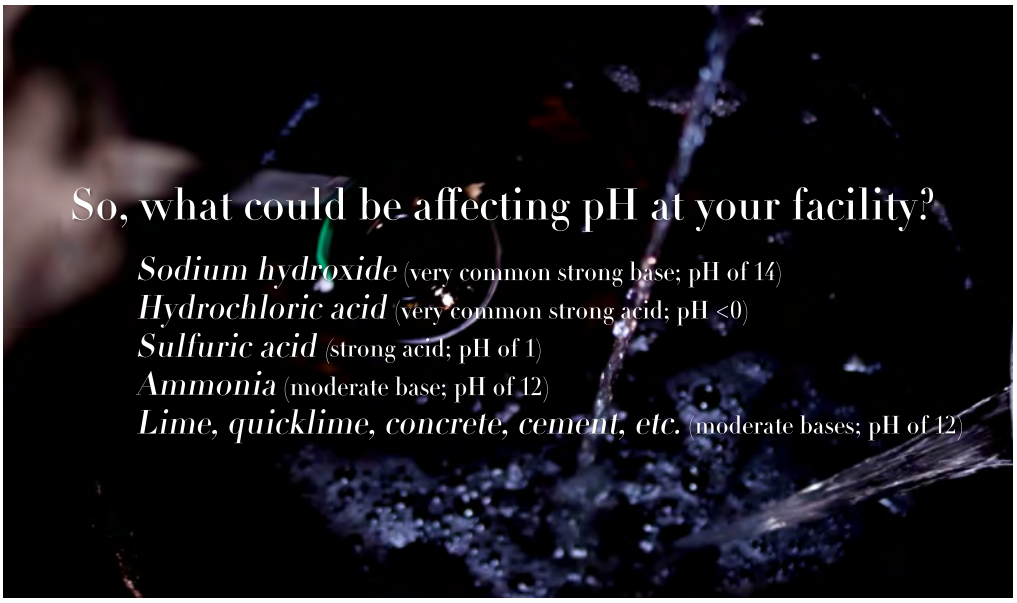
$$pH = -\log_{10}(H+)$$

The term pH – literally meaning *"potential of hydrogen"* – while it may trick you into thinking it's an element on the periodic table, pH is actually not an element or substance but a condition. It is a unit of measurement of hydrogen concentration in water—more specifically, the negative logarithm of hydrogen ion (H+) concentration in an aqueous solution (a liquid where water is the solvent). ***Oh, I'm sure that cleared it up for you!*** Well, in this month's edition of **The Rain Events,** we're going to be diving into what is pH, but we'll keep it a little more pragmatic with why it's important to monitor, and how to properly calibrate your pH meter for sampling.

What Is pH? pH measures the basicity or acidity of a solution on a scale of 0 to 14, with a pH 7 being neutral. As the concentration of H+ ions in a solution increases, acidity increases and pH gets lower (dropping below 7). As H+ ions decrease, pH levels increase which makes the solution's basicity increase (which is also referred to as caustic or alkaline). The pH scale is logarithmic, which means each whole pH value below 7 is ten times more acidic than the higher value. For example, pH 5 is ten times more acidic than pH 6 and 100 times (10 times 10) more acidic than pH 7. It is also true for pH values above 7, each of which is ten times more basic than the next lower whole value. For example, pH 9 is ten times more basic than pH 8 and 100 times (10 times 10) more basic than pH 7. Pure water is neutral, but when chemicals or pollutants are mixed with water, the water mixture can become either acidic or basic. Such is the case when storm water comes into contact with ammonia, sulfur, battery acids, lime, cement, wet or fresh concrete, and other pollutants. This mixing can happen on the ground with runoff, or can happen in the atmosphere with air pollutants, which is how we get "acid rain". When acid rain or pH impacted storm water runoff collects in streams and ponds, the pH of that water body is changed. According to the U.S. EPA, *"pH affects most chemical and biological processes in water. It is one of the most important environmental factors limiting species distributions in aquatic habitats. Different species flourish within different ranges of pH, with the optima for most aquatic organisms falling between pH 6.5-8. U.S. EPA water quality criteria for pH in freshwater suggest a range of 6.5 to 9. Fluctuating pH or sustained pH outside this range physiologically stresses many species and can result in decreased reproduction, decreased growth, disease or death. This can ultimately lead to reduced biological diversity in streams."*[1] In accordance with the Industrial General Permit (IGP), a Numeric Action Level (NAL) exceedance for pH at industrial facilities is below 6.0 and above 9.0. Even slight pH changes in streams harm fish, especially sensitive juvenile fish and other organisms, so in storm water applications, prevention is the key. It is usually much easier to prevent pollutants from coming into contact with storm water than to try to adjust the pH of the runoff.



What instruments are acceptable for pH testing? According to the IGP, dischargers who have never entered Level 1 are *"eligible to screen for pH using wide range litmus pH paper or*

other equivalent pH test kits. The pH screen shall be performed as soon as practicable, but no later than 15 minutes after the sample is collected." But for dischargers that are Level 1 and above, a calibrated pH meter is required for pH sampling.

What does the Industrial General Permit say about testing for pH? According to the IGP, *"Dischargers using a calibrated portable instrument for pH shall ensure that all field measurements are conducted in accordance with the accompanying manufacturer's instructions."* (IGP Section 11.C.2.d) So be sure you are familiar with how your device should be operated. NOTE: pH sampling is to be performed as soon as possible, but a 15 minute sampling window is allowed for pH monitoring. Using a pH meter / pen is quick and easy and generally gives very accurate readings. The field instrument must be calibrated every day prior to use since the device's calibration can easily drift without the user being aware of it. Devices such as pH meters have electrodes and sophisticated electronics that need to be calibrated to a known value. This is typically done by a three-point calibration process using pH buffers 4.01, 7.0, and 10.01 (some meters only require a 1 or 2 point calibration process, but we've found that a three point process produces more accurate readings). Along with properly calibrating your pH meter, ***the IGP requires calibration records to be maintained for 5 years.*** So don't forget to document everything!

In light of the importance of accurate calibration and record keeping, let's take a quick refresher course on the calibration process for pH meters. But before starting, be sure you are working with devices that are in good working condition – if you need to buy a new device entirely, check out our favorite meters (Hanna or Oakton). *PS – we highly recommend that those who will be measuring pH in the field, be properly trained on how to calibrate pH meters, how to keep accurate records, and how to properly sample for pH.*

Calibration Tutorial: Calibration for pH meters should occur before the first use of the day (you don't have to re-calibrate between uses, once a day is fine). Calibrating pH meters is a fairly simple process which only takes a couple minutes. It's always a good idea to wear gloves when calibrating your device since you don't know where it was used last and what type of pollutants it came in contact with. Before calibrating your pH meter, give the electrode (glass bulb) a quick rinse in deionized water (if you have it, but we have found tap water doesn't adversely affect the instrument). Shake the meter to remove excess water, press the calibration button and place device into the first of the three buffers and give it a little stir and let it sit in the buffer for 1-2 minutes – typically it is best to start with the 4 and 10 buffers and end with the 7. You may notice the reading fluctuating for the first several minutes, but once the reading has stabilized after a couple minutes, go ahead and press "enter" to calibrate the device to that buffer (or follow the manufacturer instructions for your particular device). After the device is calibrated to the first buffer, give the meter a quick rinse before repeating the same steps with the remaining two buffers. Be sure to rinse the meter between buffers and to properly document the calibration readings in the pH calibration log *(if you need a form for calibration logging, you can find the one we use and recommend, attached at the end of the newsletter)*. NOTE: Buffer can be re-used and is fairly stable, but change it when it looks cloudy or contaminated. We like using smaller disposable cups to calibrate our devices. These use less buffer solution while still allowing the electrode to be completely covered by the buffer. To store the device between uses, we recommend keeping the electrode from drying out by dampening a small piece of paper towel with tap water and placing that it inside the device cap before putting the cap back on the device. This will help extend the life of your pH meter.

Is it OK to use deionized water with my pH meter? That all depends on what you use it for. You are allowed to use deionized water as a quick rinse when using the meter in the field, but not for storage. It actually makes an excellent rinse water, because the deionized water will want to grab ions away from the surface of the detector bulb and thus "scrub" away ions that could affect the pH of the next reading. However, because of this same property, you should never store the pH bulb in deionized water. Over an extended period of exposure, the deionized water will strip away ions within the bulb and affect the operation of the unit. Many manufactures allow you to rinse with tap water both in the field and while calibrating the device. Some manufactures will provide a rinse solution with the buffer pack to use in the field. We recommend filling a spray-bottle with deionized water for rinsing in the field or using a jar with a lid containing deionized or tap water into which you can dip, swirl, and clean off the probe. For particularly contaminated or dirty bulbs, a soft-bristled toothbrush can also be used to lightly scrub away scum that is clinging to the bulb.

Tips & Tricks:

- Make sure your calibration buffers are the ones recommended for your device and check that they are not expired.
- Don't use deionized water on the electrode of your device before storage, since it can affect the electrode sensitivity.
- Use this pH logarithmic online calculator to help you compute pH averages.
- Measuring pH in flowing water (instead of in a sample bottle) is the best way to get accurate and representative results.

[1] EPA CADDIS Volume 2 https://www.epa.gov/caddis-vol2/caddis-volume-2-sources-stressors-responses-ph

The Rain Events

Lead Editor: John Teravskis
QSD/QSP, QISP, CPESC, ToR, IGPTT Participant
jteravskis@wgr-sw.com
(209) 334-5363 ext. 110 or (209) 649-0877

Supporting Editors:
Aaron Ortiz, QISP, ToR, aortiz@wgr-sw.com
(209) 334-5363 ext. 114

Chelsea Dreyer, QISP, cdreyer@wgr-sw.com
(562) 799-8510 ext. 1003

pH Meter Calibration Log

Date	Time	Name of Person Calibrating	Initials	Meter ID	Measurement pH 4.01 Buffer	Measurement pH 7 Buffer	Measurement pH 10 Buffer	Comments:

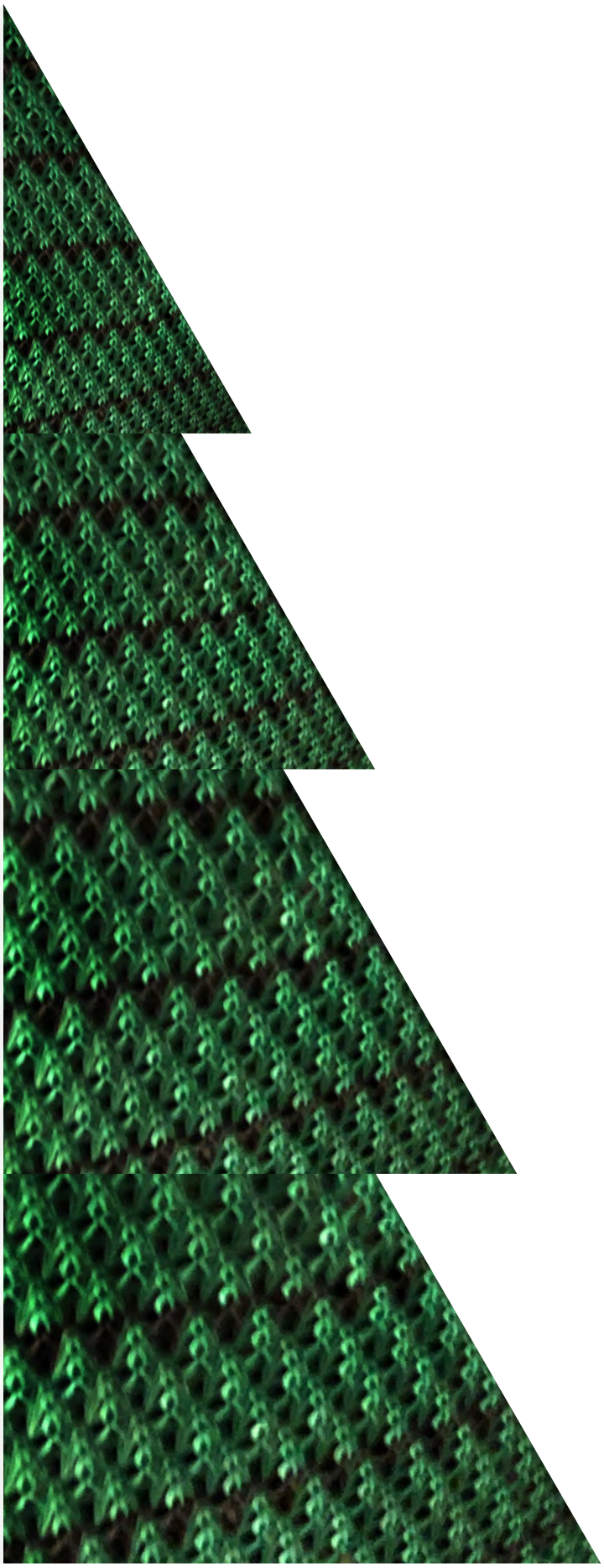

ALL IS CALM
& all is bright
wishing you the merriest christmas & a happy
new year! may your holiday season
be filled with peace and light.
isaiah 9:2

LET IT RAIN

LET IT RAIN, LET IT RAIN.

Deck your site with festive and effective BMPs for the holiday season!

bmpoutlet.com



WATERTECTONICS

YOUR PARTNER IN

ADVANCED STORMWATER TREATMENT TECHNOLOGY

- ☑ DESIGN
- ☑ INSTALLATION
- ☑ EQUIPMENT
- ☑ FIELD SERVICE

TSS | Metals | pH | Bacteria | Oil | PFAS

WWW.WATERTECTONICS.COM

contactme@watertectonics.com | (425) 349-4200

CA 1072749 • MT 261269 • WA WATERI*002NN

stormwater HOLIDAY GIFT GUIDE

Need Christmas shopping ideas? Check out these awesome finds!

1. Waterproof Rainslicker Jacket - HIS & HERS
2. WGR's Customizable Storm Water Inspection App (contact jteravskis@wgr-sw.com for more information)
3. Frogg Toggs Water-Resistant Pants - HIS & HERS
4. Free Storm Water Newsletter Subscriptions
5. FORGE - Online Learning Subscription
6. Flannel Lined Work Jeans - HIS & HERS
7. Rain Boots - HIS & HERS
8. Bullard 4 Point Pinlock Suspension Hard Hat
9. Leather Briefcase - HIS & HERS
10. Company Logo Blazer - HIS & HERS
11. Water/Tea/Cold Brew Coffee Insulated Infuser Bottle
12. Safety Vest
13. Fleece Lined Flannel Shirt - HIS & HERS
14. pH Meter
15. Rite In The Rain Waterproof Notebook and Pen
16. Deerskin Work Gloves
17. HydroFlask Insulated Coffee Mug

Original artwork by Julia's Watercolors 2020

Storm Water Contest...

Each month, we invite our readers to participate in a contest to test their knowledge of the Industrial General Permit and show their storm water compliance program. We enter all submittals to our monthly newsletter question into a drawing and one person is selected at random to receive a $25 gift card. Last month's contest question was:

How many Qualifying Storm Events are you required to sample per year?

Congratulations to Martijn who answered our contest question - *"The Permit requires 4 QSE's per year: 2 during July-December and 2 during January-June."* Martijn, we hope you enjoy a Amazon shopping trip on us!

...This Month's Contest

What pH values trigger an NAL exceedance?

We need industrial storm water sleuths to help us with this month's question. Submit your answers by Friday, January 7th. Email your answer to jteravskis@wgr-sw.com. One winner will be selected by a random drawing to receive a $25 gift card to ***Chipotle***.

GET SOCIAL:

WWW.WGR-SW.COM

WANT TO STRENGTHEN YOUR CRAFT? CHECK OUT FORGE - AN ONLINE LEARNING PLATFORM.