Penobscot River
Phosphorus Waste Load Allocation
2011 - Ambient Monitoring Plan

May 2011

Prepared by Robert Mohlar, P.E.
Bureau of Land and Water
Division of Environmental Assessment

Summary

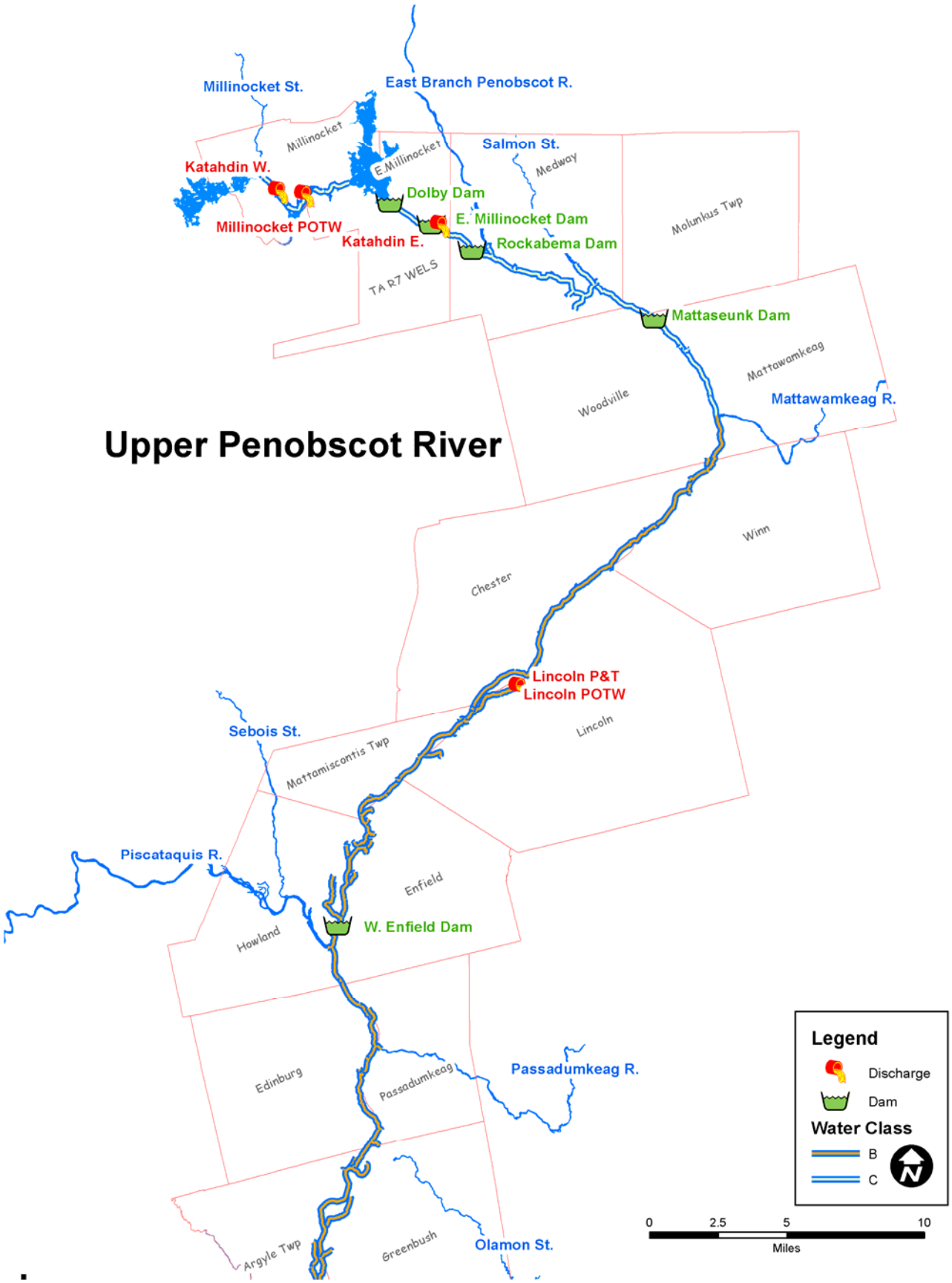
This ambient monitoring plan has been developed in accordance with the Penobscot River Phosphorus Waste Load Allocation (P-WLA), dated May 2011. The P-WLA was implemented in an effort to prevent eutrophication related non-attainment in the Penobscot River; primarily phytoplankton blooms and excessive diurnal Dissolved Oxygen (DO) swings that cause early morning DO non-attainment. The primary purpose of this plan is to monitor the DO attainment status of the Penobscot River (West Branch and Main Stem) between Millinocket and Bangor. The year 2011 will be the first of a multi-year monitoring effort. The primary goal during this first year of monitoring will be to assess the overall effectiveness of phosphorus waste load reductions and to identify potential areas of concern with regard to DO non-attainment. This ambient monitoring plan is an extension of the Adaptive Resource Management based approach being utilized for the P-WLA, and a primary goal of the plan is to provide a significant degree of flexibility to adapt/modify monitoring plans based on observances during the course of the field monitoring season. Specific components of the 2011 monitoring plan include the following;

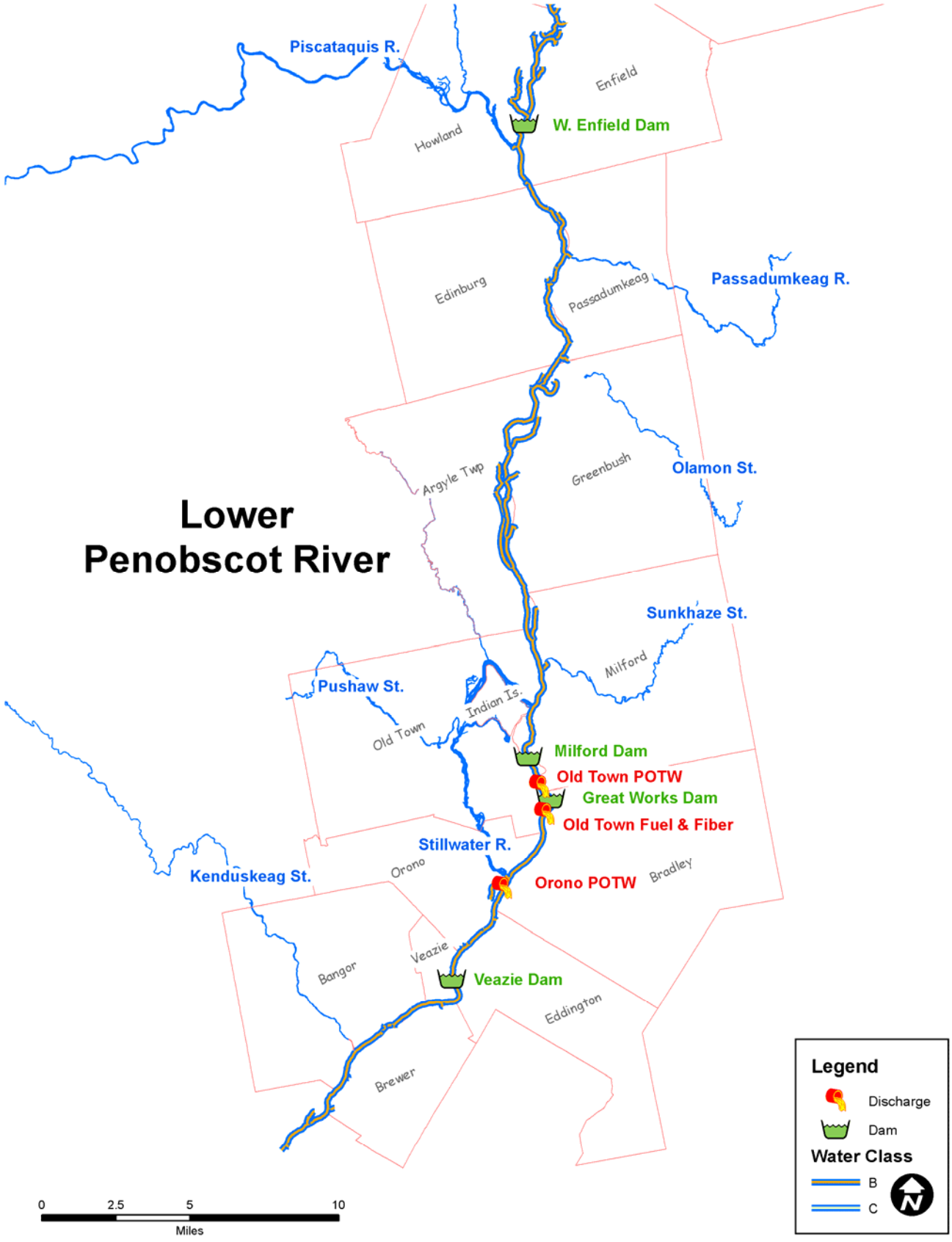
1. A network of four remote multi-probe instruments (sondes) that will be deployed throughout the river system during summer months (July – September). Each sonde will be equipped with probes to measure 4 field parameters; DO, Temperature, Specific Conductivity and Depth. These sondes will be deployed at a variety of locations for extended periods of time and will collect parameter data at defined intervals (intervals will be no less frequent than once per hour) around the clock. 24-hour data records will help to more accurately assess the full extent of diurnal parameter fluctuations. Simultaneous deployments at multiple locations will help to better assess the relative influence that a specific reach of river contributes to the diurnal signal.
2. Field data will be evaluated periodically during the course of the summer. The goal will be to move the probes throughout the river system in a systematic fashion to try and isolate potential areas of concern with regard to DO non-attainment.
3. Laboratory analysis of isolated water quality samples to support findings from field parameter monitoring. Laboratory analysis may be conducted in response to questions and/or concerns raised by ongoing field monitoring or observations. This type of data may be necessary to quantify the extent of a particular problem and/or assess causal relationships. Specific water quality chemistry might include any of the following parameters; chl-a, BOD, Total Phosphorus and ortho-phosphorus.
4. Annual data report detailing all data collected in association with the P-WLA Ambient Monitoring Plan. The annual data report will include a narrative assessment of the years monitoring efforts and detail any pertinent findings or conclusions.

Focus Area

This plan addresses ambient monitoring on the West Branch and Main Stem of the Penobscot River, between Millinocket and Bangor (Maps provided on the following two pages).

The Penobscot River is Class C from the outlet of Ferguson Pond (on the West Branch) to the confluence of the Mattawamkeag River (on the main stem). Class C DO criteria include an instantaneous minimum of 5 mg/l or 60% saturation (whichever is higher) and a monthly average of 6.5 mg/l. This stretch of river is presently considered to be in attainment for DO, but many sections are frequently below the 7 mg/l instantaneous minimum for the next highest standard (Class B). Field parameter monitoring along this Class C stretch of river during 2011 will most likely be confined to the free flowing reach between Mattaseunk Dam and the


Upper Penobscot River
Millinocket St.
East Branch Penobscot R.
Millinocket
E.Millinocket
Salmon St.
Medway
Katahdin W.
Dolby Dam
E. Millinocket Dam
Millinocket POTW
Katahdin E.
Rockabema Dam
Molunkus Twp
TA R7 WELS
Mattaseunk Dam
Mattawamkeag
Mattawamkeag R.
Woodville
Winn
Chester
Lincoln P&T
Lincoln POTW
Lincoln
Sebois St.
Mattamiscontis Twp
Piscataquis R.
Enfield
W. Enfield Dam
Howland
Passadumkeag R.
Passadumkeag
Edinburg
Argyle Twp
Greenbush
Olamon St.
Legend
Discharge
Dam
Water Class
B
C
N
0
2.5
5
10
Miles


Lower
Penobscot River
Piscataquis R.
Enfield
W. Enfield Dam
Howland
Edinburg
Passadumkeag
Passadumkeag R.
Argyle Twp
Greenbush
Olamon St.
Sunkhaze St.
Milford
Pushaw St.
Indian Is.
Old Town
Milford Dam
Old Town POTW
Great Works Dam
Old Town Fuel & Fiber
Stillwater R.
Kenduskeag St.
Orono
Orono POTW
Bradley
Bangor
Veazie
Veazie Dam
Eddington
Brewer
0
2.5
5
10
Miles
Legend
Discharge
Dam
Water Class
B
C
N

confluence with the Mattawamkeag River. Diurnal DO dynamics in this reach have the potential to trigger non-attainment below the confluence with the Mattawamkeag River, which is Class B. Chl-a and phosphorus sampling may be necessary in the Dolby Pond to Mattaseunk Impoundment stretch if a phytoplankton bloom appears to be ramping up.

The Penobscot River is Class B from the confluence of the Mattawamkeag River (in Mattawamkeag) to the confluence with Reeds Brook (in Hamden). Class B DO criteria are an instantaneous minimum of 7 mg/l or 75% saturation (whichever is higher). This section of river has experienced measured DO non-attainment at various locations during periods of low flow and high water temperature. Measured DO non-attainment has predominantly occurs in the early morning hours in free flowing sections of river with significant diurnal DO swings. A primary goal of the P-WLA is to suppress the magnitude of diurnal DO swings, which will result in less extreme early morning low DO readings. Monitoring on the Class B portion of the river during 2011 will primarily consist of remote sonde deployments in free-flowing reaches.

Parameter Selection

This plan incorporates monitoring for a variety of field and laboratory water quality parameters to help assess the effectiveness of the P-WLA. The following is a brief discussion of each.

Field Parameters:
Field parameter measurements from the four multi-probe sondes are the primary focus of this ambient monitoring program. Field data are intended to be collected throughout the course of the summer, with the possible exception of heavy runoff events.

- Dissolved Oxygen (DO) – DO concentration and percent saturation criteria are the primary thresholds for determining whether the river is attaining its designated classification. Remote sensors will allow us to see the full diurnal DO signal, which will allow us to see the true worst case condition, and also help to assess the relative degree of algal production. Paired sensor deployments will help to isolate DO oxygen kinetics associated with specific reaches of river.
- Temperature – Temperature is an essential parameter for determining DO percent saturation. It is also helpful in assessing climatic influences.
- Specific Conductivity – Specific conductivity is a field parameter that will help to assess potential relationships of point and non-points source influences on DO.
- Depth – Depth is a field parameter that can help determine specific flow/stage influences on DO.

Laboratory Analysis:
Collection of discrete samples for laboratory analysis is intended to be a secondary aspect of this ambient monitoring plan. Sample collection/analysis in accordance with this plan will only occur in response to specific concerns from field monitoring and/or observations, and generally only during low-flow conditions. Specific analyses may include any combination of the following;

- Total Phosphorus (TP) – TP testing provides an indication of the degree of nutrient enrichment. TP sampling would typically be triggered in response to significant diurnal DO swings (greater than 1 mg/l) and/or observance of nuisance algae.
- Biochemical Oxygen Demand (BOD) – BOD testing provides a quantitative measure of the degree of organic pollutants in the water. BOD testing would typically be triggered by persistent low DO readings that are not the result of diurnal swings.
- Chorophyll-a (Chl-a) – Chl-a is a surrogate measure representative of the quantity of phytoplankton biomass in the water column. Chl-a testing would be triggered by either

Responsibilities

Dischargers:
In association with this plan, dischargers will be responsible for the following;

- Cost to purchase specified field monitoring equipment.
- Providing access to the river for monitoring as deemed necessary.

Maine DEP:

- All aspects of data collection and reporting. Specific duties include; proper calibration and maintenance of sonde equipment, deploying and retrieving sondes, sample collection, proper implementation of QA/QC measures and delivery of an annual data report.
- Cost of laboratory analysis.

Comments on Plan Development

The following is a summary of formal comments received during development of the Ambient Monitoring Plan. Comments are highlighted in bold italics, followed by the Department response.

PIN Comments (letter dated May 6, 2011)

1. One of our overarching concerns is that we believe the monitoring plan does not seem to adequately recognize the role that Dolby Pond and Mattaseunk Impoundment play in affecting water quality of downstream segments of the Penobscot River. The plan makes no mention of any monitoring that will take place in Dolby Pond, despite it being the origin of the phytoplankton blooms which cause non-attainment, nor does it mention monitoring at Mattaseunk Impoundment where ME DEP found DO violations in 2007.

Dolby Pond does play a significant role relative to water quality in and downstream of the impoundment, as specifically referenced in the P-WLA (May 2011). Preventing phytoplankton blooms from initiating in Dolby Pond is a primary goal of the P-WLA. The two Katahdin paper mill's have the strictest WLA's for phosphorus (based on 0.1 mg/l total phosphorus) in recognition of the particular sensitivity of the area to phytoplankton blooms. The prescribed discharge limits are expected to significantly reduce the likelihood of phytoplankton blooms recurring in the Penobscot River. Dolby Pond could still be prone to occasional blooms, but it is suspected that recycling of phosphorus from the sediments (legacy pollutants) would be the primary contributing factor. Regardless of the cause of any potential future blooms, the Department would conduct sampling in Dolby Pond, in association with the Ambient Monitoring Plan, if such an event were to occur. Monitoring would likely consist of phosphorus and Chl-a sampling to assess the cause, scope, and magnitude of the problem. There has not been an observed bloom in this area of the river since significant phosphorus loading reductions were instituted at the Katahdin West mill in the Fall of 2007 (per Consent Agreement). The Ambient Monitoring Plan does not exclude the possibility of sampling and analysis being conducted in Dolby Pond and/or Mattaseunk Impoundment. The Department is aware of the monitoring work being conducted by the PIN in Dolby Pond, and is prepared to institute supplemental sampling if/when PIN's efforts suggest the onset of a concern.

Additionally, the Department recognizes that there has been measured DO non-attainment in Mattaseunk Impoundment, but expects that this was fallout from eutrophic conditions. The Ambient

Monitoring Plan suggests that most DO monitoring will be conducted below Mattaseunk Dam (particularly in the first year). However, a likely deployment location will be directly below the dam, which would be expected to provide insights regarding potential non-attainment above the dam. The adaptive management style approach to the P-WLA and the Ambient Monitoring Plan is intended to facilitate a focusing of efforts where most needed. No sections of the river are considered off-limits to the potential for monitoring.

2. While the monitoring plan provides for laboratory analysis of water samples to support findings from the field monitoring, we are concerned that the scope of the water sampling, as written, is too limited with respect to sampling area and the conditions under which it will be triggered. Specifically, the sample collection/analyses in the plan seems to focus on areas downstream of the West Branch during times when dissolved oxygen non-attainment is occurring. It is important that the plan provide flexibility, but we think it needs to have additional specificity to ensure its effectiveness.

As mentioned above, the adaptive management style approach to the Ambient Monitoring Plan is intended to facilitate a focusing of efforts where most needed. No sections of the river are considered off-limits to the potential for monitoring. The Department expects that the first year of monitoring will involve a good deal of moving around to try and identify specific potential areas of concern. The Department recognizes and respects the PIN's monitoring efforts on the Penobscot, and plans to adapt our monitoring efforts in response to potential concerns identified by PIN. Subsequent years of the Ambient Monitoring Plan are expected to get progressively more targeted and specific in response to findings from prior year efforts.

3. For the sampling area, the plan indicates that monitoring will most likely be limited to segments downstream of the Mattaseunk Dam. We believe that the plan should provide for sample collection/analysis upstream into the Dolby and Mattaseunk Impoundments, especially if data or observations by ME DEP, PIN, or other agencies suggest the onset of phytoplankton bloom conditions. Data from these upstream areas are integral to understanding environmental responses in downstream areas, especially given the affect these waters have had up to now.

DEP agrees, the plan should provide for monitoring and/or sampling into the Dolby and Mattaseunk Impoundments. It was not our intent to exclude these areas, and the plan has been edited to be clearer in this regard.

4. In terms of the conditions which would trigger sample collection/analysis, we believe the plan focuses too much upon dissolved oxygen problems (persistent low DO or diurnal swings > 1 mg/L) as the WLA evaluation criteria. The fact that blooms at Dolby have been cyanobacteria should be a significant concern by itself due to the neurotoxins that can potentially be produced. Other environmental response parameters such as phosphorous and chlorophyll-a, particularly at Dolby Pond, provide for earlier detection of problems and may be better criteria to evaluate the effectiveness of the WLA loadings. Additionally, with the limits and/or effluent monitoring requirements in the MEPDES licenses, it is important to obtain ambient data to understand the relationship between discharge loadings of phosphorous and ambient levels of phosphorous and chlorophyll-a. Therefore, we recommend that this plan include or refer to other work that ME DEP will conduct to generally assess ambient phosphorous and chlorophyll-a levels throughout the season in key areas including Dolby Pond. This monitoring does not need to be intensive like that used for the water quality model; monthly sampling during the May – September season

would likely suffice. Additionally, as stated above, this plan should include additional sample collection/analysis if data or observations by ME DEP, PIN, or other agencies suggest that bloom conditions are being approached.

Phytoplankton/cyanobacteria blooms in Dolby are of significant concern to the Department. Discharge limitations associated with the P-WLA specifically target these blooms and are expected to significantly reduce the likelihood of recurrence. The Department is reluctant to initiate routine monitoring for phosphorus and chl-a based on this reduced likelihood. Routine year-round phosphorus monitoring is required for both discharges upstream of Dolby Pond. These data combined with river flow data provide a reasonable measure of the relative impact of point source discharges on ambient phosphorus concentrations. If blooms were to recur in Dolby Pond, the Department expects that it would be caused by the added influence of phosphorus recycled from the sediments from legacy loadings. Significant recycling of phosphorus from the sediments in Dolby Pond is expected to be driven by thermal stratification and subsequent anoxic conditions at the sediment/water column interface. Such conditions are expected to be sporadic and very difficult to capture with routine monitoring. Due to these factors the Department is suggesting potential sampling and analysis as a reactive response only. Monitoring data and/or observations from the PIN or other agencies will be considered as due cause to conduct supplemental monitoring and/or sampling.

5. As ME DEP is aware, PIN intends to have a floating platform with sondes providing realtime data, including chlorophyll-a. at Dolby Pond for the foreseeable future. We are agreeable to making these data available to ME DEP to assist in understanding the dynamics at Dolby and to help evaluate the WLA. However, to do so would require regular communication and coordination to understand the work being done and to ensure the data meet the quality objectives of both parties. Additionally, PIN would like to better understand ME DEP protocols for other nutrient related environmental response variables in the state draft nutrient rulemaking (i .e. spatial mean for chlorophyll a.), so that PIN can assist with development of site specific criteria.

The Department appreciates and respects the monitoring efforts being conducted by the PIN. The PIN efforts at Dolby Pond are of particular interest to the Department. We appreciate the offer to make this data available and feel it is a great compliment to the Department's Ambient Monitoring Plan. We look forward to continued communication/coordination in this regard.