HRC Elk River Stream Monitoring Program

Section 6.0 of the HRC ROWD (2015) details how HRC manages and maintains current sediment source inventories and provides schedule and timing for control of controllable sources. Section 7.0 describes how HRC proposes to monitor and report on forestry activities including timber and road management, restoration activities, and control of sediment sources. Section 8.0 provides an overview of HRC's watershed trends and effectiveness monitoring and reporting relative to water quality and aquatic habitat. Appendix F of the ROWD, referenced in Section8.0, provides a brief overview of HRC's current ***Class I Stream Aquatic Habitat Trends Monitoring (ATM)*** program, including recent changes approved by the HCP Wildlife Agencies, and also references HRC's ***Hydrology (Suspended Sediment, Turbidity, and Streamflow) Trends Monitoring*** program.

Unlike *effectiveness* monitoring, *trend* monitoring is not intended to evaluate specific management practices. Trend monitoring results may, over time, corroborate the findings of effectiveness monitoring, but are also strongly influenced and constrained by inherent and variable watershed conditions and processes, apart from management, including geology and geomorphology, topography, drainage area, vegetation, and climate. Due to improvements in timber harvest practices required by the California Forest Practice Rules and Humboldt Redwood Company's (HRC) multi-species Habitat Conservation Plan (HCP), recovery of aquatic habitat and water quality, where currently impaired, is expected to occur over time. HRC's ATM and Hydrology Trends monitoring programs are designed to test this hypothesis as they track stream and riparian trends over time. These programs, along with hillslope monitoring, also provide information useful to the refinement of the HCP NOAA Aquatic Properly Functioning Condition (APFC) matrix and a science based understanding of local environmental conditions.

The most recent HRC watershed trends monitoring reports pertaining to Elk River publicly available can be found on HRC's website at:

http://www.hrcllc.com/monitoring/aquatic-conditions/

HRC synthesizes the findings of hillslope and watershed trend and effectiveness monitoring periodically at approximately 10 year intervals as part of its HCP Watershed Analysis program. The most recent watershed analysis for Elk River was completed in 2014 and is referenced in the HRC ROWD. This *Elk River/Salmon Creek Watershed Analysis Revisited* (June 2014) report is available upon request.

Detailed information specific to the *Class I Stream Aquatic Trends* and *Hydrology Monitoring* programs pertaining to HRC's NCRWQCB Waste Discharge Requirements for Elk River is provided in the following program summaries. While these summaries describe current methods and monitoring site locations, maintaining reasonable flexibility in monitoring methods and locations over time is a necessity as new science, technologies, and critical questions evolve.

Class I Stream Aquatic Habitat Trends Monitoring

Program Overview

Long-term monitoring of fish-bearing (Class I) streams in Elk River was initiated with adoption of the Habitat Conservation Plan (HCP) in 1999 with the goal to collect data to determine if salmonid habitat conditions across the property meet, or are trending towards an *Aquatic Properly Functioning Condition* (APFC). Representative stream reaches included in the ATM program were chosen for a variety of factors that included access, distribution, gradient, percentage of HCP coverage in the watershed, and watershed interest. Over the years, some sites have been added, some removed, and some moved from their initial location to a nearby location in a specific sub-watershed to better meet sampling objectives. Appendix F of the ROWD documents the most recent changes to HRC's ATM program. The basic design of this monitoring program is to repeatedly measure the habitat characteristics of stream reaches within the portion of watersheds most likely utilized by anadromous salmon (≤4% gradient) (Montgomery and Buffington, 1998).

HRC's ATM program currently records the following elements to characterize current stream conditions:

- streambed substrate
- pools
- large woody debris (LWD)
- riparian and overstream canopy
- water temperature
- stream channel cross-sectional area

These habitat characteristics are measured over time to document trends in stream habitat condition over the 50-year period of the HCP (1999-2049) and improve understanding of inherent watershed characteristics and process. Data regarding the presence/absence and relative abundance of fish within each ATM reach is also being collected. Habitat conditions are currently assessed at 44 ATM sites property-wide distributed across eight major watersheds (watershed analysis units) on HRC's 209,000 acre Humboldt County ownership.

Seven (7) ATM stations will be monitored in the Elk River watershed in conjunction with HRC's HCP and NCRWQCB watershed-wide waste discharge requirements. The current location of these ATM stations is shown on the map included with this summary report. Basic information pertaining to these ATM stations is provided in Table 1.

Table 1. Elk River ATM stations

Station ID	Stream Name	Upstream Watershed Acreage	Township Range Section	Reach Gradient (%)	Channel Width (ft)	Elevation (ft)	Bedrock Terrain
104	South Branch NF Elk River	1,207	04N 01E 35	2.8	21	360	Yager Terrane
167	North Fork Elk River	7,230	04N 01E 34	2.1	48	262	Yager Terrane
162	North Fork Elk River	8,738	04N 01E 28	0.6	46	134	Yager Terrane/ Wildcat Group
214	North Fork Elk River	12,302	04N 01E 30	0.2	49	80	Wildcat Group
217	South Fork Elk River	4,030	03N 01E 3	1.6	29	510	Yager Terrane
175	South Fork Elk River	12,200	04N 01W 26	0.0	32	39	Holocene Alluvium/ Wildcat Group
166	Elk River	26,393	04N 01W 26	0.1	49	39	Holocene Alluvium/ Wildcat Group

Sampling Methods

HRC's Class I ATM program assesses the characteristics of the streambed substrate, pools, large woody debris, forest canopy over and adjacent to the stream, aquatic species assemblages, and water temperature. Each ATM site is a stream reach that is at least 30 channel widths long. The sampling length of most sites is approximately 200 to 400 meters (600 to 1200 feet) in length.

The location of each sampling reach is permanently benchmarked to facilitate repeated measurement. Table 2 lists the primary parameters reported in the Aquatic Trends Monitoring Program, and references HRC's detailed measurement protocols (Standard Operating Protocols) for collecting data.

Characteristic	Parameters	HRC Standard Operating Protocol
Channel dimensions	Channel gradient Channel width Cross-sectional area	*SOP 15 Aquatic trends monitoring site selection and documentation* *SOP-10 Basics of topographic surveying*
Particle size of the stream bed—*Surface*	Particle size (D_5) Particle size (D_{16}) Median particle size (D_{50}) Particle size (D_{85})	*SOP 13--Surface and Sub-surface Sediment Sampling*
Pool characteristics	Pool area (%) Pool spacing Residual pool depth (m) % Pools associated with wood	*SOP 14 Stream Habitat Typing*
Large woody debris characteristics	LWD frequency (# pieces/100 ft.) Total piece count	*SOP 33 LWD Recruitment (SOP Revisions In Progress)*
Water temperature	MWAT ˚C	*SOP-09 Temperature instrumentation and deployment*
Riparian overstory Canopy	% Canopy cover over the stream (mid-channel canopy cover) % Canopy cover in the riparian forest (Riparian overstory canopy cover)	*SOP-12 Stream and riparian canopy cover measurement*

Table 1. Parameters measured in the current aquatic trends monitoring surveys.

Channel Dimensions

Cross-sectional streambed surveys are conducted to determine streambed elevation and area changes over time (Figure 1). Adjustments in channel dimensions may be sensitive to sediment and LWD loading within the stream channel and are expected to be correlated to habitat type characteristics. Streambed profiles indicate changes in channel dimensions and streambed scour or fill. A Topcon Total Survey Station is the primary instrument used to measure the streambed topography. This instrument was first deployed in 2003 to increase accuracy and repeatability of streambed surveys that had previously been measured with an auto level. Permanent critical points are installed at each monitoring station as reference for the three-dimensional sampling grid encompassing the monitoring reach.

Each reach has a minimum of five benchmarked cross-sections, measured in years when habitats are surveyed. The cross-sections are measured at each change in topography across the channel and at the water surface elevation. Cross-sectional area is determined below a reference elevation. This elevation is typically set at a channel feature associated with bank-full depth.

Data processing has been streamlined with electronic data collection and transfer and with use of multiple validating, plotting, and processing programs. HRC has developed an Excel® spreadsheet to process the cross-section data from x, y, z coordinates into standard measurements in the x- z plane. Another spreadsheet computes channel area, width and depth.

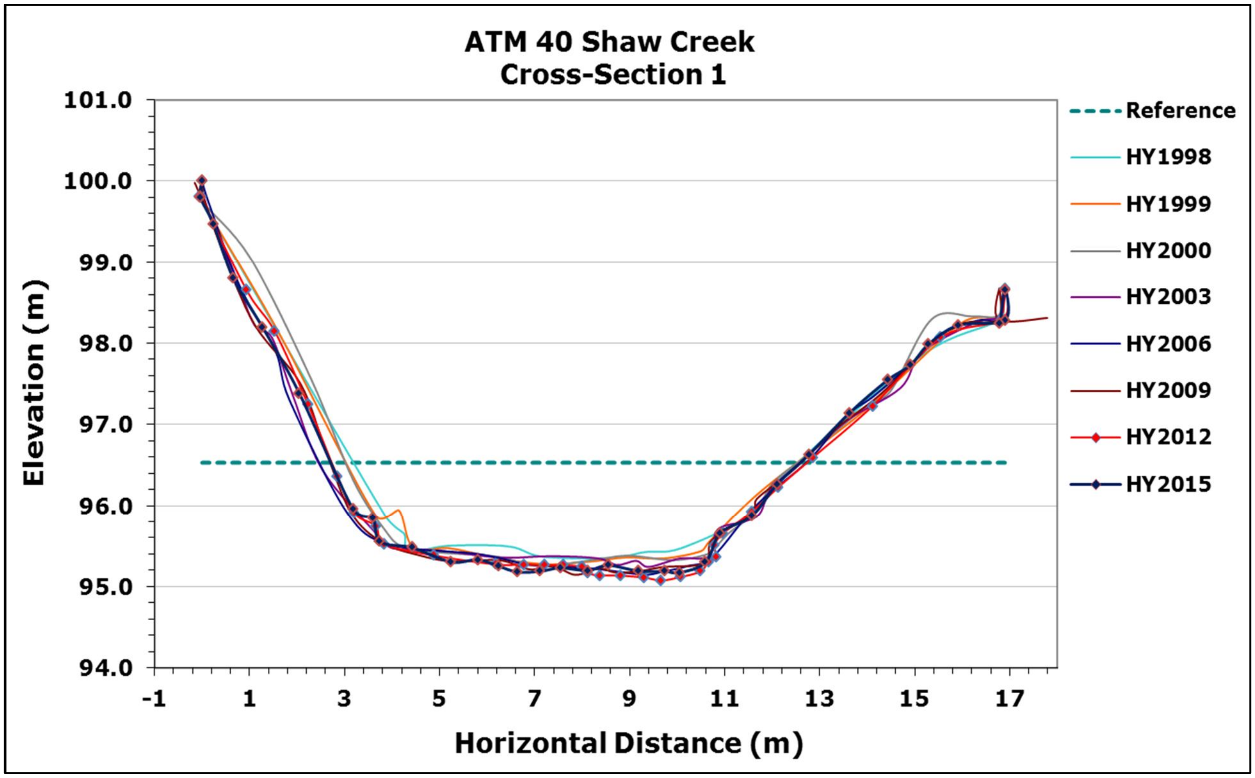


Figure 1. Example of a typical cross-sectional profile within an ATM survey reach (measured at Shaw Creek ATM Station 40)

Bed Surface Particle Size

Pebble count measurements collected at riffles are used to assess the APFC matrix target for D50 (diameter of the median [50th of 100] particle) and three additional size classes (D5, D16, D85). These sediment measures can be tracked over time to determine whether bedload sediments in a watercourse are generally becoming coarser or finer, in response to in-channel erosion and changes in sediment loading rates from hillslope sources including cumulative effects from management activities.

The first three riffles are sampled within each monitoring reach by transecting back and forth over the entire riffle within the active channel. The intermediate axis of 200 pebbles

Figure 2. Measuring particle size (mm) of the streambed surface.

is measured at each riffle (Figure). The median particle size is determined for each of the D_x class parameters, although APFC target values have only been established for the D_{50} class. Results are reported as mean values within the APFC report card, as well as cumulative particle size frequency plots (Figure 3), which serve to provide a visual aid for improved interpretation. Over time, it is expected that trends will develop that will suggest an overall fining or coarsening of the channel substrate towards APFC target values.

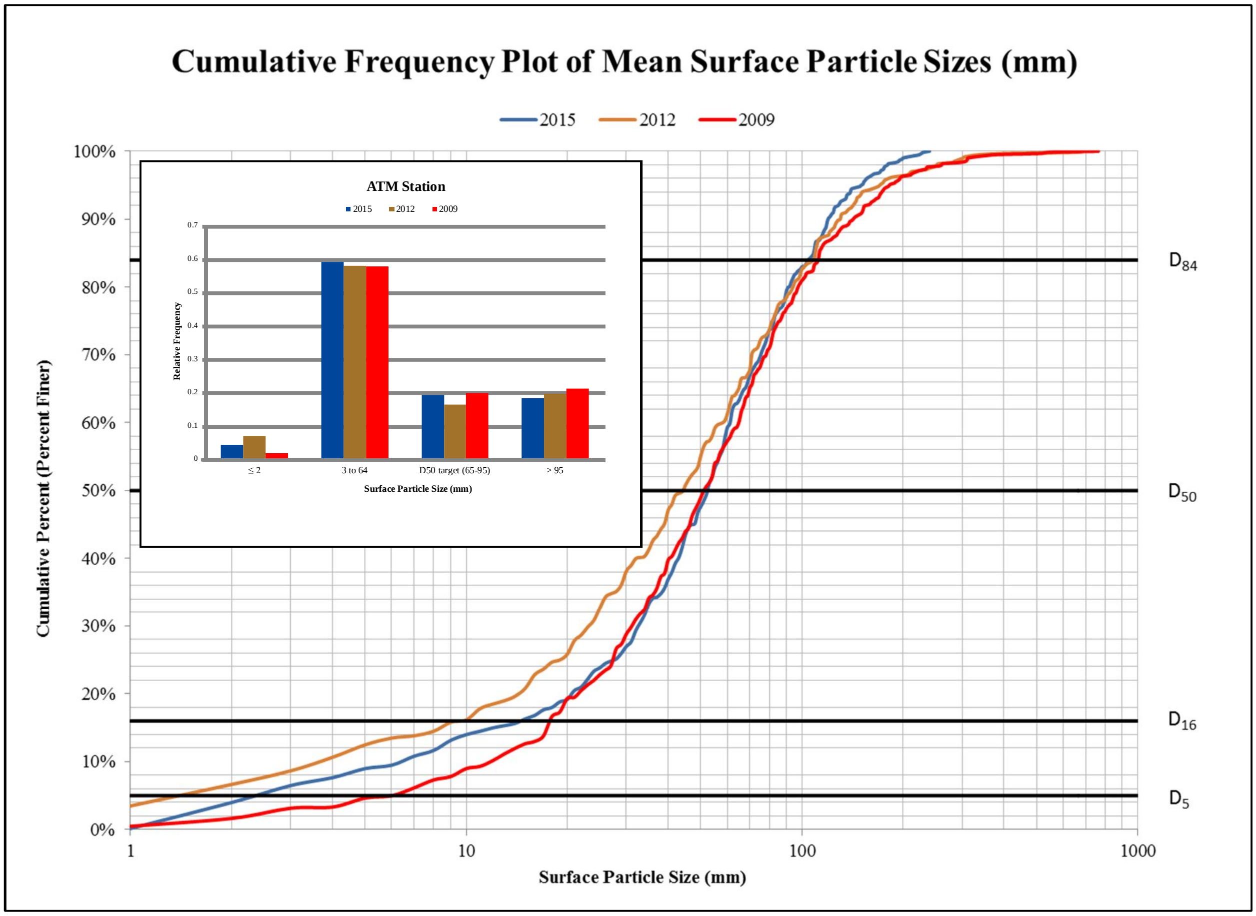


Figure 3. Example of a cumulative frequency plot of the mean surface particle sizes of three riffles measured within an ATM survey reach.

Large Woody Debris

Large Woody Debris (LWD) pieces within the bank-full stream channel are counted to determine the total piece frequency (#/100 feet) of large wood available for creating fish habitat and molding channel morphology. LWD data address APFC targets for number of pieces per 100 feet of stream. The percent of pools associated with LWD parameter will continue to be collected as part of pool habitat measurements.

Pools

The primary rearing habitat parameters measured in the Aquatic Trends Monitoring program are pool characteristics. HRC conducts habitat typing on stream reaches to assess the frequency (i.e., the percentage of channel length composed of pools), size, and depth of pools. Measurements are performed at each habitat unit in the sampling reach. Habitat units are broken down to pool, riffle, or flat-water categories. Basic physical measurements such as length, width and depth are taken and observations of LWD influence and substrate type are made.

Habitat typing addresses APFC matrix targets of pool-to-pool spacing based on bank-full width, percent of surface area comprised of pool habitat, number of pools associated with LWD, and average residual pool depth. Residual pool depth is equal to the difference between maximum depth and pool tail crest depth.

Figure 4. Redwood riparian forest overstory.

Riparian Overstory

Canopy cover measurements (percent) are used to document growth and/or stability of riparian forests, as well as to identify streams that may be subject to higher thermal loading from sunlight. Canopy cover

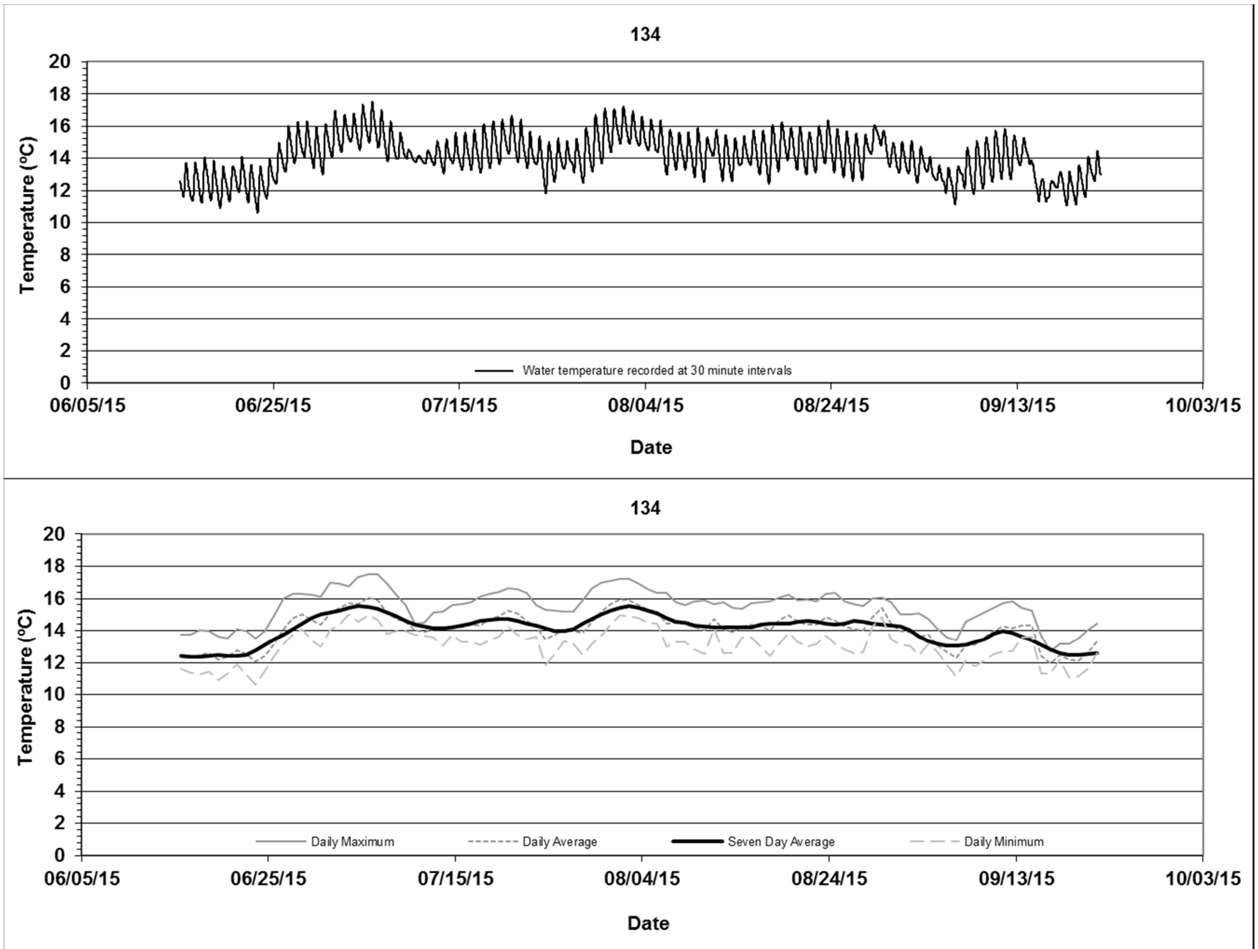
Figure 5. Pool habitat with overhead canopy.

addresses the APFC matrix target for overstory tree canopy closure within the riparian forest (**Error! Reference source not found.**) and at mid-channel (**Error! Reference source not found.**). The mid-channel canopy cover is measured as an influence of the forest on maintaining cool water temperatures. Stream canopy cover measurements are taken mid-channel at 25m intervals throughout the sampling reach using a concave densiometer. Methods for the canopy survey were changed in 2001 to align with criteria recommended by the APFC matrix. At this time, measurements of overstory canopy in the riparian forest on the floodplain adjacent to the channel were added to represent the general forest condition along the stream (riparian overstory canopy). Current surveys measure both riparian and overstream canopy characteristics. However, beginning in 2015, no riparian canopy measurements are required in stands where ≥85% riparian forest closure was documented in the prior ATM survey *unless* significant disturbance (i.e. timber harvest, blow down, landslide, high mortality, fire) is evident.

Water Temperature

Figure 6. Stream temperature logger with protective PVC case.

Stream temperature is tracked during the warmest part of the year (June through September). Temperature is monitored with continuous recording onset® HOBO® Water Temp Pro v2 Data Loggers. Temperature data loggers are inserted into protective PVC cases (**Error! Reference source not found.**) and placed in the stream at a location that meets requirements for sufficient mixing, adequate cover, and consistent flows during the summer months to ensure data integrity by reducing the likelihood of thermal stratification. Temperature data are used to calculate the Maximum Weekly Average Temperature (MWAT). This is the average of the daily mean temperature measured during the warmest seven consecutive days each year. The average of the daily maximum temperature during the same 7-day period is also calculated, but not routinely reported. The APFC target value for MWAT at all ATM stations is 16.8°C. Figure 7 illustrates a typical temperature profile as measured at ATM stations property wide.



Station: 134 Bear River					Water	Time Span	06/15/15	To	09/21/15	99 Days
Variable	ºC	ºF	Date			Variable	ºC	ºF	Date	
Minimum Temperature	10.61	51.11	06/23/15			Minimum Daily Change	0.70	1.25	07/10/15	
Average Temperature	14.08	57.35				Average Daily Change	2.45	4.40		
Maximum Temperature	17.53	63.56	07/05/15			Maximum Daily Change	3.49	6.27	07/24/15	
MWMT (with time span)	17.14	62.85	07/01/15	to	07/07/15	Notes: HOBO Pro U-22 SN#	2320565			
MWAT (with time span)	15.56	60.00	07/01/15	to	07/07/15					

Figure 7. Example temperature profile (measured at Bear River ATM Station 134).

Sampling Schedule

Substrate, pools, LWD, cross sectional area, and canopy conditions are surveyed at ATM sites three years relative with the exception of ATM site 104 (South Branch North Fork Elk River) where conditions been shown to be highly static and per agreement with the HCP Wildlife Agencies (CDFW, NOAA, USFWS) is surveyed once every 9 years. Water temperature monitoring (MWAT) and relative fish abundance and presence/absence surveys occur annually at each ATM site.

More frequent habitat sampling may be triggered by the occurrence of significant storms. Out of sequence sampling is triggered by the occurrence of a 10-year flood in either the Eel River or the Van Duzen River as measured at USGS gages at Scotia and Bridgeville, respectively. Monitoring may also be triggered by a 25-year recurrence precipitation event as recorded at National Weather Service weather stations at either Scotia or Eureka. Both of these flood and precipitation events were exceeded in Freshwater and Elk River in December 2002. These conditions have not been observed since 2002.

Quality Assurance

QA/QC activities have been implemented in the ATM program to varying degrees since 2002. Many of these activities are described within pertinent Watershed Operating Protocols.

All instruments and equipment used for sampling are routinely inspected and maintained. Any instrument repairs and/or calibrations are made either by the manufacturer or following manufacturer guidelines. Calibration of equipment is done on a regular schedule and upon any mishandling or questionable performance of the instrument.

Hydrology (Suspended Sediment, Turbidity, and Streamflow) Monitoring

Program Overview

Stage-discharge, turbidity, and suspended sediment trends data has been collected at a total of 16 different locations in the Elk River watershed since 2003 with 12 of these stations having a monitoring record of six years or more (HRC WA 2014, Section 6.4). This has provided a robust dataset for analysis of turbidity and suspended sediment trends throughout the watershed (Sullivan 2012). Stations have been activated and inactivated for various reasons over this period. Table 3 shows the nine (9) stations scheduled for continued trends monitoring in hydrologic year (HY) 2016. The location of these stations is shown on the map included with this summary report. Monitoring stations are well distributed across and downstream of HRC's ownership capturing variability in drainage area, land use activity, and geology.

Each year, raw and processed data have and will continue to be submitted to the North Coast Regional Water Quality Control Board.

Table 3. HRC Hydrology Monitoring Stations.

Location	Station ID	Basin Area (km^2)	Basin Area (mi^2)	Monitoring Record (WY)	Scheduled Status (next 10-year period)
Mainstem Elk River (metal Bridge)	509	111.53	43.06	2003-2016	Active
N. Fork Elk River	511	56.82	21.94	2003-2016	Active
N. Fork Elk River	532	35.03	13.53	2005-2016	Active
Bridge Creek (NF Elk Tributary)	517	5.71	2.20	2003-2016	Active
S. Fork Elk River	510	50.25	19.40	2003-2016	Active
Corrigan Creek (SF Elk Tributary)	522	4.33	1.67	2003-2011	Active
Little S. Fork Elk (SF Elk Tributary, Headwaters Forest)	534	3.03	1.17	2004-2015	Active[1]
Railroad Gulch - East Branch	683	1.46	0.56	2014-2016	Active[2]
Railroad Gulch - West Branch	684	1.28	0.49	2014-2016	Active[2]

[1] Station 534 (Reference Sub-basin) to be relocated downstream on the Little South Fork Elk River to capture greater control basin area. A new station ID number is to be established.

[2] To be active through completion of McCloud Shaw THP Effectiveness Monitoring Project (WY 2014-2019)

Methods: Hydrology Monitoring

Similar instrumentation (Table 4) and methodology (Table 5) is utilized for hydrology monitoring in Elk River in order to achieve common objectives (Table 6). At each hydrologic monitoring station, continuous stage (the height of the water in the stream above an arbitrary point) is recorded with a pressure transducer (Druck, General Electric Measurement and Control) that is mounted to the streambed and related to gage plates installed in the monitoring reach. Stream discharge is measured at a wide range of stages throughout the water year by applying standard methods involving the use of top-setting rods at established cross sections within each monitoring reach. Stage data from the pressure transducer is converted to streamflow (discharge, cms) by a stage-discharge rating curve that is developed for each station using stream discharge measurements (Figure X1).

Each hydrologic monitoring station in Elk River currently has a verified rating curve. A change in channel configuration, such as aggradation, scour or bank erosion may sufficiently change the stage vs. discharge relationship to warrant the construction of a new rating curve. New measurements that exhibit a poor relationship on existing rating curves usually indicate changing channel conditions. This situation is verified by annual cross-section measurements completed at the end of each hydrologic season. It is common for some scour or aggradation to occur within the discharge cross-section at most sites since they are “run of the river” and are not controlled by a weir or flume. Stations were originally selected to minimize change in the local reach. Most are sufficiently stable to allow the use of the same rating curve for many years. A few stations have been very unstable requiring considerable measurement each year, most notably Tom’s Gulch (station 533), East Branch Railroad Gulch (station 684), West Branch Railroad Gulch (station 683).

Continuous turbidity (nephelometric turbidity units, NTU) is recorded with a turbidimeter (DTS-12, Forest Technology Systems, Inc.) that is suspended in the stream at approximately 6/10 water depth (range of measurement = 0-~1600 NTU). This instrument is situated such that it can be raised or lowered as stage rises or falls. Both the pressure transducer and turbidimeter are wired to a datalogger (WaterLOG by YSI) that records stage and turbidity measurements at 15-minute intervals.

Automatic pump samplers (Teledyne ISCO Technologies Inc.) are located at each station that collect stream samples during storm events. A program is loaded into the data logger (WaterLOG by YSI, Inc.) that triggers the ISCO sampler to begin sampling based on a user-specified rise in stage within a 15-minute interval. The program runs in 2 segments (an A program and B program segment) that specifies how many bottles to fill during each program segment. The objective is for samplers to pump on the rising (A program) and falling stage limb of the storm hydrograph (B program). Sampling intervals may be varied through the season based on completion of various project objectives.

Depth-integrated point samples are collected across the range of flows and submitted for lab analyses of turbidity and suspended sediment concentration. These samples are used to validate ISCO samples that are collected at one point in the water column. Grab samples are also collected and submitted for lab analysis of turbidity only. Grab samples are used to compare with the turbidimeter data for calibration of the field and lab turbidity instruments.

Stream samples in the ISCO samplers are collected within 1 week following sampling and submitted to the HRC laboratory for analysis of suspended sediment concentration. Samples are processed in the HRC sediment laboratory where turbidity (NTU) is measured with a HACH 2100N bench turbidimeter (range of measurement = 0-2000 NTU) and total suspended sediment (SSC, mg/L) is determined through vacuum filtration. Lab turbidity data are used to re-construct periods of erratic field turbidity and to troubleshoot outliers in field turbidity vs SSC regression models used to calculate sediment loads.

Each storm that occurs during the water year is assigned a unique ID that is based on order of occurrence (i.e. 1401, 1402, 1403…). Unique relationships between turbidity and SSC are oftentimes observed across different storm events due to seasonal timing, differences in event magnitude, and fluctuation of source materials. In order to derive an annual estimate of concentration that reflects dynamic, storm-based relationships, the monitoring record for the entire water year is divided into distinct segments that bracket each storm event in which sampling occurred. Segment ID's are assigned that match the unique ID of the storm event they include (i.e. 1401, 1402, 1403…). Each segment includes the duration of the storm as well as the inter-storm period leading up to the next storm event. The portion of the water year each segment represents will vary temporally according to storm and inter-storm duration. If sampling does not occur during a designated storm or storms, that time period is grouped into the previous segment. For example, if sampling did not occur during Storms 1411 through 1414, the range of data through that set of events would be included in Segment 1410.

Regression models are developed for each segment using field turbidity and SSC relationships measured in samples collected during the storm event. Model equations derived from these regressions are applied to field turbidity data in order to estimate instantaneous SSC. SSC is multiplied by discharge in order to estimate an instantaneous sediment load for each measurement interval. The summation of each instantaneous load value equals the total sediment load for each segment. The summation of each segment load equals the annual sediment load for each sub-basin, to be expressed in totality (Mg) or per unit watershed area (Mg/km^2). This is known as the "sum of storms" method.

Precipitation is measured within each sub-basin throughout the Elk River watershed (n = 6) using tipping bucket rainfall gages (Texas Electronics) which are maintained at locations near the top and bottom of each sub-basin as shown in Figure 8.

Data in the continuous records is corrected as needed to remove outliers or spikes that appear to be anomalies of the data collection process. See Figure X2 for an example of a corrected data set. Missing data is filled using a variety of techniques at the discretion of the data processor. Data may be filled from physically measured data, interpolated between recorded data, or reconstructed from another site best matched to that site. It is HRC's norm to inspect every data record and to not leave any gaps in the continuous file between the official dates of operation for the season.

Each 15-minute turbidity and depth record has a 3 digit quality code added to the data set. The first digit codes the status of the original data, the second digit indicates the method of correction, if any, and the third digit indicates the data manager's confidence in the final data value. A code of 111 indicates original data with no corrections. In our current coding system, a value of 432 would probably be assigned to most of the repaired spikes shown in Figure 8 (a correction is apparent when the raw data value, e,g. tan for turbidity, does not match the validated value, brown). This code indicates, instrument fouling, fixed by interpolation, with good confidence.

When the turbidity value can be adjusted by a physical sample collected at the same time, it is rated '481', indicating fouling, filled by direct physical measurement, with confidence equal to original data. The data quality codes remain with the intermediate and final data sets and should be utilized by anyone using HRC data to appropriately evaluate any interpretations in consideration of whether they arise from original or corrected data.

Table 4. Standard Watershed Operating Protocols describing field and laboratory methods used in hydrology station monitoring.

Number	Title	Current Version	Description
SWOP-01	Hydrologic Site Selection, Monumenting and Documentation	2.3	Establishing and documenting a permanent monitoring station.
SWOP-02	Gaging Streams for Estimating Discharge	3	Installing a staff plate, measuring streamflow, constructing a stage-discharge rating curve.
SWOP-03	Instrumentation Methodology	1.2	Turbidimeters, water samplers, pressure transducers, and rain gauge manuals
SWOP-04	Water Quality Grab Sampling and Field Turbidity Measurement	2.1	Depth-integratred sampling methods and portable turbidimeter manual
SWOP-57	Laboratory analysis of suspended sediment using electronic data collection methods	4.3	Turbidity and sediment concentration laboratory measurement.
SWOP-19	Establishing and maintaining the physical infrastructure of a hydrologic monitoring station	1.1	Hydrologic monitoring station set-up.

Table 5. Equipment used in the field and laboratory for hydrologic monitoring and inspection schedule.

Equipment/Model No.	**Instrument Accuracy**	**Inspection Frequency**	**Type of Inspection**	**Inspector**
Water Logger Data Logger (by Design Analysis)	NA	Weekly	Check data download	Field crew
Marsh-McBirney Flo-mate 2000	Range: -0.15 – 6 m/s Zero Stability: ± 0.15 m/s Accuracy: ± 2% reading + zero stability	Each use	Proper operation	Field crew
ISCO Automated Pump Sampler, Model 6100 or 6712	NA	Weekly, or within 48 hours after significant storm event	Proper operation	Field crew
DTS-12 turbidimeter	Range: 0-1600 NTU Zero offset: ± 0.2 NTU Accuracy: ± 2% 0 to 500, ±4% 501-1600 Temp: ±0.20^{o}C	Weekly	Proper operation	Field crew
Druck Pressure Transducer Model 1830-8388	Range 75 mbar to 60 bar Accuracy: ± 0.1%	Weekly	Check data logger and check with staff plate	Field crew
HACH 2100N Lab Turbidimeter	Range: 0-4000 NTU Accuracy: <100 NTU ± 2% 100-4000 ± 5%	Daily, when used	Calibration Proper operation	Lab leader
Denver Instruments APX-100 Analytical Balance	Range: 0.0001 to 100.0 g Accuracy: ± 0.0001 g	Daily, when used	Weigh check weights	Lab leader
XP-3000 Top-loading Balance	Range: 0.1 to 1000.0 grams Accuracy: ±0.1 g	Daily, when used	Weigh check weights	Lab Leader
Lab Oven	Accuracy: 1^{o}C	Each use	Proper operation	Lab leader
Vacuum Apparatus	NA	Each use	Proper operation	Lab leader

Table 6. Annual data objectives for hydrologic monitoring sites.

Data Objective	Measurement Objective
Achieve a complete record of flow	Maintain a complete discharge record: water level record >95% complete Complete discharge measurements over a range of flow from low flow to bankfull— 15+ viable measurements well distributed over the range of observed flows.
Achieve a reasonably complete record of sediment discharge	Maintain a complete turbidimeters record: >95% operative through season
Achieve a reasonably accurate estimate of the annual load of suspended sediment	Complete sufficient manual SSC samples well distributed over the range of observed flows and throughout the winter season to determine sediment rating curve: 150+
Complete sample of storm events	Continuous samplers operative for largest 90% of storms

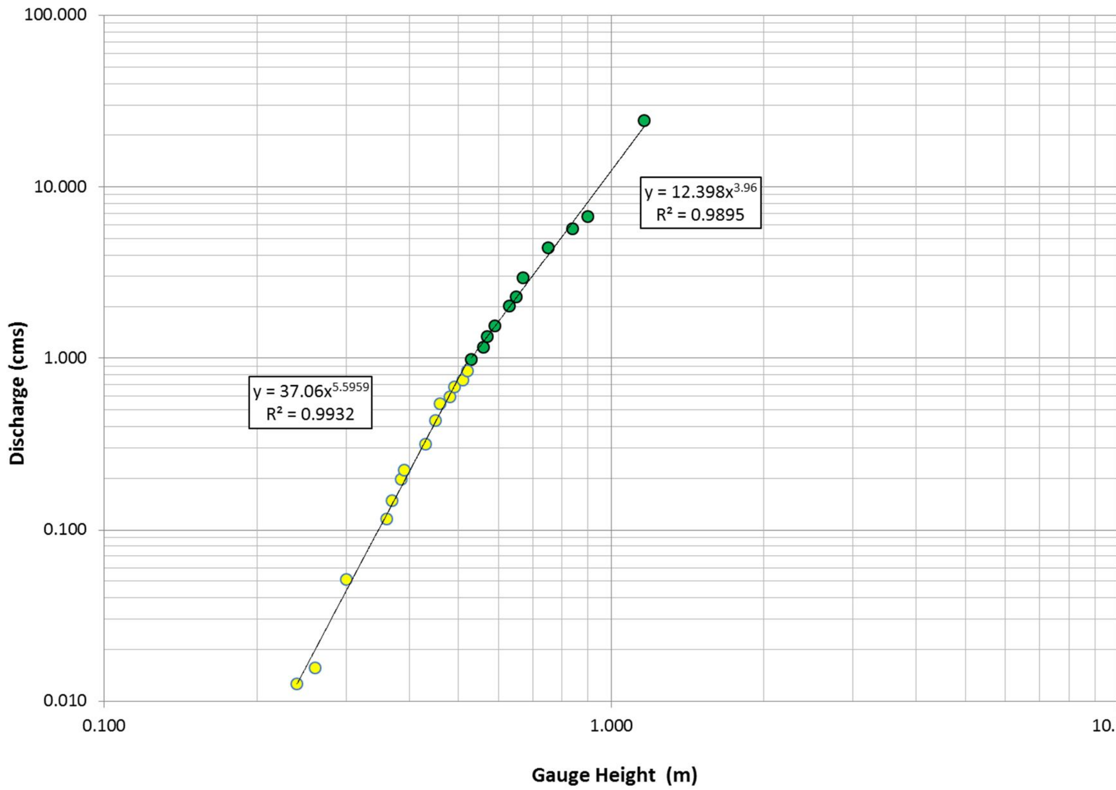


Figure X1. Example of a stage vs. discharge rating curve from the Upper North Fork Elk River (station 532). Yellow dots represent low-flow data and green dots represent high-flow data. A segment break was identified at 0.65m.

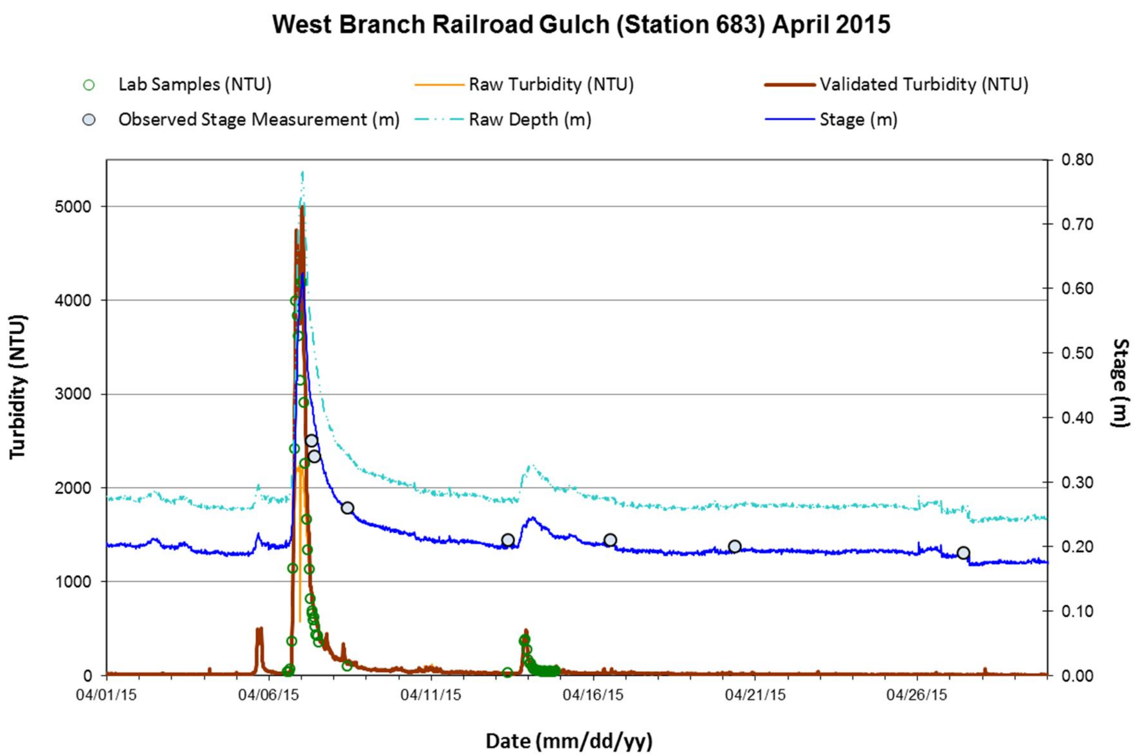


Figure X2. Example corrected hydrologic data garnered from West Branch Railroad Gulch (station 683).