bray)
509	7.9	5.4	4.8	5.8
510	7.5	5.9	5.6	6.0
511	9.0	6.5	6.1	6.6
517	9.6	6.4	5.8	7.1
522	8.0	6.1	5.5	6.3
532	7.1	5.2	4.9	5.3
535	8.1	5.9	5.7	6.3

Table 4: Statistically significant ($\alpha = 0.05$) time trends in SEV statistic across all stations and life stages from Water Year 2003 to 2025

Station	Life Stage	SEV Statistic	Kendall's τ	Sen slope	p-value
509	Eggs/Larvae	Mean	0.324	0.072	0.043
509	Eggs/Larvae	Median	0.390	0.107	0.014
517	Eggs/Larvae	90th Percentile	-0.336	-0.075	0.027
509	Juvenile (Bray)	Median	0.438	0.075	0.006

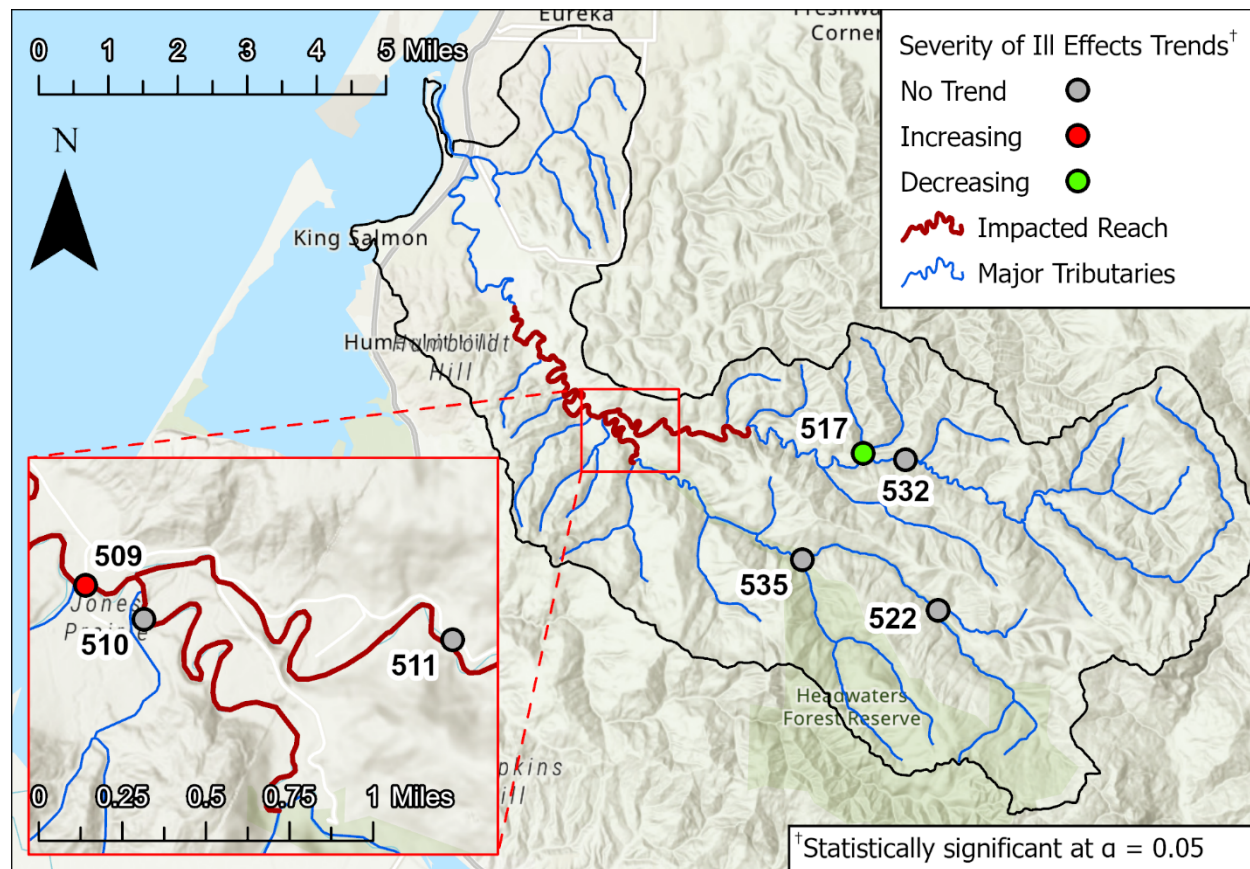


Figure 4: Map of HTM stations showing results of Mann-Kendall tests for SEV trends (Water Years 2003-2025)

Aquatic Habitat

Collecting data on in-stream physical habitat characteristics is essential for tracking watershed conditions and trends related to the distribution and movement of sediment throughout the watershed ([Figure 9](#)). HRC staff conduct aquatic trends monitoring (ATM) of stream habitat at seven locations for channel substrate (pebble counts), pools, large wood, riparian canopy, water temperature, fish surveys, and channel cross sections. ATM data are collected every three years on a rotating basis across all of HRC's timberlands. The most recent data for Elk River were collected in 2023.

Methodology

ATM data for the most recent year of data are compared to the Aquatic Properly Function Conditions (APFC) targets where applicable ([Table 5](#)). These data are subjected to the Mann-Kendall test for monotonic trends and a robust linear regression related to the Mann-Kendall test.

Table 5: ATM parameters collected and their APFC targets

Parameter Category	Parameter	Target Value
Bed Surface	D84 (mm)	None
Bed Surface	D50 (mm)	65-95
Bed Surface	D16 (mm)	None
Bed Surface	D5 (mm)	None
Pool Characteristics	Pool Area (%)	≥ 25
Pool Characteristics	Pool Spacing (channel width/pool)	≤ 6.0
Pool Characteristics	Residual Pool Depth (m)	≥ 0.91
Pool Characteristics	Pools Associated w/ wood (%)	≥ 50
Large Woody Debris	Total Piece Frequency (#/100 ft)	≥ 6.22
Large Woody Debris	Total Piece Count	None
Water Temperature	MWAT (°C)	≤ 16.8
Riparian Overstory	Canopy Over Stream (%)	≥ 90
Riparian Overstory	Canopy of Riparian Forest (%)	≥ 85

Results

[Figure 5](#), [Figure 6](#), and [Figure 7](#) show the most recent data for parameters listed in [Table 5](#) across all stations. [Figure 8](#) shows, by station, the proportion of ATM parameters whose targets are being met as of the most recent data year, excluding any parameter that does not have a specific target. All stations meet the water temperature and riparian overstory targets. Only station 214 on the lower North Fork Elk River meets all pool characteristics targets. Station 175 on the lower South Fork is missing the pool spacing target but meets the residual pool depth target. The remaining stations (104, 162, 166, 167, and 214) meet the pool spacing target but are missing the residual pool depth target. Only station 104 on the South Branch South Fork Elk River meets the large woody debris target, and only station 162 on the middle North Fork Elk River meets the bed surface target.

All stations had at least one parameter where there was a statistically significant ($\alpha = 0.05$) trend over their data record (2002-2023, shorter for some stations). [Figure 9](#) summarizes the trend results as a map, indicating whether all, none, or a mixture of parameters are trending towards their targets and whether those targets are being met. Note that [Figure 9](#) only includes data where there is a significant trend. [Table 6](#) breaks down the significant trend results by station and parameter with five station-parameter combinations highlighted for discussion. Stations 175 (lower South Fork) and 166 (mainstem) are not meeting targets for the D50 parameter; however, these stations show an improving trend towards the D50 targets. D50 and other bed surface parameters are derived from particle size distributions developed from pebble count data. The 5, 16, 50, and 84 numbers are the percentiles from the cumulative particle size distribution, with D50 being the median particle or pebble size.

Station 217 (upper South Fork) currently meets the residual pool depth target, but the data show a worsening trend away from the target. Similarly, station 104 (South Branch

North Fork) currently meets but is also trending away from the large woody debris target. Station 175 is not meeting the large woody debris target, and the trend is moving away from the target. For these select station-parameter combinations, [Figure 10](#) shows the robust linear regression versus time for station-parameter combinations highlighted in [Table 6](#). Residual pool depths measured at station 217 were meeting the target until 2009. Large woody debris frequency at station 175 fluctuated along the target until a consistent decline starting in 2014.

Despite the improving trend in the D50 bed surface parameter at stations 166 and 175, the most recent measurements are far below the targets. While the D5 and D16 bed surface parameters have no specific targets, nearly all ATM stations have increasing or coarsening trend in one or both sediment grain sizes, possibly signifying a watershed-wide trend in the reduction of fine sediment. The exception is station 104 on the South Branch North Fork, which has no statistically significant trends for these grain sizes.

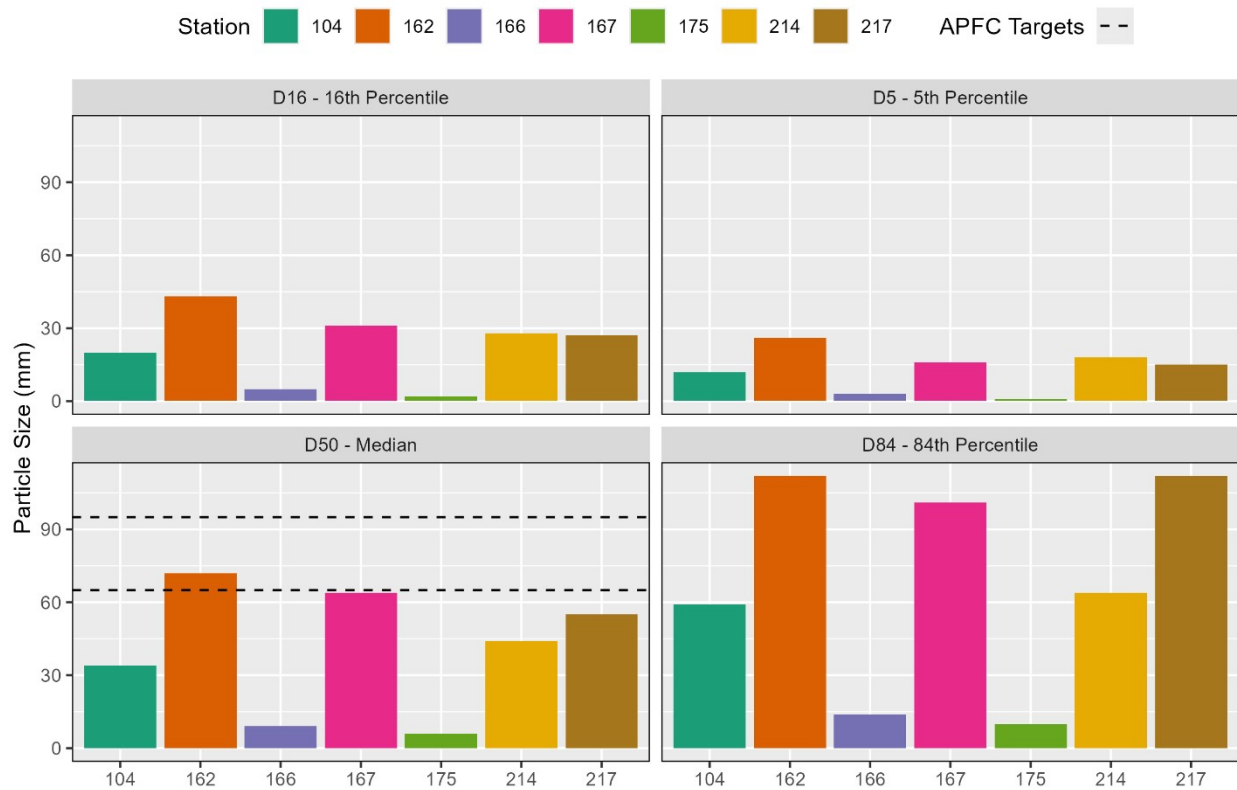


Figure 5: Most recent ATM bed surface data for all stations in 2023.

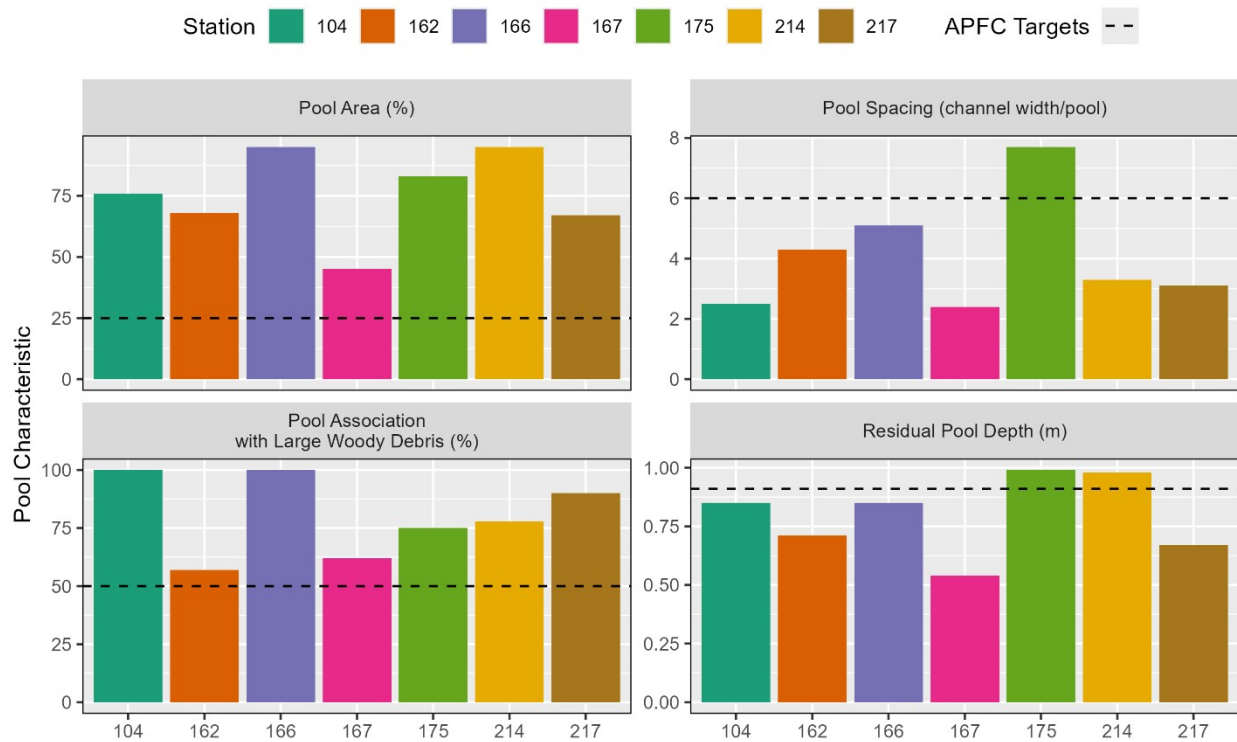


Figure 6: Most recent ATM pool characteristics data for all stations in 2023.



Figure 7: Most recent ATM data for riparian overstory, temperature, and large woody debris. Data are from 2023 except for the canopy of riparian forest parameter whose most recent year is 2013 for station 104 and 2014 for remaining stations

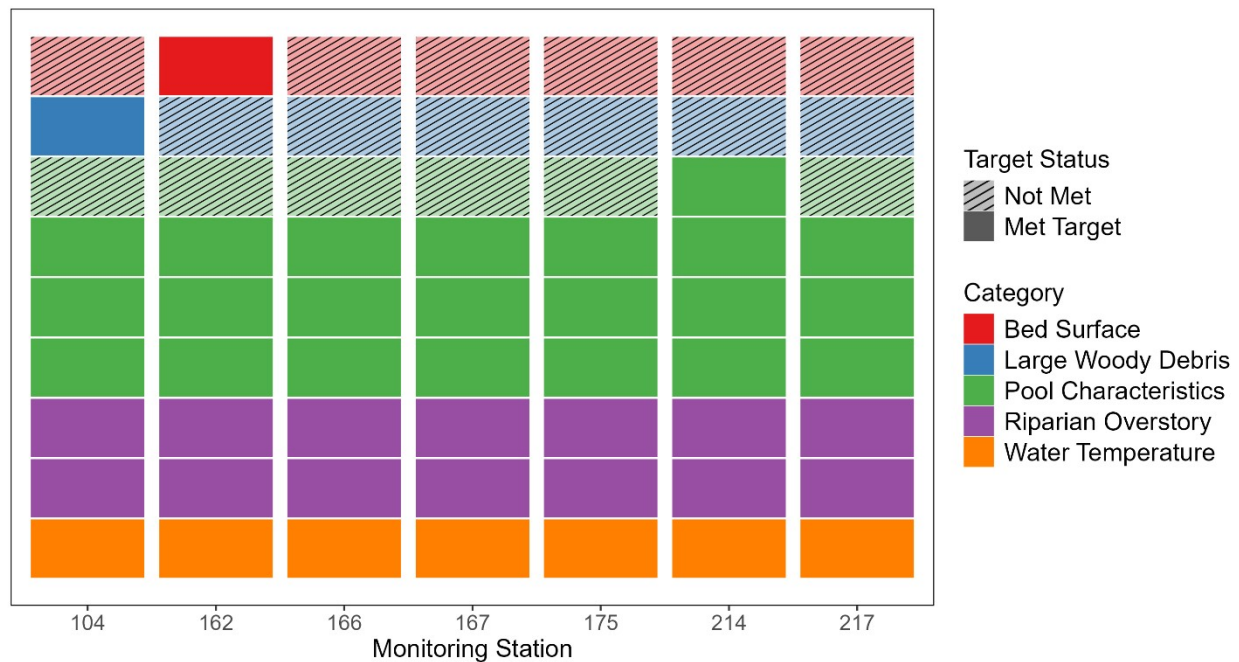


Figure 8: Proportion of ATM targets met by category in most recent year of data (2023). Parameters with no targets are excluded.

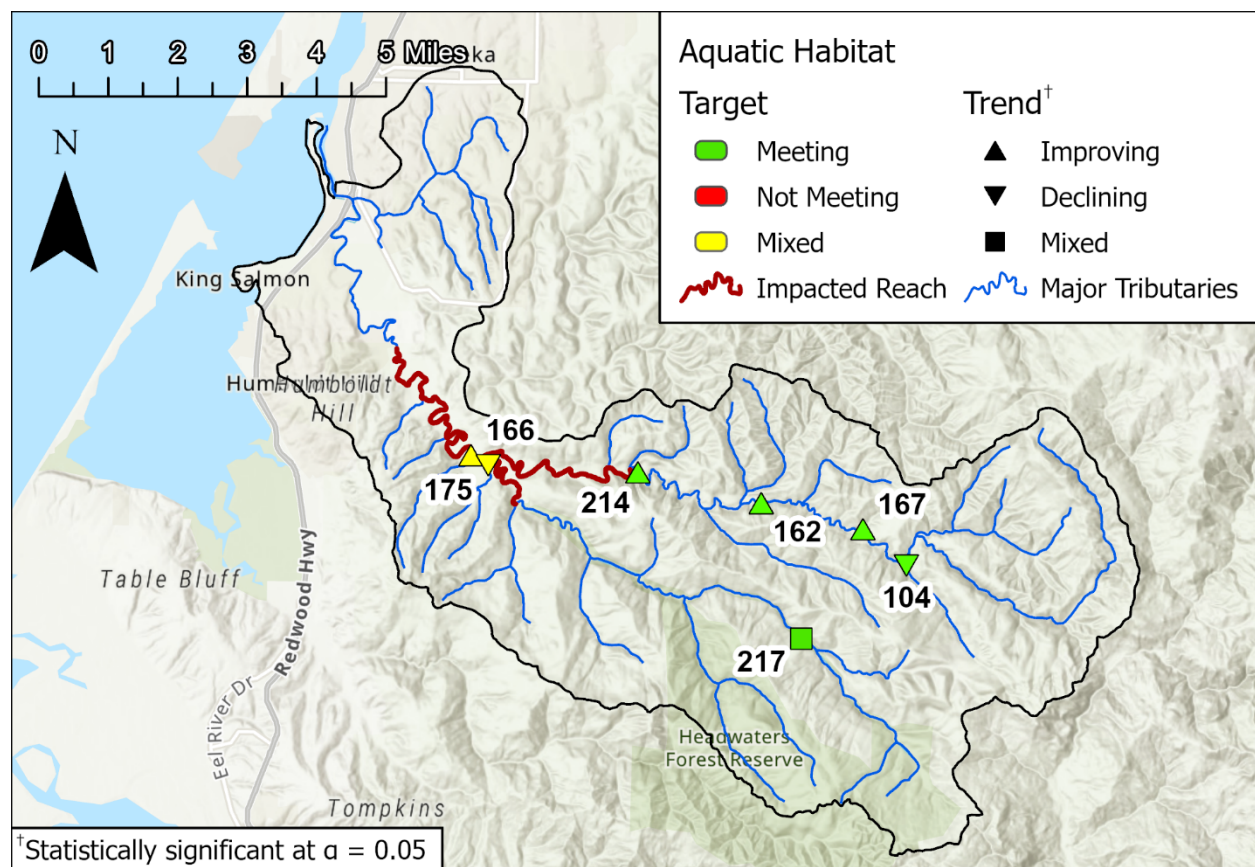


Figure 9: Stations/parameters with statistically significant ($\alpha = 0.05$) trends (2003-2023, depending on station) and whether they are meeting targets as shown on [Table 6](#).

Table 6: Statistically significant ($\alpha = 0.05$) trends (2002-2023, depending on station) in aquatic habitat parameters. In **bold** and blue highlight are stations/parameter with improving trends, but targets have not been met. In *italics* and orange highlight are stations/parameters that currently meet targets but have worsening trends. In underline and red highlight are stations/parameters that have not met targets and show worsening trends. Unhighlighted rows either have no targets, are meeting targets, and/or have improving trends.

Parameter	Station	Location in Watershed	Kendall's τ	p-value	Trend	Targets Met
Canopy Over Stream	162	middle North Fork	0.495	0.016	improving	Yes
Canopy Over Stream	166	Mainstem	0.495	0.016	improving	Yes
Canopy Over Stream	167	upper North Fork	0.571	0.003	improving	Yes
Canopy Over Stream	214	lower North Fork	0.667	0.003	improving	Yes
D16	175	lower South Fork	0.363	0.013	improving	n/a
D16	166	Mainstem	0.396	0.007	improving	n/a
D16	162	middle North Fork	0.505	0.013	improving	n/a
D16	217	upper South Fork	0.606	0.007	improving	n/a
D16	214	lower North Fork	0.667	0.003	improving	n/a
D5	166	Mainstem	0.253	0.046	improving	n/a
D5	167	upper North Fork	0.390	0.036	improving	n/a
D5	162	middle North Fork	0.527	0.008	improving	n/a
D5	217	upper South Fork	0.667	0.002	improving	n/a
D5	214	lower North Fork	0.712	0.001	improving	n/a
D50	175	lower South Fork	0.396	0.043	Improving	No
D50	166	Mainstem	0.538	0.007	Improving	No
D84	167	upper North Fork	-0.581	0.003	worsening	n/a
D84	175	lower South Fork	0.407	0.043	Improving	n/a
<i>LWD Frequency</i>	<i>104</i>	<i>South Branch North Fork</i>	<i>-0.714</i>	<i>0.019</i>	<i>worsening</i>	<i>Yes</i>
<u>LWD Frequency</u>	<u>175</u>	<u>lower South Fork</u>	<u>-0.451</u>	<u>0.029</u>	<u>worsening</u>	<u>No</u>
LWD Total Count	104	South Branch North Fork	-0.714	0.019	worsening	n/a
LWD Total Count	175	lower South Fork	-0.505	0.014	worsening	n/a
LWD Total Count	217	upper South Fork	-0.485	0.034	worsening	n/a
Pool Area	217	upper South Fork	0.652	0.004	improving	Yes
<i>Residual Pool Depth</i>	<i>217</i>	<i>upper South Fork</i>	<i>-0.530</i>	<i>0.019</i>	<i>worsening</i>	<i>Yes</i>
Residual Pool Depth	175	lower South Fork	0.407	0.048	improving	No

Station & 95% CI

104 - South Branch North Fork

166 - Mainstem

175 - Lower South Fork

217 - Upper South Fork

APFC Targets --

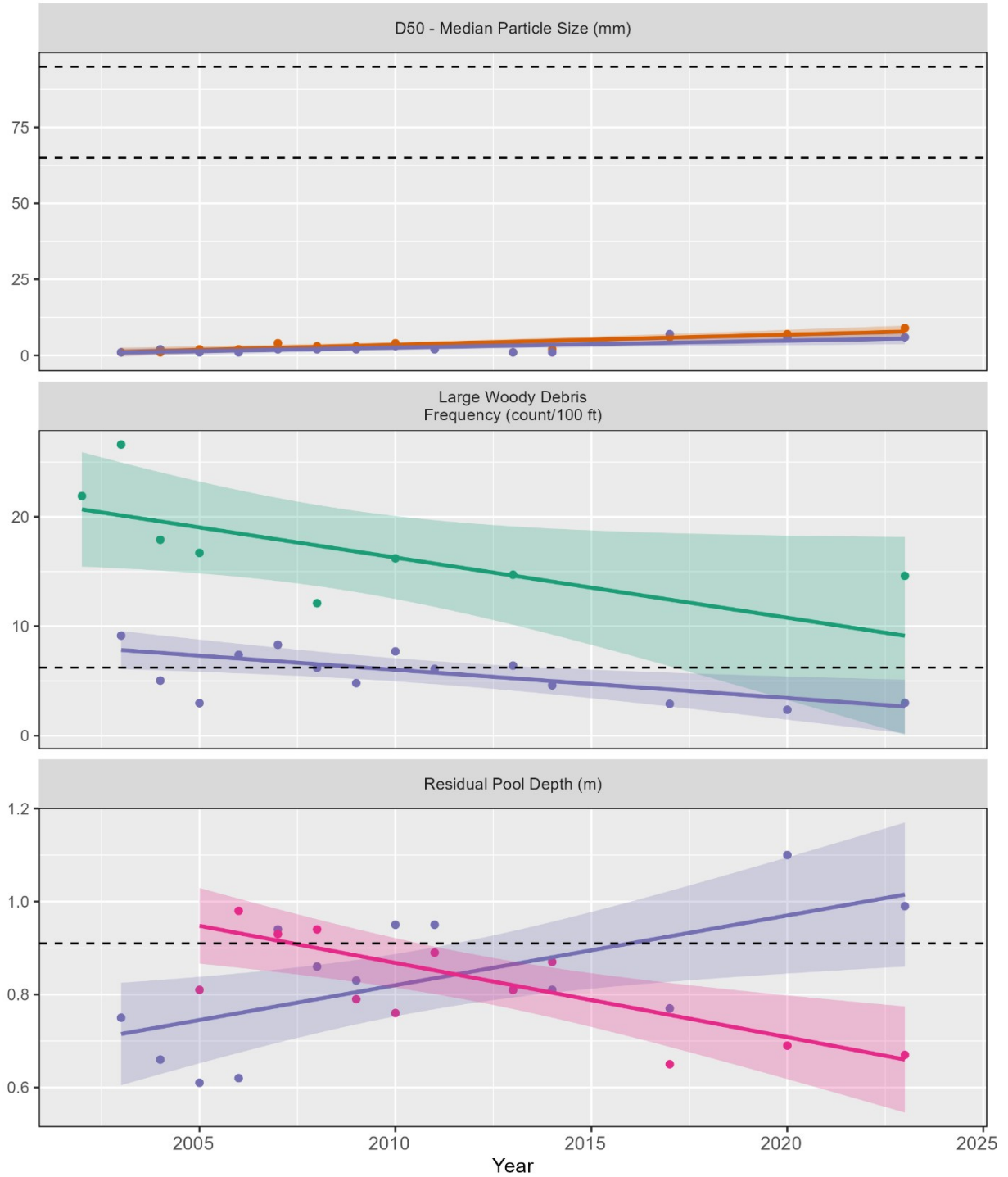


Figure 10: Select stations and parameters with statistically significant ($\alpha = 0.05$) trends (2003-2023, depending on station) with robust linear regression and confidence intervals, corresponding to highlighted cells in [in most recent year of data \(2023\)](#).

Limitations

The analyses presented in this memorandum refine and continue the methods used in the 2022 Five-Year Review, which themselves build on the Elk River Recovery Assessment (2019). In particular, the SSC and SEV trend approaches are carried forward with modifications. Consistent with the TMDL Action Plan, in 2031, the North Coast Water Board plans to “evaluate available information to assess the degree to which water quality objectives are obtained and beneficial uses are restored.” The assessment of monitoring and other data will provide key information for the 2031 evaluation of TMDL Action Plan implementation. The limitations of the current methods are important to note, as they frame expectations for that future assessment.

The methodology for the SSC trends analysis faces a computational limitation. As data accumulate, fitting generalized least squares models becomes increasingly time consuming, potentially requiring more powerful hardware or cloud computing to complete future analyses within reasonable timeframes. Alternative statistical methods that address serial autocorrelation could also be explored. The existing SSC trends analysis also offers limited interpretive value regarding land management and restoration actions. Because the regression model includes only natural covariates, any significant trend cannot be directly attributed to management activity. Incorporating such covariates is impractical due to the high frequency, irregular nature of the SSC dataset, and no suitable time series data representing management actions currently exist. Consequently, SSC trends can imply—but not directly confirm—management effects. A different analytical approach, likely using annual data, would be required to formally link SSC changes to specific actions.

The SEV model, originally published in 1996 and widely cited, has undergone little rigorous validation. Studies that have attempted to test it show weak correlations between SEV scores and fish health (e.g., Smedley et al. 2011; Pilkerton et al. 2025). While SEV remains commonly used, future assessments should consider additional or complementary methods for evaluating SSC impacts on fish. Unlike SSC and SEV, a formal ATM trends analysis was not included in the 2022 Review because a similar ATM analysis was conducted by HRC (Lackey, 2021). The Mann Kendall test is widely accepted for non-parametric trend detection, but the infrequent (three year) ATM sampling limits its usefulness. Because watersheds rotate annually within HRC’s ownership, inter-annual variability is poorly captured, and low sampling frequency reduces statistical power. With the most recent data ending in 2023, results are also not well aligned with current conditions.

With the limitations discussed, staff acknowledge that recovery of sediment impaired watersheds require multiple decades to fully reveal. Monitoring data are nevertheless important for tracking trends and informing the adaptive management process.

Conclusion

The mainstem Elk River, North Fork Elk River above the confluence with the South Fork, and Bridge Creek all show statistically significant trends of decreasing SSC. The remaining four sites did not show any trends in these data. All ATM stations meet targets for riparian overstory and stream temperature targets, all stations meet at least three out of four pool targets, only one station meets the large woody debris target, and only one station meets the sediment grain size target. The SEV scores show a similar pattern to SSC trends in that five out of seven stations have no significant trends. While the mainstem Elk River shows a decrease in SSC, SEV results show a worsening trend. SEV is also calculated from exposure time so even with a decrease in concentrations, increased exposure time could increase SEV scores.

The only location that has a consistent result across all three analyses is Bridge Creek, tributary to the North Fork Elk River. Both SSC and SEV scores at Bridge Creek are decreasing, which indicates improvement in conditions. The nearest aquatic habitat monitoring station to Bridge Creek is station 162 on the middle North Fork above its confluence with Bridge Creek. Station 162 is the only location where bed surface, the category most related to sediment, is meeting the D50 target in addition to having coarsening trends in the D5 and D16 sediment grain sizes.

Overall, this data assessment has found that aside from the exceptions mentioned above, conditions are largely static. The evidence suggests that the WDR has been effective at limiting additional sediment supply or does not contribute to worsening in-stream; changes to the WDR are likely not needed at this time. However, continuing and potentially modifying monitoring requirements as noted in the 2022 Five-Year Staff Report is necessary especially in the absence of a coordinated science and monitoring workgroup. These data and their assessments remain important as the North Coast Water Board looks towards the 2031 TMDL evaluation.

Attachments

Name	Filename	Description
A	<i>Trend_Results_Data.xlsx</i>	Trend analysis results for SSC, ATM, and SEV, and formatted data for SSC and ATM.
B	<i>HRC_Continuous_2025.rds</i>	Binary file to be used in R, containing continuous flow, turbidity, SSC, and sediment load data for all stations and water years through 2025. These data are used in the SEV trend analysis.

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