ATTACHMENT 2 TO APPENDIX F

Phosphorus and Nitrogen Reduction Credits for Selected Enhanced Non-Structural BMPs

The permittee shall use the methods explained below to calculate phosphorus and nitrogen (nutrient) load reduction credits for the following enhanced non-structural control practices implemented in the Watershed:

1) Enhanced Street/Pavement Cleaning Program;
2) Catch Basin Cleaning;
3) Turf Grass Fertilizer Management with No Applications of Fertilizers that Contain Phosphorus*; and
4) Organic Waste and Leaf Litter Collection program

* "Phosphorus free" fertilizers that contain no more than 0.67% phosphorus shall be considered a fertilizer that does not contain phosphorus and applicable for earning this credit.

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

The methods and annual nutrient load export 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) within the applicable watershed. Respectively, Tables 2-1 and 2-2 below provide annual phosphorus load and nitrogen export rates by land use category for impervious and pervious areas. The estimates of annual phosphorus loads and load reductions resulting from BMP implementation are intended for use by the permittee to measure compliance with its Phosphorus Reduction Requirement in accordance with Appendix F to the permit. The estimates of annual nitrogen load and load reductions resulting from BMP implementation are intended for use by the permittee to track and account for nitrogen load reductions in accordance with Appendix H to the permit.

Examples are provided to illustrate use of the methods and area applicable to both phosphorus and nitrogen, except for turf grass fertilizer management, which applies only to phosphorus at this time. In calculating nutrient loads, the permittee shall select the land use category that most closely represents the actual use for the area in question. For watersheds with institutional type uses, such as government properties, hospitals, and schools, the permittee shall use the commercial land use category for the purpose of calculating phosphorus and nitrogen loads. Table 2-3 provides a crosswalk table of nutrient load export rate (PLER and NLER) land use categories in Tables 2-1 and 2-2, and the corresponding land use category codes used in NH GRANIT. For pervious areas, permittees should use the appropriate value for the hydrologic soil group (HSG) if known, otherwise, assume HSG C conditions.

Alternative Methods and/or Nutrient Reduction Factors: A permittee may propose alternative methods and/or nutrient reduction factors for calculating phosphorus and nitrogen load reduction credits for these non-structural practices. EPA will consider alternative methods and/or nutrient 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 nutrient reduction factors, supporting calculations, and identification of references and sources of information that support the use of the alternative method and/or factors in the applicable watershed areas. 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 or nitrogen reduction credit other than a reduction credit calculated by the permittee following the methods in this attachment for the identified practices.

Table 2-1: Average annual distinct phosphorus (P) load export rates for use in estimating P load reduction credits in the NH MS4 Permit

Phosphorus Source Category by Land Use	Land Surface Cover	P Load Export Rate, lbs./acre/year	P Load Export Rate, kg/ha/yr.
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	2.0
	Pervious	See* DevPERV	See* DevPERV
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	2.6
	Pervious	See* DevPERV	See* DevPERV
Medium -Density Residential (MDR)	Directly connected impervious	1.96	2.2
	Pervious	See* DevPERV	See* DevPERV
Low Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	1.34	1.5
	Pervious	See* DevPERV	See* DevPERV
Forest (FOR)	Directly connected impervious	1.52	1.7
	Pervious	0.13	0.13
Open Land (OPEN)	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (AG)	Directly connected impervious	1.52	1.7
	Pervious	0.45	0.5
*Developed Land Pervious (DevPERV) – HSG A	Pervious	0.03	0.03
*Developed Land Pervious (DevPERV) – HSG B	Pervious	0.12	0.13
*Developed Land Pervious (DevPERV) – HSG C	Pervious	0.21	0.24
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	0.29	0.33

*Developed Land Pervious (DevPERV) – HSG D	Pervious	0.37	0.41

Notes:
- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the phosphorus load export rate.
- Agriculture includes row crops, actively managed hay fields, and pasture lands. Institutional land uses, such as government properties, hospitals and schools, are to be included in the commercial and industrial land use grouping for the purpose of calculating phosphorus loading.
- Impervious surfaces within the forest land use category are typically roadways adjacent to forested pervious areas.

Table 2-2: Average annual distinct nitrogen (N) load export rates for use in estimating N load reduction credits in the NH MS4 Permit

Nitrogen Source Category by Land Use	Land Surface Cover	N Load Export Rate, lbs./acre/year	N Load Export Rate, kg/ha/yr.
Commercial (COM) and Industrial (IND)	Directly connected impervious	15.0	16.9
	Pervious	See* DevPERV	See* DevPERV
All Residential	Directly connected impervious	14.1	15.8
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	10.5	11.8
	Pervious	See* DevPERV	See* DevPERV
Forest (FOR)	Directly connected impervious	11.3	12.7
	Pervious	0.5	0.6
Open Land (OPEN)	Directly connected impervious	11.3	12.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (AG)	Directly connected impervious	11.3	12.7
	Pervious	2.6	2.9
*Developed Land Pervious (DevPERV) – HSG A	Pervious	0.3	0.3
*Developed Land Pervious (DevPERV) – HSG B	Pervious	1.2	1.3
*Developed Land Pervious (DevPERV) – HSG C	Pervious	2.4	2.7
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	3.1	3.5
*Developed Land Pervious (DevPERV) – HSG D	Pervious	3.6	4.1

Notes:
- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the phosphorus load export rate.
- Agriculture includes row crops. Actively managed hay fields and pasture lands. Institutional land uses such as government properties, hospitals and schools are to be included in the commercial and industrial land use grouping for the purpose of calculating phosphorus loading.
- Impervious surfaces within the forest land use category are typically roadways adjacent to forested pervious areas.

Table 2-3: Crosswalk of land use groups for NH MS4 P Load calculations to land use codes in NH GRANIT

Description of Land Use (LU) Groups for Calculating P Load Using PLERs	NH GRANIT LU Category Codes [1]
Commercial	1210-1290, 1442, 1146, 1520-30, 1590, 1610-90, and 1790
Industrial,	1300, 1370, 1410-20, 1460-80, 1510, and 1580
High Density Residential	1110, 1120 and1140
Medium Density Residential	1130 and 1150
Low Density Residential	1190
Highway/Freeway	1440-45, 1447-50 and 1490
Forest	3000, 4000, 6000, 190
Open Land	1710-90, 1800
Agriculture	2000 and 2900

[1]NH GRANIT land use categories can be found at the following link (See Table 1, page 4): http://www.granit.unh.edu/resourcelibrary/GRANITresources/standards/LUStandards-I93-061107.pdf

(1) Enhanced Street/Pavement Cleaning Program: The permittee may earn a phosphorus or a nitrogen reduction credit for conducting an enhanced cleaning program of impervious surfaces. Table 2-2 below outlines the default phosphorus removal factors for enhanced street/pavement cleaning programs. The credit shall be calculated by using the following equation:

$$\text{Phosphorus Credit}_{\text{P sweeping}} = \text{IA}_{\text{swept}} \times \text{PLER}_{\text{IC-land use}} \times \text{PRF}_{\text{sweeping}} \times \text{AF} \quad \textbf{(Equation 2-1)}$$

$$\text{Nitrogen Credit}_{\text{N sweeping}} = \text{IA}_{\text{swept}} \times \text{NLER}_{\text{IC-land use}} \times \text{NRF}_{\text{sweeping}} \times \text{AF} \quad \textbf{(Equation 2-2)}$$

Where:

$\text{Credit}_{\text{sweeping}}$ = Amount of nutrient load removed by enhanced sweeping program (lbs./year)

IA_{swept} = Area of impervious surface that is swept under the enhanced sweeping program (acres)

$\text{PLER}_{\text{IC-land use}}$ = Phosphorus Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (see Table 2-1)

$\text{NLER}_{\text{IC-land use}}$ = Nitrogen Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (see Table 2-2)

$\text{PRF}_{\text{sweeping}}$ = Phosphorus Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-4).

$\text{NRF}_{\text{sweeping}}$ = Nitrogen Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-4).

AF = Annual Frequency of sweeping. For example, if sweeping does not occur in Dec/Jan/Feb, the AF would be 9 mo. /12 mo. = 0.75. For year-round sweeping, AF=1.0[1]

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

Table 2-4: Nutrient reduction efficiency factors for sweeping impervious areas ($PRF_{sweeping}$ & $NRF_{sweeping}$)

Frequency[1]	Sweeper Technology	$PRF_{sweeping}$	$NFR_{sweeping}$
2/year (spring and fall)[2]	Mechanical Broom	0.01	0.01
2/year (spring and fall)[2]	Vacuum Assisted	0.02	0.02
2/year (spring and fall)[2]	High-Efficiency Regenerative Air-Vacuum	0.02	0.02
Monthly	Mechanical Broom	0.03	0.03
Monthly	Vacuum Assisted	0.04	0.04
Monthly	High Efficiency Regenerative Air-Vacuum	0.08	0.08
Weekly	Mechanical Broom	0.05	0.06
Weekly	Vacuum Assisted	0.08	0.07
Weekly	High Efficiency Regenerative Air-Vacuum	0.10	0.10

Example 2-1: Calculation of enhanced street/pavement cleaning program phosphorus load reduction credit (Credit $_{P\ sweeping}$): A permittee proposes to implement an enhanced street/pavement cleaning program and perform monthly cleaning from March 1 – December 1 (9 months), using a high efficiency regenerative air-vacuum assisted sweeper on 20.3 acres of parking lots and roadways in a high-density residential area of the LPCP area. For this site the needed information to calculate the **phosphorus** load reduction is:

IA_{swept} = 20.3 acres
$PLER_{IC\text{-}HDR}$ = 2.32 lb./acre/yr. (from Table 2-1)
$PRF_{sweeping}$ = 0.08 (from Table 2-4)
AF = (9 months / 12 months) = 0.75

Substitution into equation 2-2 yields a $Credit_{sweeping}$ of 2.8 pounds of phosphorus removed per year.

$Credit_{P\ sweeping}$ = IA_{swept} x $PLER_{land\ use}$ x $PRF_{sweeping}$ x AF
= 20.3 acres x 2.32 lbs./acre/yr. x 0.08 x 0.75
= 2.8 lbs./yr.

The corresponding **nitrogen** load reduction credit ($Credit_{N\ sweeping}$) for the same sweeping program in the specified LPCP area is calculated as follows:

IA_{swept} = 20.3 acres
$NLER_{IC\text{-}HDR}$ = 14.1 lb./acre/yr. (from Table 2-2)

[1]For full credit for monthly and weekly frequency, sweeping must be conducted year round. Otherwise, the credit should be adjusted proportionally based on the duration of the sweeping season (using AF factor).

[2] In order to earn credit for semi-annual sweeping the sweeping must occur in the spring following snow-melt and road sand applications to impervious surfaces and in the fall after leaf-fall and prior to the onset to the snow season.

$NRF_{sweeping}$ = 0.08 (from Table 2-4)
AF = (9 months / 12 months) = 0.75

Substitution into equation 2-2 yields a $Credit_{sweeping}$ of 17.2 pounds of nitrogen removed per year.

$Credit_{N\ sweeping}$ = IA_{swept} x $NLER_{land\ use}$ x $NRF_{sweeping}$ x AF
= 20.3 acres x 14.1 lbs./acre/yr. x 0.08 x 0.75
= 17.2 lbs./yr.

(2) Catch Basin Cleaning: The permittee may earn a nutrient reductions credit for phosphorus and nitrogen, $Credit_{CB}$, by removing accumulated materials from catch basins (i.e., catch basin cleaning) in the Watershed such that a minimum sump storage capacity of 50% is maintained throughout the year. The credit shall be calculated by using the following equations for phosphorus and nitrogen:

$$Credit_{P\ CB} = IA_{CB} \times PLER_{IC\text{-}land\ use} \times PRF_{CB} \quad \textbf{(Equation 2-3)}$$

$$Credit_{N\ CB} = IA_{CB} \times NLER_{IC\text{-}land\ use} \times NRF_{CB} \quad \textbf{(Equation 2-4)}$$

Where:

$Credit_{CB}$ = Amount of nutrient load removed by catch basin cleaning (lb. /year)
IA_{CB} = Impervious drainage area to catch basins (acres)
$PLER_{IC\text{-}land\ use}$ = Phosphorus Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (see Table 2-1)
$NLER_{IC\text{-}land\ use}$ = Nitrogen Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (see Table 2-2)
PRF_{CB} = Phosphorus Reduction Factor for catch basin cleaning (See Table 2-5)
NRF_{CB} = Nitrogen Reduction Factor for catch basin cleaning (See Table 2-5)

Table 2-5: Phosphorus reduction efficiency factor (PRF_{CB}) for catch basin cleaning

Practice	PRF_{CB}	NRF_{CB}
Catch Basin Cleaning to maintain 50% free-storage capacity in CB sump	0.02	0.06

Example 2-2: Calculation for catch basin cleaning credit ($Credit_{CB}$):
A permittee will conduct a CB maintenance program that will remove accumulated sediments and contaminants captured in the CBs. The program will maintain at least a 50% free-storage capacity in CB sumps in the same LPCA area as specified in Example 2-1. Catch basins in the applicable watershed drains runoff from 20.3 acres of HDR impervious area. For this site the needed information to calculate the **phosphorus** load reduction credit is:

IA_{CB} = 20.3 acre
$PLER_{IC\text{-}HDR}$ = 2.32 lbs./acre/yr. (from Table 2-1)

PRF_{CB} = 0.02 (from Table 2-5)

Substitution into equation 2-3 yields a $Credit_{P\ CB}$ of 0.9 pounds of phosphorus removed per year:

$Credit_{P\ CB}$ = IA_{CB} x $PLER_{IC\text{-}HDR}$ x PRF_{CB}
= 20.3 acre x 2.32 lbs./acre/yr. x 0.02
= 0.9 lbs. P/yr.

Note: The same methodology is applicable for calculating the nitrogen load reduction credit ($Credit_{N\ CB}$).

(3) Turf Grass Fertilizer Management with No Applications of Fertilizers that Contain Phosphorus: If a permittee has historically and regularly used fertilizer containing phosphorus in LPCA watershed area, the permittee may earn a phosphorus reduction credit by not applying fertilizers that contain phosphorus to turf grass pervious areas within the LPCP area. The application of any fertilizers containing phosphorus to turf grass areas within the LPCP area at any time during the reporting year by the permittee or any contractor or subcontractor acting on behalf of the permittee shall preclude the permittee from earning this credit for such areas for the reporting year. Note: "Phosphorus free" fertilizers that contain no more than 0.67% phosphorus shall be considered a fertilizer that does not contain phosphorus and is applicable for earning this credit. The permittee must provide written certification to EPA annually that no fertilizers containing phosphorus have been applied by the permittee or its agents (including contractors and subcontractors) to turf grass areas within the LPCP area for which the permittee is claiming credit ($Credit_{no\ P\ fertilizer}$). The $Credit_{no\ P\ fertilizer}$ shall be determined using the following equation:

$$Credit_{no\ P\ fertilizer} = (Area_{turf\ grass\ no\ P}) \times (PLER_{PC\text{-}HSG}) \times (0.33) \quad \textbf{(Equation 2-5)}$$

Where:

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

$Area_{turf\ grass\ no\ P}$ = All applicable turf grass area (acre) within LPCP area which have not received applications of phosphorus containing fertilizers

$PLER_{PC\text{-}HSG}$ = Phosphorus Load Export Rate for pervious cover and HSG (lbs./acre/yr.) (see Table 2-1)

0.33 = 33% phosphorus reduction factor for not applying fertilizers containing phosphorus

Example 2-3: Calculation for no phosphorus fertilizer credit for turf grass areas ($Credit_{no\ P\ fertilizer}$): A permittee has the option of applying phosphorus free fertilizer to the lawns and landscaped areas of municipally owned facilities located within the LPCP area. The municipality has determined through soil tests that additional phosphorus is not needed to support healthy turf grass growth for 19.1 acre of turf grass associated with the facilities. The HSG for all of the 19.1 acres of turf grass is presently unknown (assume HSG C). The needed information to calculate the $Credit_{no\ P\ fertilizer}$ for the 19.1 acres of turf grass area is:

Area $_{\text{turf grass no P}}$ = 19.1 acres; and
PLER $_{\text{PC-HSG C}}$ = 0.21 lbs./ac/yr. (from Table 2-1)

Substitution into equation 2-5 yields a Credit $_{\text{no P fertilizer}}$ of 2.1 pounds of phosphorus removed per year.

Credit $_{\text{no P fertilizer}}$ = (19.1 acres) x (0.21 lbs./acre/yr.) x (0.33)
= 1.3 lbs./yr.

(4) Enhanced Organic Waste and Leaf Litter Collection program: The permittee may earn phosphorus and nitrogen reduction credits by performing regular gathering, removal and proper disposal of landscaping wastes, organic debris, and leaf litter from impervious surfaces within applicable watershed areas (i.e., LPCP area or Great Bay watershed). In order to earn this credit (Credit $_{\text{leaf litter}}$), the permittee must gather and remove all landscaping wastes, organic debris, and leaf litter from impervious roadways and parking lots at least once per week during the period of September 1 to December 1 of each year. Credit can only be earned for those impervious surfaces that are cleared of organic materials in accordance with the description above. The gathering and removal shall occur immediately following any landscaping activities in the applicable watershed 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. 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 $_{\text{leaf litter}}$ for phosphorus and nitrogen load reductions shall be determined by equations 2-6 and 2-7, respectively:

Credit $_{\text{P leaf litter}}$ = (IA $_{\text{leaf litter}}$) x (PLER $_{\text{IC-land use}}$) x (0.05) **(Equation 2-6)**

Credit $_{\text{N leaf litter}}$ = (IA $_{\text{leaf litter}}$) x (NLER $_{\text{IC-land use}}$) x (0.05) **(Equation 2-7)**

Where:

Credit $_{\text{leaf litter}}$ = Amount of nutrient load reduction credit for organic waste and leaf litter collection program (lb. /year)

IA $_{\text{leaf litter}}$ = Impervious area (acre) in applicable watersheds that are subject to enhanced organic waste and leaf litter collection program

PLER $_{\text{IC-land use}}$ = Phosphorus Load Export Rate for impervious cover and specified land use (lbs./acre/yr.) (see Table 2-1)

NLER $_{\text{IC-land use}}$ = Phosphorus Load Export Rate for impervious cover and specified land use (lbs./acre/yr.) (see Table 2-1)

0.05 = 5% nutrient reduction factor for organic waste and leaf litter collection program in the applicable watershed

Example 2-4: Calculation for organic waste and leaf litter collection program credit (Credit $_{\text{leaf litter}}$): A permittee will 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 September 1 to December 1 over

12.5 acres of impervious roadways and parking lots in an industrial/commercial area of the LPCP area. Also, the permittee will ensure that organic materials are removed from impervious areas immediately following all landscaping activities in the area. For this site the needed information to calculate the Credit $_{\text{leaf litter}}$ for **phosphorus** is:

$IA_{\text{leaf litter}}$ = 12.5 acres; and
$PLER_{\text{IC-commercial}}$ = 1.78 lbs./acre/yr. (from Table 2-1)
Substitution into equation 2-6 yields:

$Credit_{\text{P leaf litter}}$ = (12.5 acre) x (1.78 lbs./acre/yr.) x (0.05)
= **1.1 lbs. P/yr.**

Note: The same methodology is applicable for calculating the nitrogen load reduction credit ($Credit_{\text{N leaf litter}}$) for the specified organic waste leaf litter collection program.

Associated Street/Pavement Cleaning Credit

The permittee also may earn a phosphorus reduction credit for enhanced cleaning of roads and parking lot areas (i.e., $Credit_{\text{P sweeping}}$) for using the mechanical broom sweeper weekly during the three month leaf litter collection program.

Using equation 2-1, $Credit_{\text{P sweeping}}$ is:
$Credit_{\text{P sweeping}} = IA_{\text{swept}} \times PLER_{\text{IC-land use}} \times PRF_{\text{sweeping}} \times AF$ **(Equation 2-1)**
IA_{swept} = 12.5 acre
$PLE_{\text{IC-commercial}}$ = 1.78 lbs./acre/yr. (from Table 2-1)
PRF_{sweeping} = 0.05 (from Table 2-4)
AF = 3 mo./12 mo. = 0.25

Substitution into equation 2-1 yields a $Credit_{\text{P sweeping}}$ of 0.3 pounds of phosphorus removed per year.

$Credit_{\text{P sweeping}} = IA_{\text{swept}} \times PLER_{\text{IC-commercial}} \times PRF_{\text{sweeping}} \times AF$
= 12.5 acre x 1.78 lbs./acre/yr. x 0.05 x 0.25
= 0.3 lbs. P/yr.