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NORTH CAROLINA
Environmental Quality

MEMORANDUM
October 29, 2019

To: Interested Parties
From: Linda Culpepper, Director, Division of Water Resources LC
Subject: Approval of *Storm Drain Cleaning Nutrient Reduction Practice*

I received and have reviewed the practice description entitled "Design Specifications and Nutrient Accounting for *Storm Drain Cleaning*," dated October 14, 2019. I approve the use of this practice as specified therein toward compliance with Existing Development Stormwater rules, and where it may be allowed by other rules in the future, under Division nutrient strategies. This practice adds to the toolbox of management options contributing to more cost-effective water quality restoration in the state.

I understand that this nutrient reduction practice has been developed by the Division's Nonpoint Source Planning Branch in consultation with subject matter experts, vetted through the Nutrient Scientific Advisory Board (NSAB), made available for public comment, and that the final product was endorsed by the NSAB at its October 4, 2019 meeting.

Subject to changes in governing nutrient strategy regulations, this practice may be revised in the future through Director approval.

cc: Jim Gregson
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Design Specifications and Nutrient Accounting for Storm Drain Cleaning

I. Summary

A. Description

Storm Drain Cleaning is defined as the practice of periodic removal of gross solids and associated material from storm drain catch basins. Gross solids may include organic debris, litter, or coarse sediments. Associated material may include finer sediments. The combined material may be collected from unaltered catch basins or catch basins with a gross solids collection device installed. These devices are designed to alter catch basins to store more material than unaltered catch basins.

To determine the nutrient removal credit, the weight of material collected is converted to a representative weight of nitrogen and phosphorus removed from the system.

The intent of this document is to provide approved practice standards and associated credit calculations on Storm Drain Cleaning as a method of reducing nutrient loads to surface waters with nutrient strategies. Information about other practices can be found on the Division of Water Resources Nutrient Practices and Crediting website.

B. Utility

The practice is potentially useful in any stormwater collection setting involving structural inlets and curb and gutter and may also provide ancillary pollutant removal benefits. Credit is directly quantified, proportional to the amount of material collected. Targeted placement of collection devices in storm drains receiving the greatest material loads can increase practice efficiency.

C. Applicability

This practice applies toward compliance with Existing Development stormwater rules and may be implemented by parties with stormwater system maintenance responsibility. Credit can be given for storm drain cleaning that is new or improved since the baseline time period of the applicable nutrient strategy as specified in strategy purpose and scope rules. This practice is not available for credit toward New Development nutrient reduction requirements.

D. Credit Overview

The weight of freshly collected material is measured directly or is determined indirectly by its relationship to the average weight of the contents of a collection vehicle. The conversion factors of **0.023 lb TN and 0.002 lb TP** per pound of material are applied to the collected weight to determine the weight of N and P removed from the system.

II. Practice Design and Implementation

A. Qualifying Conditions and Limitations

1. Applicability

This practice applies toward compliance with Existing Development rules and may be implemented by parties with stormwater system maintenance responsibility including local governments and state or federal parties. Credit can be given for storm drain cleaning that is new or improved since the baseline time period of the applicable nutrient strategy as specified in strategy Purpose and Scope rules. Use in new development settings would require adoption of the practice by the NC Division of Energy, Mineral and Land Resources stormwater permitting program. This practice cannot currently be used for credit toward New Development nutrient reduction requirements.

2. Preconditions

- None.

3. Practice Constraints

- This nutrient reduction practice does not include credit for materials from autumn-based streetside leaf pickup or instream devices.
- A storm drain material collection system will not be placed in a manner which inhibits the passage of aquatic organisms in intermittent or perennial streams, particularly during low flow conditions.

B. Design Guidance

1. Required Elements

None.

2. Recommended Elements

- Consider developing or refining a collection program standard operating procedure for internal training purposes. This may include collection method, frequency, routes, weighing method, and disposal method. See the Operation and Maintenance Section for more information.
- To maximize cost effectiveness, consider installing collection devices in locations that receive the greatest amount of organic matter. Locations may include drainage areas with the greatest tree canopy or the highest sediment or debris loads and may be influenced by leaf area index, tree species, and stormwater flow.
- Storm drain collection devices may be commercially available proprietary devices, each with its own manufacturer guidelines for installation, maintenance, and operation. Parties are responsible for evaluating any device used for flooding or other safety concerns.
- Avoid installing collection devices at low points in the storm drain system that are more likely to contribute to localized flooding.

C. Installation/Implementation

1. Required Elements

None.

2. Recommended Elements

Follow manufacturers' guidelines for storm drain material collection devices.

D. Operation and Maintenance

1. Required Elements

- The weight of collected solids will be determined by direct weighing of material or indirectly by determining the average weight of the contents of a full collection vehicle, based on a representative number of samples, and then recording the number of loads collected each year. Partially full vehicles may be assigned a proportional weight of material. Drying the material before weighing is not required.
- Solids will be stored and disposed of in a manner that prevents material and associated nutrients from reaching surface waters through surface flow.

2. Recommended Elements

- Consider establishing a standard operating procedure regarding staff training, prioritizing locations, collection methods, frequency, tracking, reporting, verification, disposal, equipment maintenance, and other program elements discussed below.
- More frequent collection from a high-yielding drain may provide proportionally greater nutrient yield per unit of material, as a result of higher unit-mass nutrient concentrations in fresh material, if a program is interested in evaluating nutrient content.
- Collection frequency may need to be optimized in relation to tree canopy, operating costs, staff costs, return on investment for equipment, flooding, and resident complaints.
- Research suggests storm drain collection devices may initially need to be inspected (and potentially maintained and emptied) as often as quarterly and before and after major rain events such as tropical storms. These inspections will help determine potential flooding concerns and help adjust collection frequency for installed devices. A program may develop a record of seasonal accumulation with which it then designs a modified field-checking and harvesting schedule.
- Parties are encouraged to follow manufacturers operation and maintenance guidelines for installed storm drain devices.

E. Credit Award and Renewal

This is a results-based credit that is calculated based on mass of harvested material and totaled on an annual basis. Results are credited relative to those produced during a nutrient strategy's baseline time period. Where material is obtained through use of collection devices, the assumption is made that no such collection was done during the baseline time period, and that all currently collected material provides credit. Where material is obtained from unaltered, existing catch basins, the credit-seeking party will need to provide information establishing a basis for estimating an increase in annual material collected relative to baseline time period. In either case, for any year in which nutrient reduction credit is sought, the party shall submit records to DWR that include:

1) Data supporting the calculations described in Section III;
2) The calculations themselves, including as applicable, the truckload averaging method; and
3) The corresponding nutrient credit results.

Custom conversion factors for material weight to nutrient mass may be developed based on laboratory analysis and proposed for use in place of the factors provided. Contact DWR if you are interested in developing custom conversion factors.

III. Nutrient Credit Estimation

A. Credit Method Description

The credit calculation involves applying N and P mass conversion factors to the collected weight of material, regardless of solids composition provided solids are limited to organic matter, litter, moisture content, and coarse sediments. Throughout this practice, weight always refers to the collected weight in its natural form.

The most direct measurement of collected weight is to weigh each truckload. Another method is to determine the average weight of material in a full truckload based on a reasonable number of sampling events and then record how many truckloads of that type are collected during the year.

B. Calculation Instructions

The following equation will be used to determine N and P removal credit for a given collection.

$RC = W \times F$

Where:

- RC = Reduction credit (lbs of nutrient) $RC_{N \text{ or } P}$ RC_P
- W = Weight of collected material (lbs of debris)
  W may be determined directly by weighing each truckload or by determining the average weight of collected debris of a full truckload and scaling the weight of material based on the proportion of a full load.
- F = Conversion factor (lbs nutrient/lbs debris) F_N or F_P (Table 1)

Table 1: Collected Debris Weight Nutrient Conversion Factors (F) (Waickowski, 2018)
F_N = 0.023 lb TN / lb collected debris
F_P = 0.002 lb TP / lb collected debris

IV. Supporting Technical Information

A. Reductions Obtained

Data in Raleigh NC (Rubin, 2017) showed collection from one installed device could range from 500 to 1,400 pounds per year of freshly collected debris, translating to approximately 12-33 lbs of nitrogen and 1-3 lbs of phosphorous per year per device installed.

B. Example Calculation

Example 1: The Town of Orangeville has installed 30 material collection devices in storm drains throughout town. On a regular basis throughout the year, the town collects material from these storm drains.

The material collected is deposited at their facility management yard, on a pervious area that does not drain directly to a stream or storm drain. When the material has drained it is taken to a yard waste disposal site. Orangeville's reporting method is topnotch so they know that they have collected 27 full vacuum truckloads of material through the storm drain cleaning process this year.

To determine the average weight of collected material in a full truckload, Orangeville weighed the contents of five truckloads of each type of truck used, and determined average weight of debris in a full vacuum truck is 1,000 pounds.

The weight used to determine the nutrient credit is the # of truckloads multiplied by the average weight of one truckload: 27 * 1,000 = 27,000 pounds of debris from storm drains**.**

Using the conversion factors found in Section IIIB, Orangeville claims the following credits.

RC_N = 27,000 pounds debris * 0.023 lbs TN/pounds debris = 621 lbs TN

RC_P = 27,000 pounds debris * 0.002 lbs TP/pounds debris = 54 lbs TP

C. Credit Basis and Relative Confidence

Using a Confidence Evaluation Matrix, a qualitative review of the studies meant to guide further research (NCDWR, 2018), relative confidence in the reductions estimated for Storm Drain Cleaning is Medium to High. The studies supporting this practice have high levels of confidence in: the loading source, study location sites, real-world adaptation, nutrient measurements, and data quality, but only two replicates of each device were conducted with only a partial year of monitoring.

The credit for Storm Drain Cleaning is based on studies by Rogers et al. (2017). Four Piedmont and Coastal Plain cities were used with drainage basins incorporating high and low density housing as well as urban/downtown sites. Municipal officials assisted with site selection. Only one type of storm drain inlet was used.

Previous studies, Donner (2016) and Stack et al (2013), assigned nutrient content based on % organic matter and % sediment found in the collected samples. Waickowski (2015) determined the relative nutrient content based on the entire collected debris sample. While assignment of different conversion factors for organic and mineral fractions was considered technically preferable, in practice it appeared that separation of these fractions for weighing would prove practically infeasible.

D. Cost Analysis

Costs were not included in the scope of the studies used. The following qualitative factors may be worth considering in undertaking this practice. Costs incurred from any collection program, whether or not collection devices are involved, include staff time such as field verification of sites, monitoring, maintenance, collection, weighing, and disposal. Vacuum trucks, their purchase, operation and maintenance, are a significant program cost. Already owning this equipment is a distinct advantage in set up cost. Some communities may find private contractors an economically viable alternative.

Installing collection devices will increase the amount of material collected, which may help improve the returns per unit labor. As a collection program progresses and gathers data, its records may help fine tune the collection (storm drains and sweeping) frequency of any site and the location of installed devices, improving efficiency and thereby reducing costs.

E. Risks and Benefits

Potential benefits of storm drain cleaning beyond nutrient credit include: reduced flooding, reduced property damage, reduced customer complaints, reduced litter in streams, increased awareness of system problems, reduced toxic inputs from urban watersheds and reduced organic matter and sediment in streams which can reduce scouring and improve habitat.

For installed collection devices in storm drains, the potential risks may include increased flooding or collection schedules.

F. References & Resources

Donner S, Frost B, Goulet MH et.al. 2016. Recommendations of the Expert Panel to define Removal Rates for Street and Storm Drain Cleaning Practices. Final Report.

NC Division of Water Resources Confidence Evaluation Matrix. 2018. https://deq.nc.gov/about/divisions/water-resources/planning/nonpoint-source-management/nutrient-offset-information

Rogers LR, Carey ES, Waickowski SE 2017. Gross Solids and Catch Basin Inserts: A Comparison of Multiple Products - Evaluation of Gross Solids Proprietary Devices.

Rubin, Robert. 2017. Trashguard trial data in Raleigh NC neighborhood. Unpublished.

Stack B, Law N, Drescher S 2013. Gross solids Characterization Study in the Tred Avon Watershed, Talbot County, MD. Prepared by the Center for Watershed Protection as fulfillment of the Chesapeake and Atlantic Coastal Bay Trust Fund 14-11-1415 TRF08 and Tred Avon Local Implementation Grant FY 2011.

Tetra Tech. 2013. North Carolina Piedmont Nutrient Load Reducing Measures Technical Report. Report Submitted to Division of Water Resources, 7 September 2013.

Waickowski SE 2015. Gross Solids in Urban Catch Basins: A Pollutant Accounting Opportunity? (Master's thesis). Retrieved from http://www.lib.ncsu.edu/resolver/1840.16/10611

Waickowski SE 2018. Concentrations for Nutrient Credits for Storm Cleaning and Street Sweeping (Memo)

G. Credit Development Documentation

NCSU recommends the above conversion factors be used to provide nutrient credits for debris collected from storm drain cleaning. Data used to formulate these concentrations were collected from sweep-able streets in NC and are not dependent upon the capture efficiency of inserts. (Waickowski, 2018).