

## Nutrient Reduction Strategy for Inland Fresh Waters: Phosphorus

### Background

Connecticut Water Quality Standards No 8, 18, 19, and 20 collectively constitute the State's Water Quality Standard for nutrients. These narrative policy statements direct the Department to impose Best Management Practices (BMPs) including discharge limitations or other reasonable controls on both point and non point sources to achieve conditions that resemble those that would occur naturally. WQS No 8 defines "Natural Conditions" to include those resulting from "man's normal use of the land" provided BMPs have been applied to control point and nonpoint sources of nutrients. Nutrient BMPs are defined in WQS Appendix A as practices that reduce nutrient loading to surface water that are technically, economically and institutionally feasible to implement.

In order to more fully support ongoing water quality management activities, such as discharge permitting, monitoring, assessment of use attainment, and development of Total Maximum Daily Loads, the Connecticut Department of Environmental Protection has adopted the following protocol to translate the narrative policy statements appearing in the WQS into numerical criteria.

It is important to note these criteria differ from the criteria for toxic pollutants in WQS Appendix D in two ways. First, they are not based on establishing a threshold for nutrient loading above which designated uses will not be supported. Rather, they establish the maximum nutrient loads that can be considered to be consistent with the narrative policy statements incorporated into the WQS. Second, technical and economic feasibility was considered in establishing the nutrient criteria which is not allowed under federal law when establishing effects-based criteria such as those in Appendix D.

### Numeric Expression of Narrative Policy Statements

Connecticut's policy for phosphorus management is translated into a numeric expression by means of a geo-spatial analysis that determines the maximum acceptable seasonal phosphorus mass load per unit area of watershed contributing flow to the point of assessment. This load may originate from either point or nonpoint sources.

The loading per unit area for nonpoint sources is based on land cover characteristics as existed in 2002 and the expected export of phosphorus per unit area once BMPs have been fully implemented throughout the watershed. Land cover characteristics are benchmarked using photo interpretation of satellite imaging data (UCONN CLEAR Land Use Dataset). The maximum acceptable nonpoint source loadings for the period April through October are:

For forested land cover	$1.04 \times 10^{-4}$ lbs/acre/day
For agricultural land cover	$7.90 \times 10^{-4}$ lbs/acre/day
For urban land cover	$1.73 \times 10^{-4}$ lbs/acre/day

In many urbanized settings, normal use of the land includes use of sanitary sewers and treatment of the collected wastewater to protect public health and the environment. Point discharges must also apply BMPs to reduce phosphorus loading in order for water quality conditions in the receiving water body to be considered as consistent with the WQS Policy statements. BMP performance criteria were established by the Department for each municipal sewage treatment facility discharging to non tidal waters based on consideration of five factors.

1. The current degree of enrichment of the receiving water body at the point of discharge.
2. The facility's contribution to the total watershed enrichment at the point of discharge
3. The facility's current average effluent P concentration
4. The facility's contribution to the enrichment of the nearest downstream impoundment
5. The facility's contribution to the enrichment of any waters listed as nutrient impaired by the Department pursuant to Sec 303(d) of the federal Clean Water Act.

This approach helps insure that designated uses are achieved and maintained since water bodies that are most likely to be impacted by excess phosphorus are protected by more stringent BMP requirements. Consideration of the relative magnitude of each individual point discharge contribution to the total loading impacting a water body serves to balance the societal cost of removing incrementally greater amounts of phosphorus with the magnitude of environmental benefit achieved by application of known effective treatment technologies. This balancing is a fundamental requirement for establishing BMPs consistent with the Water Quality Standards definition. Individual BMP loads were calculated by multiplying the performance criteria assigned to each facility by the average seasonal effluent discharge rate for the period 2001-2007 and are presented in Table 1.

### Summary

The numeric expression corresponding to Connecticut's Narrative Water Quality Standard Policy for Phosphorus is equivalent to the sum of the post-BMP implementation export load from forested, agricultural, and urban land use and the cumulative BMP loading for any point discharges upstream:

$$\Sigma \text{Export}_{\text{FORESTED}} + \text{Export}_{\text{AGRICULTURE}} + \text{Export}_{\text{URBAN}} + \text{Export}_{\text{POINT DISCHARGE}}$$

Where Export equals the maximum acceptable seasonal loading following application of BMPs

### Implementation Guidance – NPDES Permit Renewals

Permits for facilities for which BMP loads have been established by the Department (Table 1) will incorporate limits and monitoring requirements as necessary to document that the BMP performance loads are being achieved. Compliance schedules may be incorporated into the permit to allow for the planning, design, financing, and construction of any treatment facilities necessary to achieve BMP performance levels. Limitations on phosphorus for privately owned point discharges will be determined on a case-by-case basis at the time of permit renewal.

### Implementation Guidance – Monitoring, Assessment and Listing

Assessment of standard attainment requires no fewer than 21 separate in-stream monitoring results collected during the growing season across a range of stream flow rates representative of the natural seasonal hydrograph. The seasonal load will be estimated from these data in accordance with the protocol used by the Department to validate the land use export coefficients in *Connecticut Methodology for the Development of Statewide Freshwater Nutrient Criteria*. Stream segments where excursion above the maximum seasonal loading criteria is documented by field data will be considered for listing pursuant to Section 303(d) of the Clean Water Act for development of a Total Maximum Daily Load. Stream segments currently listed will continue to be identified on Connecticut's Impaired Waters List as impaired for phosphorus until monitoring data confirm that designated uses are being fully supported. Water bodies for which monitoring data are insufficient to support assessment but exhibit characteristics consistent with nutrient over enrichment or where designated uses appear threatened by nutrient enrichment will be targeted for additional monitoring.

### **Implementation Guidance – Total Maximum Daily Load (TMDL) Development**

Monitoring data collected for purposes of assessment shall be considered in most cases to be sufficient to support establishing a Total Maximum Daily Load. Exceptions may include resources where significant quantities of phosphorus are being remobilized from bottom sediments and this remobilization load must be quantified. The principal purpose of establishing a TMDL will be to apportion point loads between wastewater treatment facilities and regulated storm water. The criteria derivation protocol employed by DEP considered storm water load to be part of normal urban land use export. Storm water is considered to be a point load under federal law governing the TMDL program and a portion of the urban export load must be transferred to the point load allocation in order to comply with those federal TMDL program requirements.

### **Implementation Guidance – Anti-degradation**

The Phosphorus criteria were established based on 2002 land cover and seasonal average point discharge flows reported for the period 2000 through 2008. Future changes in land use or increases in the volume of treated effluent flows from point discharges that can be expected to result in the export of greater amounts of phosphorus shall be considered a new or expanded discharge and must be evaluated for consistency with the State's Anti-degradation Policy as articulated in Appendix E of the Water Quality Standards.

### **Implementation Guidance – Effects-based Criteria**

The phosphorus criteria established in accordance with this protocol may be superseded in the future by the adoption of effect-based criteria. It is the Department's intent to continue to work towards development of a scientific basis for deriving effects-based nutrient criteria and will vigorously pursue adoption of such criteria should the implementation of BMPs required to achieve consistency with WQS Policy be found ineffective in achieving full support of designated uses. Effects-based criteria may be developed for individual water bodies or for broader applicability. Any proposed criteria must be adopted pursuant to the procedures established in Section 22a-426 of the Connecticut General Statutes including provision for public participation and approval by the federal Environmental Protection Agency.

### **Implementation Guidance – Growth and Development**

"Normal use of the land" in Connecticut is determined primarily by local municipal land use boards and commissions with minimal involvement by State or federal authorities. The DEP is actively working to encourage Municipalities to adopt responsible growth practices that promote the use of Low Impact Development techniques that can minimize export of phosphorus from developed parcels to *de minimus* levels. Growth that results in increased flow to a wastewater treatment facility may result in a requirement for that facility to increase the level of BMP treatment provided.

**TABLE 1 Maximum Seasonal Average Daily Phosphorus Loading for Point Discharges**

<b>FACILITY</b>	<b>BMP LEVEL</b>	<b>BMP LOAD (pounds/d)</b>	<b>FACILITY</b>	<b>BMP LEVEL</b>	<b>BMP LOAD (pounds/day)</b>
Ansonia WPCF	LOW	43.32	Plymouth WPCF	MED	6.13
Beacon Falls WPCF	LOW	7.91	Putnam WPCF	MED	8.41
Bristol WPCF	MED	52.35	Redding WPCF	MED	0.29
Canton WPCF	LOW	24.80	Ridgefield Main WPCF	HIGH	1.04
Cheshire WPCF	HIGH	4.06	Ridgefield RTE 7 OMI	LOW	*
Danbury WPCF	HIGH	15.11	Salisbury WPCF	MED	2.22
Farmington WPCF	MED	24.54	Seymour WPCF	LOW	41.09
Griswold WPCA	LOW	5.52	Simsbury WPCF	MED	13.15
Killingly WPCF	MED	18.23	Heritage Village WPCF	LOW	5.43
Litchfield WPCF	MED	2.92	Southington WPCF	HIGH	7.53
Manchester Water & Sewer	HIGH	10.57	Sprague WPCF	LOW	3.11
Meriden WPCF	MED	61.00	Stafford WPCA	LOW	8.61
Naugatuck WPCF	MED	28.75	Thomaston WPCF	MED	5.14
New Canaan WPCF	HIGH	1.55	Thompson WPCF	MED	2.10
New Hartford WPCF	LOW	*	Torrington WPCF	MED	30.27
New Milford WPCF	LOW	2.68	UCONN WPCF	LOW	23.76
Newtown WPCF	LOW	2.18	Vernon WPCF	HIGH	6.51
Norfolk Sewer District	LOW	3.45	Wallingford Water & Sewer	MED	31.32
North Canaan WPCF	LOW	4.29	Waterbury WPCF	MED	119.89
Plainfield North WPCF	MED	3.86	Willimantic WPCF	LOW	18.63
Plainfield WPCF	MED	2.51	Winsted WPCF	MED	8.06
Plainville WPCF	MED	12.21			

\* No current effluent monitoring data available – cap to be established following monitoring