Appendix D

Nonpoint Source Pollution Control Modeled Estimate

Why were nonpoint source needs modeled?

Estimating the overall costs of addressing NPS pollution throughout the United States has long constituted a major challenge to EPA and to other groups. The States have reported for many years that NPS pollution is the most significant source of remaining water quality impairments in the United States. In EPA's most recently published *National Water Quality Inventory*, which summarizes the State water quality reports submitted to the Agency under section 305(b) of the Clean Water Act, the States have, for example, identified agriculture as causing or contributing to 48 percent of remaining waterbody impairments in the United States. The States also list hydrologic modification, habitat modification, urban runoff, forestry, and resource extraction as top contributors to water quality impairment. NPS pollution is a significant contributor to impairments of lakes and coastal estuaries as well.

Despite the evident significance of NPS pollution, the cost of remediating such pollution has remained difficult to quantify. The chief difficulty lies in the vast number of potential sources of NPS pollution, including more than 300 million acres of agricultural production managed by well over a million producers and production entities; hundreds of millions of acres of forestland and rangeland; many thousands of small communities that contribute urban NPS pollution; tens of thousands of abandoned mines; tens of millions of septic tanks, cesspools, and other on-site wastewater treatment systems; and many other significant sources of pollution. Not all of these sources are causing pollution problems or require remediation; however, a great many of these sources do need new or improved practices to control NPS pollution.

Given the vast array of sources of NPS pollution, to date States have been unable to identify all of them. Similarly, States have not been able to develop or identify to the degree necessary other documentation required for the "documented needs" approach used in the CWNS 2000, as discussed in Section 2 of this report (e.g., description of the water quality impairment, its location, BMPs used to address the problem, and the cost of each BMP). For example (as shown in Appendix A, Table A-2, of this report), by using the documented needs approach, only 15 States were able to estimate any costs for cropland or animal agriculture, despite the fact that agriculture constitutes the most significant source of NPS pollution in the Nation. Similarly, only 16 States were able to estimate costs for hydromodification (the second most reported source of impairment to rivers and streams in State 305(b) reports); only 2 States were able to estimate costs for silviculture (forestry); and only half could do so for urban sources.

To address this analytical shortcoming, EPA has supplemented the documented needs approach used in the CWNS 2000 with the continued use of a modeled approach that estimates the current expenditures to prevent and control NPS pollution from selected source categories. The modeled approach thus estimates the additional resources ("needs") necessary to address the identified NPS problem(s) in only those select categories. The modeled approach in the CWNS 2000 is broader than the modeled approach used in the 1996 Clean Water Needs Survey, including several source categories not previously included; it now includes seven major source categories. Although this modeled approach is still limited, EPA believes it captures a substantial portion of the Nation's total NPS capital needs and therefore provides critical information that readers of this report should consider in conjunction with the documented needs discussed earlier in this document.

It is important to note that ultimately a documented approach will provide a more accurate and complete assessment of national NPS needs, as well as better information at the State and watershed levels. During the next 10 to 15 years, EPA expects that State programs will generate the sort of improved data needed. States are developing TMDLs for all impaired waters, which will identify the NPS pollutant loads (and therefore the ultimate load reductions) needed to achieve water quality standards in each impaired waterbody. Moreover, using Section 319 funds and

other funding sources, States are now beginning to develop watershed-based plans for watersheds significantly affected by NPS pollution. Such plans describe the pollutant sources, the pollutant load reductions to be achieved from relevant categories and subcategories of nonpoint sources in the watershed, and the BMPs to be implemented. States will use these watershed-based plans as the basis for their implementation activities in impaired watersheds, working in partnership with other Federal and State agencies and with local communities to solve their NPS problems. Thus, EPA hopes eventually to be able to thoroughly document all NPS needs across the United States, and to do so on a watershed-by-watershed basis.

Finally, it must be noted that for two reasons the modeled NPS needs represent only a partial picture of the true total NPS needs. First, certain source categories were omitted altogether because of a lack of data with which to obtain an acceptable modeled estimate. Second, even for the categories modeled, the full array of BMPs and behavioral changes that would be needed to fully address the Nation's NPS problems within those source categories have not been accounted for because of data and time constraints.

What are the NPS modeled needs results?

Table D-1 and Figure D-1 present estimated total capital needs. Categories VII-D and VII-G together contribute approximately $15.0 billion to the total modeled NPS capital needs estimate. Approximately 98 percent ($9.4 billion) of the total capital needs for Category VII-D ($9.63 billion) are for implementing on-site wastewater treatment systems. Categories VII-A and VII-B, with needs estimated to be approximately $5.9 billion, account for the largest remaining share of the total capital needs.

How were NPS needs estimated for the CWNS 2000?

The CWNS 2000 expands the total number of NPS categories beyond what was modeled in the 1996 Clean Water Needs Survey. The 1996 survey modeled only agricultural cropland, animal feeding operations, and silviculture.

Table D-1. Estimated CWSRF-Eligible Needs for Selected NPS Categories (January 2000 dollars in billions)

CWNS Category		Estimated Total Capital Needs	Percent of Total
VII-A	Agriculture (Cropland)[a]	4.44	20.6
VII-B	Agriculture (Animals)	1.51	7.0
VII-C	Silviculture	0.025	0.1
VII-D	Urban	9.71	45.1
VII-F	Marinas	0.0027	0.01
VII-G	Resource Extraction	5.40	25.1
VII-K	Hydromodification[a]	0.417	1.9
Total		21.50	100.0

[a] The value presented is the midpoint of the needs range determined by the analysis.

It is important to note that only CWSRF-eligible needs were modeled. For example, operation and maintenance costs for BMPs are not eligible for CWSRF funding and therefore were not included in the modeling analysis. Furthermore, in some cases, such as silviculture and resource extraction, needs pertain to sources on Federal land. Needs on Federal lands, however, were generally *not included* in the analysis because such needs presumably would be addressed by Federal agencies and not by the CWSRF. (Hydromodification is an exception to this rule; refer to the explanation for the Hydromodification category at number 6 in the list below.)

For the purposes of this analysis, the categories are defined as follows:

1. ***Agriculture (cropland)*** includes those croplands identified in the U.S. Department of Agriculture's (USDA) *National Resources Inventory* with an erosion level higher than *T*. (The *T* value is the maximum average annual soil loss that will permit current production levels to be maintained economically and indefinitely.)
2. ***Agriculture (animals)*** was defined as animal feedlots with fewer than 500 animal units. That number had been chosen in accordance with one of the options

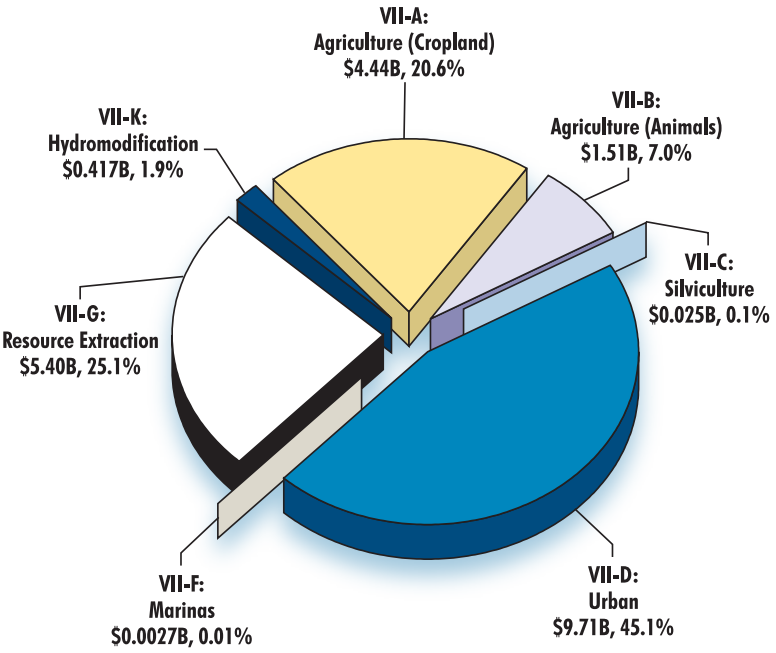

Figure D-1. Total modeled needs for NPS pollution control (January 2000 dollars). Note: CWNS 2000 NPS Need Categories VII-E, H, I, and J were not modeled.

in the proposed Concentrated Animal Feeding Operation (CAFO) rule (68 FR 7176). The final CAFO rule defined a CAFO as an operation with 1,000 or more animal units. This change does not substantially alter the modeled NPS needs estimate for agriculture (animals).

3. ***Silviculture*** includes *only* needs to address timber harvest. Costs for maintenance of forest roads, which is considered operation and maintenance and thus not CWSRF-eligible, are actually considerable, and would have greatly inflated the estimate for silviculture. Furthermore, the estimated compliance rate for implementation of timber harvest practices under current regulatory schemes is fairly high, thus lowering the total additional needs figure.

4. ***Urban*** includes NPS needs associated with on-site wastewater treatment systems, existing residential development, and construction sites covering less than 1 acre. The on-site wastewater treatment system analysis includes only the need for repairing or replacing leaking systems, not for building new systems in new subdivisions. This is because the latter need is not included in Category VII-D of the documented NPS needs but is subsumed under Categories I and II. The residential construction site limit is placed at 1 acre because this is the permitting limit under the Storm Water Phase II rule (and therefore areas larger than 1 acre do not qualify as nonpoint sources).

5. ***Resource Extraction*** includes *only* abandoned coal mines because that was the only category of resource extraction for which the data available to model needs were adequate.

6. ***Hydromodification*** includes *only* dissolved oxygen mitigation for dams. However, because EPA was unable to separate Federal dams from private dams because of the format in which data were available, the estimate for dams includes Federal dams even though those would not be addressed through CWSRF funds. This category *does not* attempt to address the much broader range of hydrologic modification and habitat modification, although States have identified these as their second and third most important sources of impairment to rivers and

streams. Those sources were not modeled because of a lack of quality data to support such an analysis. Inclusion of those sources would likely inflate the total for the hydromodification category alone into the tens or even hundreds of billions of dollars.

The major water pollution problems associated with the source categories addressed by the practices costed for the modeled NPS approach are the following:

- Erosion and sediment runoff (agriculture, silviculture, abandoned mine lands, and residential construction).
- Pathogen and nutrient export (agriculture and on-site wastewater treatment systems).
- Acid mine drainage (abandoned mine lands).
- Depletion of dissolved oxygen (dams).
- Fuel spills (petroleum hydrocarbons from marinas).

It is important to note that the source categories for the modeled NPS needs do not exactly match those for the documented NPS needs. This is because the modeled NPS needs were largely based on information accumulated in prior years by EPA for particular source categories, and from information sources where sufficient data were available to actually scale-up NPS need estimates to the national level. Therefore, the following categories are *not* included in the modeled NPS needs, although a few States were able to provide some documented needs for these categories to EPA:

- Ground Water Protection: Unknown Source (VII-E)
- Brownfields (VII-H)
- Storage Tanks (VII-I)
- Sanitary Landfills (VII-J)

What was the basic methodology used to model NPS needs?

Although the specific methodologies used to determine needs differ to some extent among the NPS categories, the methodology for each category followed five steps.

1. Estimate the magnitude of the problem.
2. Identify applicable BMPs.
3. Estimate unit costs for the BMPs and multiply by the number of BMPs or acreage required to alleviate the NPS pollution.
4. Estimate total public and private sector expenditures incurred to date.
5. Subtract expenditures incurred (step 4) from costs (step 3) to estimate total needs.

How was the magnitude of the problem estimated for each NPS pollution category?

To estimate the magnitude of the problem, each source category analysis identified the number of facilities or acres that generate NPS pollution and could negatively affect water quality. The number and size of each source of pollution were estimated using various data sources, including the USDA's *National Resource Inventory*, USDA's 1997 *Census of Agriculture*, various Federal and State silviculture databases, the U.S. Department of the Interior's Abandoned Mine Lands database, the National Small Flows Clearinghouse, and the Tennessee Valley Authority.

How were BMPs identified for each NPS pollution category?

The second step involved identifying a set of applicable BMPs for each NPS category. The selected BMPs were chosen because of their acceptance by government agencies, as indicated in guidance issued by USDA and EPA, and confirmed through expert interviews.[1] The BMPs evaluated do not necessarily represent the only applicable management practices for each source category. Rather, they reflect management practices that government agencies have accepted, that are widely used, and for which at least some reliable cost data are available. The BMPs used to estimate costs to control pollutants from each source category are shown in Table D-2.

[1] BMPs for animal feeding operations were selected using the least-cost model that was being used to support development of what were then the proposed (but are now the final) effluent limitations guidelines for these facilities.

How were total costs estimated for each NPS pollution category?

The third step entailed estimating costs for each BMP and then applying those unit costs to the relevant NPS categories. Where a range of BMP costs was found for a specific practice, an average cost was used. For on-site wastewater treatment system analysis, average costs of repair and replacement were estimated based on the estimated number of failing systems. For abandoned coal mine lands, unit costs are not necessarily relevant; instead the analysis used estimated costs for cleaning up abandoned coal mine land sites identified by the States as posing threats to the environment.

Some BMP unit costs and management practices were adjusted for regional differences where data supporting such variation were available. This was particularly true for estimating silviculture BMP unit costs. For agriculture, conservation tillage costs were estimated using national unit costs, although variations in BMP usage by crop type were taken into account. Regional BMP cost differences were not considered in analyses of marinas and dams.

Where cost data on BMPs were limited or unreliable, best professional judgment was used by consulting with experts at the USDA, the Conservation Technology Information Center, the U.S. Forest Service, and the U.S. Department of the Interior.

Total national costs were estimated by multiplying BMP unit costs by the number of acres of land to which BMPs would be applied for cropland and silviculture and the number of NPS facilities for animal feeding operations.

How were total expenditures estimated for each NPS pollution category?

The fourth step involved estimating total public and private expenditures already incurred for BMPs that have been implemented to address NPS pollution problems. Those expenditures had funded a broad

Table D-2. BMPs Used as Basis for Cost Estimates

	Types of BMPs		
NPS Category	**Erosion and Sediment Control**	**Pathogens and Nutrients**	**Other**
Agriculture (cropland)	conservation tillage, conservation buffers, and crop nutrient management	crop nutrient management plans	NA
Agriculture (animals)	NA	comprehensive nutrient management plans and facility upgrades	NA
Silviculture	pre-harvest planning, selective haul road location, water turnouts, water bars, streamside management zones, culverts, fords, temporary bridges, seeding, and mulching	NA	NA
Urban Development (On-site Wastewater Treatment Systems)	NA	replacement and repair	NA
Urban Development (Residential Construction)	silt fences, construction entrances, and seeding	NA	NA
Marinas[a]	NA	NA	booms, drain guards, and drain inlet filters
Resource Extraction[b]	NA	NA	site reclamation
Hydromodification (Dams)	NA	NA	low dissolved oxygen mitigation

Note: NA = not applicable.

[a] Marina BMPs are designed primarily to prevent spillage of petroleum hydrocarbon products.

[b] Site reclamation for abandoned coal mines is meant primarily to address acid mine drainage as well as sediment runoff.

array of endeavors, ranging from developing nutrient management plans to retrofitting dams with equipment to increase dissolved oxygen levels.

The expenditures included costs incurred by owners or operators to implement structural and nonstructural BMPs and funds appropriated by the public sector to create incentives for operators to implement such practices.[2] Structural BMPs are engineered structures designed to control or alter runoff. The structural BMPs evaluated for agriculture and silviculture NPS control include conservation tillage,[3] riparian buffers, silt fences, and dips and bars. Nonstructural BMPs include changes in the way operators implement pollution control practices to minimize the generation of NPS pollutants. Nonstructural BMPs in the CWNS 2000 include nutrient management planning for cropland and animal feeding operations.

The accuracy of expenditure estimates varied among categories. For example, accurately estimating expenditures incurred for cropland pollution control measures posed methodological challenges because much of the required information was not readily available. Also, because EPA was not able to separate needs for federally operated dams from needs for privately operated dams, federally operated dam needs are included in Appendix D of the CWNS 2000 (even though these dams would not use CWSRF funding). Public expenditures for NPS pollution control, especially at the local level, are often not explicitly reported in published budgets. Private expenditures were even less available and had to be estimated by starting with the frequency of current practices and then applying BMP unit costs. Abandoned mine land reclamation was an exception because most of those efforts are funded through a single program created under the Surface Mining Control and Reclamation Act. Reclamation expenditures are tracked through the Abandoned Mine Land Inventory System, which is available to the public.[4]

As mentioned previously, where usage data on BMPs were limited or unreliable, best professional judgment was used by consulting with experts at the USDA, the Conservation Technology Information Center, the U.S. Forest Service, and the U.S. Department of the Interior.

What are the major limitations of the NPS modeled needs analysis?

The modeled NPS needs do not capture all potential pollution problems for the categories analyzed. For example, categories evaluated might contribute to other surface water pollution problems, such as heavy metals and pathogen contamination, but time and budget constraints precluded consideration of those pollutants. It should be noted, however, that the animal feeding operation analysis in the CWNS 2000 evaluates facility upgrades that can reduce bacterial pathogen contamination of water, although it does not explicitly estimate costs for a suite of BMPs that would comprehensively control pathogens. Similarly, the agriculture analysis could not identify BMPs specifically designed to minimize pesticide runoff, although the BMPs used for erosion and sediment runoff can reduce export of pesticides to the surrounding environment. Finally, as mentioned above, the hydromodification category *does not* attempt to address the much broader range of hydrologic modification and habitat modification, although States have identified these as their second and third most important sources of impairment to rivers and streams. Those sources were not modeled because of a lack of data to support such an analysis.

[2] For abandoned mine lands, these expenditures would be used to reclaim sites; for failing on-site wastewater treatment systems, these expenditures would be used to repair or replace existing systems.

[3] Although conservation tillage does not involve building a structure, it does involve altering the operator's equipment and hence results in some capital expenditures.

[4] Although these mining funds help to pay for pollution mitigation projects, abandoned mines were included in the CWNS 2000 because the funds might not be available in a timely fashion or in a sufficient amount to fully mitigate the pollution from abandoned coal mines. Therefore, CWSRF funds might still be of use.