

ATTACHMENT 2 TO APPENDIX D

Phosphorus Reduction Credits for Selected Enhanced Non-Structural BMPs at the Designated Discharge (DD) Site

The permittee shall use the following methods to calculate phosphorus load reduction credits for the following enhanced non-structural control practices implemented at its DD Site:

- 1) Enhanced Sweeping Program;
- 2) Semi-annual Catch Basin Cleaning;
- 3) No Application of Fertilizers Containing Phosphorus; and
- 4) Organic Waste and Leaf Litter Collection program.

The methods include the use of default phosphorus reduction factors that EPA has determined are acceptable for calculating phosphorus load reduction credits for these practices.

The methods and annual phosphorus export load rates presented in this attachment are for the purpose of counting load reductions for various BMPs treating storm water runoff from varying site conditions (i.e., impervious or pervious surfaces) and different land uses (e.g. industrial and commercial). The estimates of annual phosphorus load and load reductions resulting from BMP implementation are intended for use by the permittee to measure compliance with its Phosphorus Reduction Requirement under the permit. It may also be used by a municipality in whose CMPP a permittee is participating for the purpose of gauging the municipality's compliance with phosphorus reduction requirements under its MS4 permit.

Alternative Methods and/or Phosphorus Reduction Factors: A permittee may propose alternative methods and/or phosphorus reduction factors for calculating phosphorus load reduction credits for these non-structural practices. EPA will consider alternative methods and/or phosphorus reduction factors, provided that the permittee submits adequate supporting documentation to EPA. At a minimum, supporting documentation shall consist of a description of the proposed method, the technical basis of the method, identification of alternative phosphorus reduction factors, supporting calculations, and identification of references and sources of information that support the use of the alternative method and/or factors for the DD Site. If EPA determines that the alternative methods and/or factors are not adequately supported, EPA will notify the permittee and the permittee may receive no phosphorus reduction credit other than a reduction credit calculated by the permittee using the default phosphorus reduction factors provided in this attachment for the identified practices.

(1) Enhanced Sweeping Program: The permittee may earn a phosphorus reduction credit for conducting an enhanced sweeping program of impervious surfaces that **do not** drain to structural storm water BMPs. The credit shall be calculated by using the following equation:

$$\text{Credit}_{\text{sweeping}} = \text{IA}_{\text{swept}} \times \text{PLE}_{\text{IC-land use}} \times \text{PRF}_{\text{sweeping}} \quad \text{(Equation 2-1)}$$

Where:

- Credit_{sweeping} = Amount of phosphorus load removed by enhanced sweeping program (lbs/year)
- IA_{swept} = Area of impervious surface that does **not** drain to a structural BMP and is swept under the enhanced sweeping program (acres)
- PLE_{IC-land use} = Phosphorus Load Export Rate for impervious cover and specified land use (lbs/acre/yr) (see Table 2-1)
- PRF_{sweeping} = Phosphorus Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-2).

As an alternative, the permittee may apply a credible sweeping model of the DD Site and perform continuous simulations reflecting build-up and wash-off of phosphorus using long-term local rainfall data.

Table 2-1. Composite phosphorus load export rates by land cover

Land use	Composite P Load Export rate (CPL)(lbs/acre/yr)***	Land surface cover	P Load Export (PLE) rate by cover (lbs/acre/yr)
Agriculture *	0.45	Pervious	0.45
Commercial **	1.50	Impervious	2.23
		Pervious	0.27
Forest	0.12	Impervious	0.89
		Pervious	0.09
Freeway	0.80	Impervious	1.34
		Pervious	0.27
High-density residential	1.00	Impervious	2.23
		Pervious	0.27
Industrial	1.30	Impervious	1.78
		Pervious	0.27
Low-density residential (rural)	0.27	Impervious	0.89
		Pervious	0.13
Medium-density residential	0.50	Impervious	1.34
		Pervious	0.27
Open space	0.27	Impervious	0.89
		Pervious	0.22

Notes:

* Agriculture includes row crops, actively managed hay fields and pasture land.

** Institutional type land uses such as government properties, hospitals, and schools are included in the commercial land use category for the purpose of calculating phosphorus loadings.

*** The composite phosphorus load export rate (CPL) represents the overall average phosphorus load export rate for the land use category including both the impervious and pervious area in the communities of Bellingham, Franklin, and Milford.

Table 2-2. Phosphorus reduction efficiency factors (PRF_{sweeping}) for sweeping impervious areas

Frequency*	Sweeper Technology	PRF_{sweeping}
Monthly	Mechanical Broom	0.03
Monthly	Regenerative Air/Vacuum Assisted	0.04
Weekly	Mechanical Broom	0.05
Weekly	Regenerative Air/Vacuum Assisted	0.08

* Sweeping shall be conducted year round.

Example 2-1: Calculation of enhanced sweeping program credit ($Credit_{\text{sweeping}}$): A permittee with a commercial DD Site proposes to implement an enhanced sweeping program and perform weekly sweeping on a year round basis, using a regenerative air sweeper on 5.30 acres of parking lot and roadway that will **not** drain to structural storm water BMPs (the DD Site has an additional 5.15 acres of impervious area that will drain to structural BMPs). Only the impervious area (IA_{swept}) that does **not** drain to a structural BMP is eligible for the phosphorus reduction sweeping credit ($Credit_{\text{sweeping}}$). For this site the needed information is:

$IA_{\text{swept}} = 5.30$ acres
 $PLE_{\text{IC-commercial}} = 2.23$ lbs/acre/yr (from Table 2-1)
 $PRF_{\text{sweeping}} = 0.08$ (from Table 2-2)

Substitution into equation 2-1 yields a $Credit_{\text{sweeping}}$ of 0.95 pounds of phosphorus removed per year.

$Credit_{\text{sweeping}} = IA_{\text{swept}} \times PLE_{\text{land use}} \times PRF_{\text{sweeping}}$
 $= 5.30 \text{ acres} \times 2.23 \text{ lbs/acre/yr} \times 0.08$
 $= \mathbf{0.95 \text{ lbs/yr}}$

(2) Semi-annual Catch Basin Cleaning: The permittee may earn a phosphorus reduction credit, $Credit_{\text{CB}}$, by removing accumulated materials from catch basins (i.e., catch basin cleaning) at the DD Site at a frequency of twice per year (semi-annually). $Credit_{\text{CB}}$ can only be earned for impervious areas of the DD Site that are tributary to catch basins that **do not** drain to structural storm water BMPs. The credit shall be calculated by using the following equation:

$$Credit_{\text{CB}} = IA_{\text{CB}} \times PLE_{\text{IC-land use}} \times PRF_{\text{CB}} \quad \text{(Equation 2-2)}$$

Where:

$Credit_{\text{CB}}$ = Amount of phosphorus load removed by semi-annual catch basin cleaning (lbs/year)
 IA_{CB} = Impervious drainage area to catch basins cleaned semi-annually that do **not** drain to structural storm water BMPs (acres)
 $PLE_{\text{IC-and use}}$ = Phosphorus Load Export Rate for impervious cover and specified land use (lbs/acre/yr) (see Table 2-1)

PRF_{CB} = Phosphorus Reduction Factor for catch basin cleaning frequency of twice per year (see Table 2-3)

Table 2-3. Phosphorus reduction efficiency factor (PRF_{CB}) for semi-annual catch basin cleaning.

Frequency	Practice	PRF_{CB}
Semi-annual	Catch Basin Cleaning	0.02

Example 2-2: Calculation for semi-annual catch basin cleaning credit ($Credit_{CB}$):

A permittee with an industrial DD Site proposes to clean catch basins (i.e., remove accumulated sediments and contaminants captured in the catch basins) that drain runoff from 15.29 acres (acre) of impervious area semi-annually. Runoff from 8.58 acre of impervious area at the DD Site will ultimately discharge to an infiltration basin (structural storm water BMP). Only the impervious drainage area (IA_{CB}) tributary to catch basins that does **not** drain to a structural BMP is eligible for the phosphorus reduction catch basin cleaning credit ($Credit_{CB}$). For this site the needed information is:

$$\begin{aligned}
 IA_{CB} &= 15.29 \text{ acre} - 8.58 \text{ acre} \\
 &= 6.71 \text{ acre} \\
 PLE_{IC-industrial} &= 1.78 \text{ lbs/acre/yr (from Table 2-1)} \\
 PRF_{CB} &= 0.02 \text{ (from Table 2-3)}
 \end{aligned}$$

Substitution into equation 2-3 yields a $Credit_{CB}$ of 0.24 pounds of phosphorus removed per year:

$$\begin{aligned}
 Credit_{sweeping} &= IA_{CB} \times PLE_{industrial} \times PRF_{CB} \\
 &= 6.71 \text{ acre} \times 1.78 \text{ lbs/acre/yr} \times 0.02 \\
 &= \mathbf{0.24 \text{ lbs/yr}}
 \end{aligned}$$

(3) No Application of Fertilizers Containing Phosphorus: If a permittee has historically and regularly used fertilizer containing phosphorus on its DD Site, the permittee may earn a phosphorus reduction credit by not applying fertilizers that contain phosphorus to any area of the DD Site. The application of any fertilizers containing phosphorus at the DD Site at any time during the reporting year shall preclude the permittee from earning this credit for the reporting year. The permittee must provide written certification to EPA annually that no fertilizers containing phosphorus have been applied to any area on the DD Site in order to earn the credit ($Credit_{no \text{ P fertilizer}}$). The $Credit_{no \text{ P fertilizer}}$ shall be determined using the following equation:

$$Credit_{no \text{ P fertilizer}} = (\text{Developed DD Site Area}) \times (CPL_{land \text{ use}}) \times (0.10) \quad \textbf{(Equation 2-3)}$$

Where:

$Credit_{no \text{ P fertilizer}}$ = Amount of phosphorus load reduction credit for not applying fertilizers containing phosphorus to the DD Site (lbs/year)

Developed DD Site Area = All impervious area and all landscaped and/or managed pervious area such as gardens and grassed areas that are actively managed (acre)

CPL_{E land use} = Composite Phosphorus Load Export rate for a specified land use (lbs/acre/yr) (see Table 2-1)

0.10 = 10% phosphorus reduction factor for not applying fertilizers containing phosphorus to the DD Site

Example 2-3: Calculation for no phosphorus fertilizer credit (Credit_{no P fertilizer}): A permittee with a 10.25 acre site has the option of applying phosphorus free fertilizer to the lawns and landscaped areas. The site consists of 9.07 acre of multi-family residential use (i.e., high density residential use that include the lawns and landscaped areas) and 1.18 acre of unmanaged woodland. For this site the needed information to calculate the Credit_{no P fertilizer} is the:

Developed DD Site Area = 9.07 acres; and
CPL_{E HDR} (see Table 2-1) = 1.00 lbs/ac/yr

Substitution into equation 2-3 yields a Credit_{no P fertilizer} of 0.91 pounds of phosphorus removed per year.

$$\text{Credit}_{\text{no P fertilizer}} = (9.07 \text{ acres}) \times (1.00 \text{ lbs/acre/yr}) \times (0.10) \\ = \mathbf{0.91 \text{ lbs/yr}}$$

(4) Enhanced Organic Waste and Leaf Litter Collection program: The permittee may earn a phosphorus reduction credit by performing regular gathering, removal and disposal of landscaping wastes, organic debris, and leaf litter from impervious surfaces. In order to earn this credit (Credit_{leaf litter}), the permittee must gather and remove all landscaping wastes, organic debris, and leaf litter from all impervious roadways and parking lots at least once per week during the period of April 1 to December 15 of each year. The gathering and removal shall occur immediately following any landscaping activities at the DD Site and at additional times when necessary to achieve a weekly cleaning frequency. The permittee must ensure that the disposal of these materials will not contribute pollutants to any surface water discharges. For example, blowing organic materials from impervious areas to off-site impervious areas at any time during the reporting year shall preclude the permittee from earning this credit for the reporting year. The permittee may use an enhanced sweeping program (e.g., weekly frequency) as part of earning this credit provided that the sweeping is effective at removing leaf litter and organic materials. The Credit_{leaf litter} shall be determined by the following equation:

$$\text{Credit}_{\text{leaf litter}} = (\text{Developed DD Site Area}) \times (\text{CPL}_{\text{E land use}}) \times (0.05) \quad \textbf{(Equation 2-4)}$$

Where:

Credit_{leaf litter} = Amount of phosphorus load reduction credit for organic waste and leaf litter collection program (lbs/year)

Developed DD Site Area = All impervious area and all landscaped and/or managed pervious area such as gardens and grassed areas that are actively managed (acre)

$CPL_{land\ use}$ = Composite Phosphorus Load Export rate for a specified land use (lbs/acre/yr) (see Table 2-1)
 0.05 = 5% phosphorus reduction factor for organic waste and leaf litter collection program at the DD Site

Example 2-4: Calculation for organic waste and leaf litter collection program credit

(Credit_{leaf litter}): A permittee with a 12.50 acre commercial DD Site proposes to implement an organic waste and leaf litter collection program by sweeping the parking lots and access drives at a minimum of once per week using a mechanical broom sweeper for the period of April 1- December 15. Also, the permittee will ensure that organic materials are removed from impervious areas immediately following all landscaping activities at the site. The DD site includes 9.35 acres of impervious surface (including 2.10 acres of roof tops), 2.76 acres of landscaped pervious area and 0.39 acres of unmanaged meadow. Drainage from 4.21 impervious acres of parking lot and access road will drain to a structural BMP. For this site the needed information to calculate the Credit_{leaf litter} is:

Developed DD Site Area = 9.35 acre + 2.76 acre
 = 12.11 acre; and
 $CPL_{commercial}$ (see Table 2-1) = 1.50 lbs/acre/yr

Substitution into equation 2-4 yields a Credit_{leaf litter} of 0.91 pounds of phosphorus removed per year:

Credit_{leaf litter} = (12.11 acre) x (1.50 lbs/acre/yr) x (0.05)
 = 0.91 lbs/yr

Since a portion of the impervious area that will be swept weekly will not drain to a structural BMP, the permittee also may earn a phosphorus reduction credit for enhanced sweeping (i.e., Credit_{sweeping}) if the sweeping program is extended to be year round. Using equation 2-1, Credit_{sweeping} is:

$Credit_{sweeping} = IA_{swept} \times PLE_{IC-land\ use} \times PRF_{sweeping}$ **(Equation 2-1)**
 $IA_{swept} = 9.35\ ac - 2.10\ ac\ (roof\ top) - 4.21\ ac\ (area\ draining\ to\ structural\ BMP)$
 = 3.04 acre
 $PLE_{IC-commercial} = 2.23\ lbs/acre/yr$ (from Table 2-1)
 $PRF_{sweeping} = 0.05$ (from Table 2-2)

Substitution into equation 2-1 yields a Credit_{sweeping} of 0.34 pounds of phosphorus removed per year.

Credit_{sweeping} = $IA_{swept} \times PLE_{IC-commercial} \times PRF_{sweeping}$
 = 3.04 acre x 2.23 lbs/acre/yr x 0.05
 = **0.34 lbs/yr**