



Specific Conductance in Streams *Resource Brief*

Importance

One of the most defining characteristics of a body of water is whether it's freshwater, saltwater, or a mix of both (brackish water). Many people recognize this as salinity, a measure of dissolved salts (of many different types) that effect water and the life that lives in it. Salts, when dissolved in water, break apart into ions that can be detected by measuring the capacity of water to conduct electricity. Corrected for temperature, this measure is called specific conductance. Specific conductance is often used to determine water salinity.

Freshwater streams are generally characterized by low specific conductance (S.C.) levels. Background levels of S.C. may be raised by natural weathering of rocks and minerals, atmospheric deposition of materials, and flow from contaminated groundwater. But extended periods or spikes of specific conductance in a freshwater environment (depending on their source) can be particularly damaging for aquatic organisms, wildlife, and their habitats.

In the freshwater streams of national parks in the National Capital Region (NCR), many streams show increasing trends



Salt build up on rocks in winter at Minnehaha Creek, GWMP.

Photo: NPS/Watts

in specific conductance. One of the most likely contributing factors is runoff from applications of salt (sodium chloride) to roadways and sidewalks during winter storms. Development has also increased the amount of hardened (impervious) surfaces including buildings themselves, which accelerate storm water runoff into nearby streams.

Specific conductance is a high concern because there is no natural process that breaks down chloride salts; therefore they cannot be removed from the environment, only diluted.

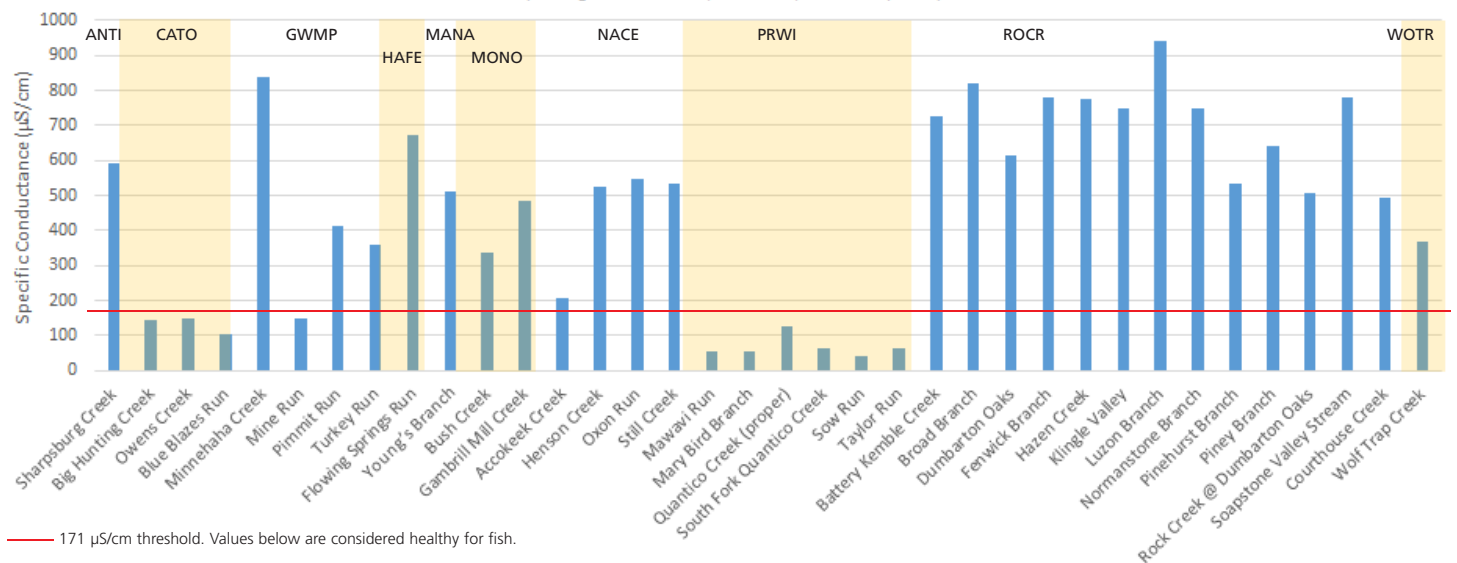
Monitoring

The National Capital Region Network, Inventory & Monitoring (NCRN I&M) program tracks the condition of 36 freshwater streams throughout NCR national parks. We look at many different chemical parameters, but here focus on specific conductance. We analyzed data gathered between June 2005 to October 2015 (monthly until October 2013, quarterly thereafter) which shows monthly and seasonal patterns in water quality and quantity. Measurements were compared against specific

Figure 1.

NCR Stream Specific Conductance

(Average value within 6/2005 to 10/2015 time period)



— 171 µS/cm threshold. Values below are considered healthy for fish.

PARK ACRONYMS

ANTI = Antietam National Battlefield
CATO = Catocin Mountain Park
GWMP = George Washington Memorial Parkway

HAFE = Harpers Ferry National Historical Park
MANA = Manassas National Battlefield Park
MONO = Monocacy National Battlefield
NACE = National Capital Parks - East

PRWI = Prince William Forest Park
ROCR = Rock Creek Park
WOTR = Wolf Trap National Park for the Performing Arts



conductance thresholds for aquatic organism health determined by the Maryland Biological Stream Survey (Morgan et al. 2007) of levels below $<247 \mu\text{S}/\text{cm}$ as optimal for macroinvertebrates health and below $<171 \mu\text{S}/\text{cm}$ for fish health.

Results

We calculated the average specific conductance for each of the 36 streams we monitor from June 2005 through October 2015 (Figure 1). Typically, the peak measurements of specific conductance occur in the winter months while the lowest measurements are usually seen during the summer. Out of the 36 streams that the NCRN I&M program is responsible for monitoring, only ten hold average specific conductance readings below the $171 \mu\text{S}/\text{cm}$ threshold for fish health. These ten streams are in: CATO, GWMP, and PRWI. Within CATO and PRWI, all of the streams we monitor had an average specific conductance below the threshold; however, only Mine Run in GWMP, met that criterion. This still leaves 26 different streams in eight other parks that on average have exceeded the preferred maximum specific conductance for fish health over the past 10 years. Most of these 26 maintain a specific conductance level year round that exceeds the threshold. Even those that do not, such as Accokeek Creek, only contained levels below $171 \mu\text{S}/\text{cm}$ for a month or two during certain years, and still average above the threshold overall.

None of the streams in the region showed declining levels of specific conductance. All showed steady or increasing levels, with some streams showing specific conductance rates increasing more dramatically than others (Figure 2). For the 19 streams without an increasing trend, 13 are already at average levels exceeding the $171 \mu\text{S}/\text{cm}$ threshold. Of the remaining 17 streams that did show an increasing trend, only four currently

average below the threshold: Big Hunting Creek (CATO), Owens Creek (CATO), Mine Run (GWMP), and Mawavi Run (PRWI). These four streams, along with five others, are increasing at a more moderate rate, between two and ten $\mu\text{S}/\text{cm}$ per year. There are eight streams experiencing a steeper rate of increase, between 18 and $37 \mu\text{S}/\text{cm}$ per year, which are focused between just two different parks: Rock Creek Park and Greenbelt Park (Still Creek) in National Capital Parks - East. A large reason for this is likely the enormous amount of development that is concentrated around these two parks. Each is not only located near at least one major roadway, but is also entirely surrounded by non-forested regions or communities.

Future Study

In October 2012, NCRN began a pilot monitoring project in 7 streams using continuous logging devices that take measurements every 15 minutes. These instruments log both water temperature and conductivity (a non-temperature-corrected version of specific conductance) which are then used to calculate specific conductance. This continuous data may better allow us to detect short duration spikes in specific conductance related to stormwater runoff, road treatment, and intentional or unintentional pollutant discharges.

More Information

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Figure 2.

Annual Rate of Specific Conductance Increase by Stream

(Average value within 6/2005 to 10/2015 time period)

