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WSTB Meeting Planning Session – Nutrient Trends in the Nation's Waters

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SUMMARY: The Water Science and Technology Board (WSTB) seeks to develop a study focused on understanding nutrient trends in the nation's waters and lessons learned for nutrient reduction strategies. A consensus study on this topic will be timely and useful for several reasons. Over the past few decades, there have been significant expenditures devoted to reduce nutrients in surface and groundwater across the United States. There have been few, clear successes, in part because identification of direct outcomes from specific nutrient control activities presents many scientific challenges and uncertainties. The ability to recognize clear signals and outcomes from nutrient management activities inhibits efforts to develop successful actions and to demonstrate accountability and wise expenditure of resources.

Reducing nutrient pollution is a current priority for the federal government, and an independent assessment of existing monitoring, data gathering, and nutrient reduction strategies could provide guidance for optimizing nutrient management actions and outcomes within constrained budgets. Given the complexity of the issues to be studied and the importance of involving multiple federal agencies and stakeholders in the discussion, the WSTB proposes to convene a planning session to engage several experts in the development of a written plan and proposal to address these issues in an NRC study.

BACKGROUND: Over the past few decades, the environmental impacts of excessive nitrogen and phosphorus in surface waters, including degraded habitats and harmful algal blooms that affect the survival of aquatic life, have become widely recognized. Numerous conservation efforts have been implemented in basins with impaired waters, including major initiatives in the Chesapeake Bay watershed, the Neuse River, the Great Lakes, the Illinois River, the Mississippi River Basin, and the state of Florida. Billions of dollars have been invested to reduce the amount of nutrients in the nation's fresh waters through improved farming practices, enhanced stormwater management, and upgraded wastewater treatment facilities.

Yet, at a national scale, the USGS (2008, 2010) reports that between 1993 and 2003, most monitoring sites showed no significant trends in nutrients, and where trends were observed, more were increasing rather than decreasing. An analysis by Hirsch et al. (2010) reported that between 2000 and 2008, decreasing phosphorus trends were observed in only one river basin in the Chesapeake Bay watershed out of nine analyzed after thirty years of nutrient reduction initiatives, although declining nitrate trends were observed in five of the watersheds. Sprague and Gronberg (2012) analyzed 133 large U.S. watersheds to assess linkages between water quality and management practices, and reported unexpected results, with greater observed nitrogen export in areas with more land in the Conservation Reserve Program and greater phosphorus export in areas with more conservation tillage.

Scientists have identified several factors that lead to unexpected water quality responses to land-based nutrient reduction practices. For example, nitrate in ground water may lag years behind the movement of nitrogen in surface water. Years to decades after agricultural applications are reduced or eliminated, phosphorus may be leached into surface waters from large reservoirs of soil-associated phosphorus. Additionally, it may take years (or decades) after implementation for certain land-based conservation practices (e.g., forested buffers) to realize definitive results. Although the lag times and legacy effects are recognized, their role remains poorly quantified in large-scale assessments of nutrient trends. Thus, when nutrient concentrations and loads in the nation's rivers are not reduced after major conservation initiatives, scientists, farmers, environmental groups, policy makers alike are left to speculate on a range of possible causes. These scientific uncertainties, and the complexities of these systems and their responses to nutrient management actions, confound and may frustrate the many parties seeking to implement nutrient reduction actions that lead to improved water quality.

PLANNING SESSION: The Water Science and Technology Board (WSTB) proposes to convene a one-day planning session to discuss and explore the many scientific dimensions and challenges of monitoring and detecting changes in nutrient levels in the nation's surface and ground water. Members of the Water Science and Technology Board, along with some invited experts, will organize and participate in the meeting, with support from NRC staff. Scientists and managers from agencies and prospective sponsors also will attend, including the federal agencies with primary responsibilities and programs in nutrient management and water quality studies—the U.S. Department of Agriculture Natural Resources Conservation Service, the U.S. Environmental Protection Agency, and the U.S. Geological Survey. Meeting discussions will be structured to address challenges related to monitoring, data collection, and analysis of the status and drivers of U.S. nutrient trends and the potential benefits of a NRC study focused on (but not limited to) the following questions and topics:

1) Are existing monitoring strategies and modeling tools (applied at either national or local levels) sufficient to detect flow-adjusted trends in nutrients? Are existing monitoring strategies, data, and modeling tools sufficient to determine the drivers of those trends and the impacts of nutrient control strategies across a range of spatial and temporal scales? If not, what additional data, strategies, and tools are needed and what are the highest priorities?

2) Based on a review of fresh water nutrient trends in the United States and worldwide, are there lessons that can be learned for improved nutrient management elsewhere? Are there lessons that can be learned from areas with increasing nutrient imbalances and loss trends, particularly in areas actively implementing nutrient reduction strategies?

3) What nutrient reduction strategies provide the most rapid responses in surface water quality, and what strategies provide mainly long-term benefits? How should lag times and legacy effects be considered in the prioritization of nutrient reduction strategies and associated monitoring?

OUTCOME: The goal of the proposed event is to gauge broad interest of prospective sponsors in supporting a study, and accordingly develop a plan and proposal for a study on lessons learned for improved monitoring of nutrients in the nation's surface and groundwater, with emphasis on monitoring of nutrient control actions and strategies.