Water Quality 101: Turbidity: "I Can See Clearly Now…or Not"

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There is no doubt that the rains have come back home to roost on the southern Oregon Coast. We wake up to dark mornings and wet commutes, and now only the slugs and fish are content to travel in this wet certainty. Within our watersheds, a rain induced seasonal renewal is swelling the creeks and rivers to a whole new flow process, as the watersheds receive the increased rainfall. Uplands are irrigated, groundwater reserves are filled, and all the excess drains into the tributaries, creeks, rivers, and reservoirs; and with it comes all of the soil erosion, waste discharge, urban runoff and re-suspended organic matter from the increased flow rates that boost turbidity measurements.

Turbidity refers to how clear the water is. The greater the amount of total suspended solids (TSS) in the water, the murkier it appears and the higher the measured turbidity. If you are sitting along a stream side on a clear summer day, you should be able to see the bottom of the creek. That's low turbidity. On the other hand, if you visit the stream after a November rainstorm when all the muck has been stirred up, you won't be able to see the bottom; that's high turbidity. The Tribe's land Resources and Environmental Services' (LRES) water quality staff use turbidity measurements to calculate the inputs from erosion and nutrients.

LRES staff measure turbidity using a turbidimeter, which estimates how light is scattered by suspended particulate material in a sample of water. Turbidity measurements are recorded in Nephelometric Turbidity Units or NTU's. The turbidimeter, has a photocell (similar to the one on your camera) set at 90 degrees to the direction of the light beam to estimate *scattered* rather than absorbed light. This measurement generally provides a very good correlation with the concentration of particles in the water that affect clarity.

High concentrations of particulate matter can modify light penetration, cause shallow lakes and bays to fill in faster, and smother benthic (substrate bottom) habitats - impacting both organisms and eggs. As particles of silt, clay, and other organic matter settle on the bottom, they can suffocate newly hatched larvae and fill in spaces between rocks which could have been used by aquatic organisms as habitat. Fine particulate material also can clog or damage sensitive gill structures, decrease organism resistance to disease, prevent proper egg and larval development, and potentially interfere with feeding activities. If light penetration is reduced significantly, plant growth may be decreased which would in turn impact the organisms dependent upon them for food and cover. Reduced photosynthesis can also result in a lower daytime release of oxygen into the water.

Turbidity also has an affect on water temperature, as suspended particles absorb heat from sunlight, the surrounding water environment also heats up; and if you

remember from our previous Water Quality 101 articles, warm water holds less dissolved oxygen than cooler water.

Very high levels of turbidity for a short period of time may not be significant and may even be less of a problem than a lower level that persists longer. Adverse impacts of turbidity on aquatic organisms are proportionally related to the amount of time that suspended particles remain in the waterbody. That is, the longer the water remains murky, from hours to days to months, the greater the adverse impacts are to aquatic organisms.

Here on the Southern Oregon Coast, our river basins are naturally prone to sediment production, due to the interplay of terrain, geology, and precipitation. Heavy seasonal rainfall combined with steep, thinly soiled slopes on unstable bedrock leaves the drainage highly susceptible to earthflows, debris slides, erosion, and flash flooding. This is even more so for newly disturbed sites where the vegetation has been stripped away and soils are exposed to direct rainfall. Timber harvesting, road building, urban construction, and over grazing all have a tendency to overly expose soils to rainwater runoff; which then carries sediment, fertilizers, bacteria, and potential toxins into the water ways. High turbidity rates are not caused by sediment production alone, algal densities, among other impacts, can also raise turbidity levels.

The Tribe protects forest water quality from excessive sediment input by retaining adequate forest buffers on either side of a stream. Some research suggests that 150 ft of forest buffer per side is adequate to protect streams from sediment input; the Tribe follows the 220 ft of buffers per side for non-fish bearing and 440 ft per side for fish bearing streams; in accordance to the Federal Northwest Forest Plan, to manage for water quality and habitat.

Pollution tends to reduce water clarity. Watershed development and poor land use practices cause increases in erosion, organic matter, and nutrients, all of which cause increases in suspended particulates and algae growth. Turbidity measurements can be used to corroborate nonpoint source pollution inputs into Tribal waters; and when measured up to a water quality standard these measurements can demonstrate a direct violation of the Clean Water Act, where appropriate mitigation actions can be taken. Turbidity is another parameter or condition of a waterbody which assists the Tribe in actively protecting the land.