Construction General Permit – Technical Bulletin Series

Issue 2013.1

The Construction General Permit (CGP) Technical Bulletin Series is written and produced by staff of the State Water Board and aims to address common, public questions about how to implement the CGP. We will occasionally address topics using this bulletin format for questions that require more detailed answers than those found in the "Frequently Asked Questions" answers on the CGP FAQ web page:: http://www.swrcb.ca.gov/water_issues/programs/stormwater/gen_const_faq.shtml

This issue will address the following questions:

Q1: pH is required to be averaged by the CGP, but averaging pH is awkward in general and especially awkward for sites with multiple drainage areas and outfalls – how does the Water Board want pH values to be reported?

Q2: What are my options for meeting the "final stabilization" criteria in the CGP?

<u>Q1: pH is required to be averaged by the CGP, but averaging pH is awkward in general and especially awkward for sites with multiple drainage areas and outfalls – how does the Water Board want pH values to be reported?</u>

A1: Determination of Average Daily pH

The General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit or CGP) establishes Numerical Action Levels (NALs) for pH. For Risk Level 2 and 3 sites, the CGP sets a pH NAL of between 6.5 and 8.5. When daily average pH levels are below or above pH 6.5 or 8.5 respectively, the permit directs the discharger to take certain actions that are explained in the permit.

pH is a measure of the hydrogen ion concentration in storm water. If more than one measurement of pH is taken, the average pH is dependent upon the hydronium ion concentration, storm water flow (gallons per minute - gpm) and the time period of the pH observation. pH 7 is considered neutral. pH values less than 7 are considered acidic and pH values greater than 7 are considered basic or alkaline.

pH is defined as:

$$\text{pH} = -\text{Log}_{10}(H_3O^+)$$

The concentration of hydronium ion is defined as:

$$[H_3O^+] = 10^{-\text{pH}};$$

where [H3O+] is the concentration, C, of hydronium ion.

Determination of the accurate or true daily average pH requires the discharger to measure pH and volume of discharge corresponding to the pH measured. The true daily average pH is defined as:

$$-\log_{10}\left[\frac{C_1\,\Delta t_1\,Q_1 + \;\; C_2\Delta t_2 Q_2}{\Delta t_1 Q_1 + \;\; \Delta t_2 Q_2}\right]$$

Where C_1 and C_2 is the concentration of hydronium ion (defined above in terms of pH measured), Δt_1 and Δt_2 are the observation time periods and Q_1 and Q_2 are the storm water flows at the time of pH measurement.

Unfortunately the permit does not require the discharger to measure flow, nor does it require the calculation and reporting of the volumes of discharges over an observed time period, as is needed to compute the true daily average pH in the equation, above. Meanwhile it is not technically valid to calculate an arithmetic mean as the daily average pH. For the purpose of this permit, though, it is acceptable to report the daily average pH is defined as the arithmetic average of the pH readings, if all readings are above pH 7 or below pH 7. For a combination of acidic and alkaline readings, the discharger must report two daily averages of pH – one for the acidic and one for the alkaline readings.

Determining the daily average pH

The daily average pH will be taken as the arithmetic average of two or more pH readings taken during a twenty four hour period defined as midnight to midnight.
As, under most circumstances, the difference between the arithmetic average and true average is small, the discharger is not required to determine the true average, unless it's their opinion that the true average is a significantly more accurate representation of the daily average pH for their site.

The arithmetic average pH is defined as:

$$\frac{\sum pH}{n}$$

Where ∑pH means the sum of the daily pH measurements and "n" is the number of measurements.

pH measurements above pH 7

Example 1

Measurement 1; pH = 7.4
Measurement 2; pH = 8.9
Daily Average pH = $\frac{7.4+8.9}{2}$
= 8.2 (rounded to one decimal place)

pH measurements below pH 7

Example 2

Measurement 1; pH = 6.8
Measurement 2; pH = 4.5

Daily Average pH = $\frac{6.8+4.5}{2}$
= 5.7 (rounded to one decimal place)

Under no circumstance should pH measurements above pH 7 be averaged with pH measurements below pH 7. pH measurements above and below 7 should be averaged and reported separately.

pH measurements above and below pH 7

Example 3

Measurement 1; pH = 6.8
Measurement 2; pH = 8.6

For this example there are two daily average pH's, 6.8 and 8.6. As daily average of 8.6 exceeds the NAL for risk level 2 and 3 construction sites then the discharger must report this value as an NAL exceedance. A simple calculation tool is provided in excel (Technical Bulletin 2013.1 – pH) to demonstrate the different calculation options.

Q2: What are my options for meeting the "final stabilization" criteria in the CGP?

A2: Options for Meeting Final Stabilization Criteria

The discharger shall continue coverage under the CGP for any parcel that has not achieved "final stabilization". In order for the site to reach "final stabilization" the site should not pose any additional sediment discharge risk than it did prior to the commencement of construction activity as specified in Section II.D.1.a. Disturbed areas on lands that will be returned to an agricultural use such as cropland, rangeland, or silviculture shall be returned to the preexisting agricultural use condition at minimum (e.g., tilled land, grass rangeland, agricultural buffer strip, etc.)

Section II.D.3. of the CGP requires final stabilization conditions to be demonstrated by one of the following methods:

a. "70% final cover method," no computational proof required
OR:
b. "RUSLE or RUSLE2 method," computational proof required
OR:
c. "Custom method", the discharger shall demonstrate in some other manner than a or b, above, that the site complies with the "final stabilization" requirement

Note that these methods are stand-alone options to demonstrate compliance with the final stabilization criteria.

Final stabilization must be demonstrated with photographs at minimum. Projects demonstrating final stabilization utilizing RUSLE, RUSLE2 or a custom method must also submit computational support and/or all testing and analysis results.

To qualify for NOT approval, all the conditions of Section II.D1.of the CGP have to be met (e.g., a site may have achieved final stabilization, but the NOT may be denied because the site still has potential for construction-related storm water pollutants to be discharged into site runoff).

70% Final Cover Method
70% Final Cover refers to the percent of exposed soil that is covered by vegetation or any other non-vegetative means of stabilization. Vegetative final stabilization only requires getting to 70 percent of the "natural" vegetative cover in that part of the state. If the natural cover is only 50 percent, you only have to get back to 35 percent cover (70 percent of 50 percent). Non-vegetative stabilization measures could include rip-rap, gravel, gabions, etc., and in some circumstances mulch and bark. Impervious cover such as concrete or asphalt should be avoided as a final stabilization technique. Long term semi-permanent erosion control practices combined with seeds that would establish vegetative stabilization (e.g., properly secured seed impregnated erosion control mats, etc.) may also be used as "final stabilization" at the discretion of the Regional Water Board Inspector. To qualify as "long-term", the erosion control practice must be selected, designed, and installed so as to provide at least three years of erosion control.

Notices of Termination or NOTs may be denied were sites have been seeded but 70 percent growth has not occurred. Dischargers may be allowed to terminate prior to achieving full 70% vegetative coverage if they can demonstrate that the site will not pose any threat to water quality. The Regional Water Board should make this decision on a case-by-case basis considering all site specific factors.

RUSLE or RUSLE2 Method

The Revised Universal Soil Loss Equation or RUSLE can be used to meet the final stabilization requirements in the CGP. RUSLE is available as a computer program used to evaluate erosion potential. Using RUSLE, the calculations should match the pre-development erosion potential with the post-construction erosion potential showing that the site will not pose any additional sediment discharge risk than it did prior to the commencement of construction activity. The current version of RUSLE (RUSLE2) is a Windows-based model that uses extensive databases that are geographically-linked. RUSLE2 can require a large investment of time to set up, but this model may allow for less than 70% final cover. RUSLE2 can be downloaded free of charge from the Internet. The California Department of Transportation (Caltrans) has developed a version of RUSLE2 that incorporates California specific information and can be downloaded at: http://www.dot.ca.gov/hq/oppd/stormwtr/rusle2.htm. Note that RUSLE2 is an upgrade of RUSLE, and contains more detailed data therefore calculations may differ based on the program used. More information on RUSLE is contained in the Agricultural Handbook Number 703, Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE), Chapter 2, pp. 21-64, January 1997 available at: http://www.epa.gov/npdes/pubs/ruslech2.pdf.

RUSLE 1.06c is also available for download at the following internet address: http://www.ars.usda.gov/Research/docs.htm?docid=5971.
Hand calculations of RUSLE may be accepted if appropriate factors are determined (R, K, LS, C, P etc.). Below is a short list of sources where factors for RUSLE can be found.

- Fifield, J.S. 2011. Designing and Reviewing Effective Sediment and Erosion Control Plans, 3rd Edition. Santa Barbara, CA. Forester Press.

- Haan, C.T., B.J. Barfield, and J.C. Hayes. 1994. Design Hydrology and Sedimentology for Small Catchments. Academic Press, New. York

- Various manufacturer websites (e.g., North American Green, http://www.nagreen.com/)

Custom Method

Dischargers may use a Custom Method if the other methods are not suitable to demonstrate final stabilization at the project site. This methodology must be technically accepted by the larger, scientific and academic community and must relate to the concepts of final stabilization in the other methods. Please contact your local Regional Water Board for further information. A contact list is available at:
http://www.waterboards.ca.gov/water_issues/programs/stormwater/contact.shtml