WATER QUALITY PRE-INVESTMENT STUDIES IN FOUR DANUBE RIVER TRIBUTARY BASINS

EXECUTIVE SUMMARY REPORT

WATER AND SANITATION FOR HEALTH PROJECT

EUROPE BUREAU

WASH Field Report No. 407

WATER QUALITY PRE-INVESTMENT STUDIES IN FOUR DANUBE RIVER TRIBUTARY BASINS

SUMMARY REPORT

Prepared for the Europe Bureau,
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under WASH Task No. 420

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PREFACE

This summary report describes pre-investment studies conducted by the Water and Sanitation for Health (WASH) Project on four river basins tributary to the Danube River: the Yantra basin in Bulgaria, the Sajo-Hernad basin in Hungary, the Arges basin in Romania, and the Hornad basin in Slovakia. The purpose of these studies was to identify high-priority wastewater pollution control projects that could serve municipalities and industries within the four river basins. The report also includes the status on institutionalization in the four countries of computerized country databases and software for DEMDESS (the Danube Emissions Management Decision Support System). Funding and coordination of the WASH studies has been provided by the Europe Bureau of the U.S. Agency for International Development (USAID).

The studies were conducted from September 1992 through May 1993 by two teams of three persons. WASH Team A worked in Hungary and Slovakia and comprised Jim McCullough (team leader and financial specialist), Dave Horsefield (municipal wastewater specialist), and Tarik Pekin (industrial wastewater specialist). WASH Team B worked in Bulgaria and Romania and included Max Clark (team leader and environmental engineer), Dave Laredo (financial and institutional specialist), and Bill Hogrewe (industrial wastewater specialist). Tim Bondelid provided DEMDESS technical assistance to the WASH teams in the four countries and coordinated the development of country databases and applications of DEMDESS.

Local support and technical assistance to the WASH teams has been provided under WASH subcontracts by Water Engineering Ltd. of Sofia, Innosystems of Budapest, Inginerie Urbana S.A. of Bucharest, and Drako and Associates of Bratislava.

Within the four countries, the WASH studies were carried out in coordination with other USAID projects, including the ETP (Environmental Training Project); the industrial waste minimization program being executed by the WEC (World Environment Center); the LEM (Local Environmental Management Project) in Hungary; and the CCAP (Center for Clean Air Policy) program in Slovakia.

Work began in each basin with an initial assessment of water pollution problems, for which potential cleanup projects were identified. These projects were prioritized in consultation with local and national environmental officials, and prefeasibility studies were conducted on one or more of the high-priority projects in each basin. The projects identified include a variety of industrial and municipal wastewater treatment facilities, associated wastewater collection and conveyance facilities, and an air pollution control facility. The affordability of the projects, based on user fees required for full cost recovery compared with household income levels, was

assessed. In addition, opportunities for technical assistance at the national or basin level were identified for possible funding by international donors or lenders.

The WASH studies concluded in May 1993 with a final meeting in each country with WASH team members, local subcontractors, and government officials from national, regional, and local bodies. During the meetings, a draft basin report served as the basis of discussion. Based on the comments received, the four basin reports have been finalized; this summary volume is intended as a brief introduction to the fuller discussion presented in those reports. In addition, DEMDESS workshops were held in Budapest in May 1993, and in Sofia in July 1993; the results of these workshops and other DEMDESS activities are described herein, and have also been incorporated in a final DEMDESS report and a revised DEMDESS user's guide.

ACKNOWLEDGMENTS

The WASH study teams received the willing cooperation and support of people in the municipalities and industries within the four basins, as well as in several ministries and agencies in the national capitals. Many people deserve particular thanks for their assistance with the studies; a full list of their names is given in Appendix A.

The team wishes to thank those in the Europe Bureau and WASH Project staff who gave their support and energies to the year-long undertaking, especially Jim Taft (EUR/DR/ENR) and Craig Hafner, Teresa Sarai and Jonathan Darling of the WASH Project.

This report and the six others related to the 1992-93 Danube Basin activities have been edited by Christine DeJoy.

ACRONYMS

A.I.D.	Agency for International Development (Washington)
A.I.D./EUR/DR/ENR	A.I.D.'s Bureau for Europe, Office of Development Resources, Environment and Natural Resources
BAZ Co.	Borsod-Abauj-Zemplen County Water Works Company
BOD	biochemical oxygen demand
CCAP	Center for Clean Air Policy (Slovakia)
COD	chemical oxygen demand
DEMDESS	Danube Emissions Management Decision Support System
DO	dissolved oxygen
EBRD	European Bank for Reconstruction and Development
EC PHARE	European Community/Poland-Hungary Aid for Restructuring of Economies
EIB	European Investment Bank
ELI	Environmental Law Institute
EPA	Environmental Protection Agency (United States)
EPDRB	Environmental Program for the Danube River Basin
ETP	Environmental Training Project
EVR	North Hungarian Regional Water Works
GIS	geographic information systems
GPA	groundwater protection area
IBRD	International Bank for Reconstruction and Development (division of World Bank)
ICIM	Engineering and Research Institute on the Environment (Romania)
LEM	Local Environmental Management Project
LIC	Laboratory and Information Center
MERP	Ministry of Environment and Regional Planning (Hungary)

MOE	Ministry of the Environment
MSM	Ministry of Soil Management
NGO	nongovernmental organization
NIMH	National Institute for Meteorology and Hydrology (Bulgaria)
OECD	Organization for Economic Cooperation and Development
PBaH	Bodrog-Homad River Basin Authority
PCU	Program Coordination Unit
RTI	Research Triangle Institute
TSS	total suspended solids
UNDP	United Nations' Development Programme
UNEP	United Nations' Environmental Programme
USAID	U.S. Agency for International Development (overseas missions)
VSZ	East Slovakian Iron Works
VVAK	East Slovakian Water Works Authority
WASH	Water and Sanitation for Health (Project)
WEC	World Environment Center
WHO	World Health Organization
WWTP	wastewater treatment plant

UNITS

cmd	cubic meters per day
cu m, m^3	cubic meters
cu m/sec	cubic meters per second
dca	decare; 1,000 square meters or 0.1 hectares
g	grams
ha	hectares
HUF	Hungarian forints
Kcs*	crown
kg	kilograms
km	kilometers
L	liters
mg	milligrams
ml	milliliter
s, sec	second
sq km, km^2	square kilometers
t	metric tons; 1,000 kg

* As of January 1, 1993 the Czech and Slovak currencies split. In April 1993, the Slovakian monetary unit was renamed the Slovak crown (Sk) While this report uses the former symbol, Kcs, all values given are current.

EXECUTIVE SUMMARY

This summary report describes pre-investment studies conducted by WASH on four river basins tributary to the Danube River: the Yantra basin in Bulgaria, the Sajo-Hernad basin in Hungary, the Arges basin in Romania, and the Hornad basin in Slovakia. The WASH studies comprise the U.S. contribution to several elements of the Three Year Action Plan adopted by the Danube riparian countries in September 1991. The purpose of these studies was to identify high-priority wastewater pollution control projects that could serve municipalities and industries within the four river basins. The report also includes the status on institutionalization in the four countries in the computerized country databases and software for DEMDESS (the Danube Emissions Management Decision Support System). The report concludes with a number of cross-cutting issues and recommendations. Funding and coordination of the WASH studies has been provided by the Europe Bureau of the U.S. Agency for International Development (USAID).

The studies were conducted from September 1992 through May 1993 by two teams of three persons each and a single person who provided data management support and development. The work consisted of making initial assessments of water pollution problems, identifying potential cleanup and pollution prevention projects, ranking these projects in consultation with local and national environmental officials, and conducting prefeasibility studies on one or more of the high-priority projects in each basin. (Project sites are shown in Figure 1, and a summary of preinvestment studies is shown in Table 1.) The affordability of the projects was also assessed and opportunities for technical assistance at the national and basin levels identified.

Yantra Basin in Bulgaria

The Yantra basin in north-central Bulgaria has a population of 541,000 and includes the major towns of Gabrovo, Veliko Tarnovo, and Gorna Oriahovitza on the main stem of the Yantra River, and Sevlievo on the Rositza River tributary. Industry is concentrated in Gabrovo, Gorna Oriahovitza, Sevlievo, and Biala. Reservoirs on the upper reaches of the Yantra in the mountains serve a large portion of the population with safe water supplies, while the Stambolijski Reservoir on the Rositza River below Sevlievo was built to provide irrigation in the lower basin.

Water quality in the Yantra above Gabrovo is good but is degraded by domestic and industrial emissions from Gabrovo, which has a municipal wastewater treatment plant but is only 50 percent sewered; Veliko Tarnovo, which has a municipal wastewater treatment plant and is 93 percent sewered but bypasses two-thirds of its sewage without treatment directly to the Yantra; and Gorna Oriahovitza, which discharges all of its sewage untreated into the Yantra and is the site of a sugar/alcohol plant that discharges large quantities of organics and nutrients to the river. Water from the Rositza River is of relatively good quality above Sevlievo but is degraded by untreated domestic emissions from that town and industrial wastewater from a tannery.

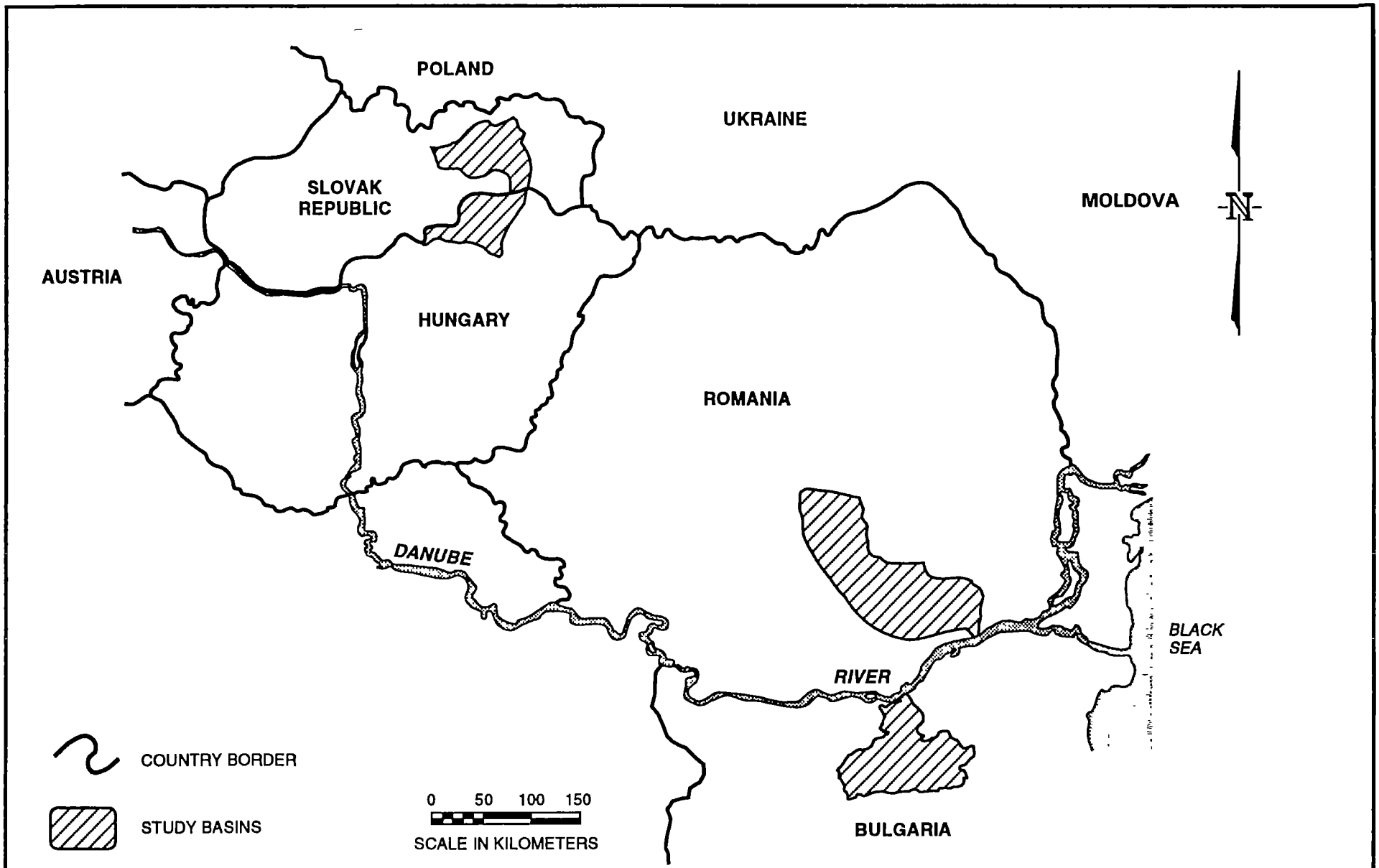

Figure 1
Danube Study Area Map

Table 1

Summary of Pre-Investment Studies

Country	Basin	Prefeasibility Study Sites	Description	Cost (in dollars)
Bulgaria	Yantra	Sevlievo	• Extend sewers	$3,700,000
			• Build new tertiary treatment plant	13,000,000
			• Minimize industrial waste	
			• Improve industrial treatment after waste minimization programs	
		Gorna Oriahovitza	• Extend sewers	3,000,000
			• Build new tertiary treatment plant	20,500,000
			• Minimize industrial waste	
			• Improve industrial treatment after waste minimization programs	
Hungary	Sajo-Hernad	Miskolc Area	• Extend sewers to 10 towns	15,870,000
			• Expand wastewater treatment plant	21,920,000
			• Institute industrial waste pretreatment	200,000
			• Improve municipal and industrial operating efficiencies	2,360,000
Romania	Arges	Pitesti	• Rehabilitate and expand wastewater plants and sewers	27,200,000
		Cimpulung		670,000
		Curtea de Arges	• Improve industrial treatment after waste minimization programs	2,980,000
Slovakia	Hornad	Krompachy	• Control air emissions at Kovohuty Copper Smelter	7,000,000
		Krompachy	• Complete wastewater treatment plant	4,260,000
		Municipality	• Improve solid-waste management	750,000

Legislation is in place in Bulgaria that empowers the Ministry of Environment with broad jurisdiction for environmental management via regional inspectorates. Municipalities have been given the responsibility for providing municipal services and can elect to own and operate water supply and wastewater facilities. Existing state-owned water and wastewater companies have been converted to limited commercial enterprises. Under current economic and institutional circumstances, funding of capital improvements to municipal wastewater treatment is the major obstacle to river clean-up programs.

Prefeasibility studies were conducted on comprehensive projects in Sevlievo and Gorna Oriahovitza. Both projects include capital improvements at the municipal wastewater treatment facilities, as well as technical assistance at industrial enterprises (e.g., waste minimization). The project in Sevlievo would reduce industrial and domestic contamination so that the Stambolijski Reservoir could be used for drinking water supply. The project includes extension of the existing sewer system and tertiary treatment of municipal wastewater for an estimated capital cost of $US 16.7 million and an annual operating cost of $US 1.27 million. The project in Gorna Oriahovitza would decrease organic and nutrient loadings to the lower Yantra. That project includes extension of the existing sewer system and tertiary treatment of municipal wastewater for an estimated capital cost of $US 23.5 million and an annual operating cost of $US 1.65 million. The primary financial concern is whether domestic users can afford to pay for the improved wastewater systems. At present, households in both communities pay less than 1 4 percent of their income for wastewater service. It is estimated that an additional 20 percent of their income would be needed to repay the capital loan and operating costs for the proposed municipal wastewater treatment facilities. Consequently, building these facilities may necessitate subsidizing project costs, reducing the project's scope, or phasing in implementation.

Sajo-Hernad Basin in Hungary

The Sajo-Hernad basin in north-east Hungary has a population of approximately 740,000. Until Hungary's recent economic restructuring, the basin contained a concentration of heavy industry, notably iron and steel makers and petrochemical and fertilizer manufacturers Economic changes have reduced employment in these industries by about half and have led to improved water quality throughout the Sajo-Hernad basin in recent years. However, threats to drinking water sources remain, primarily due to insufficient municipal sewerage coverage, land application of primary sludge from the Miskolc wastewater treatment plant, and the existence of numerous waste dumps.

Hungary's water supply and wastewater sector is undergoing significant changes, primarily as a result of the decentralization of service delivery functions and of the service pricing policies adopted by the central government. The main organizational change in the sector is the transfer of water and sewer assets from the state-owned authorities to the municipal governments. New legislation on municipal property transfer that mandates a return of water supply and sewerage system facilities to the municipal governments has had the effect of breaking up the regional and county water works authorities because many municipalities want to establish their own water enterprises, or at least negotiate a new relationship between themselves and the water works authorities. For the majority of municipalities, however, the water and sewer systems will continue to be managed by the regional/county water works authorities under contract to the municipalities.

The central government has in place a set of grant programs that could fund 50 to 80 percent of the costs of new sewerage system construction. At present, no established channels exist for providing long-term loans to municipalities for infrastructure investment, although efforts are under way to establish a municipal bank for that purpose at the local level. Additionally,

while an increase in sewer tariffs across Hungary during the past four years has augmented local water/sewer authorities' financial self-sufficiency, it also has discouraged households from connecting to networks.

A WASH prefeasibility study was conducted on a project to protect the critical groundwater resources of the Sajo-Hernad confluence. This aquifer is one of the most productive in Hungary and is already serving as one of the primary water supply sources for the basin's population. The highest-priority components of the project consist of extending sewerage to 10 municipalities, controlling groundwater contamination from waste dump sites, and instituting an industrial pretreatment program for the Miskolc sewerage system (total cost: $16.07 million). Other high-priority project components include upgrading and expanding the Miskolc Wastewater Treatment Plant, improving the Borshod Brewery wastewater disposal system, and instituting a program to increase the operating efficiencies in water supply and wastewater agencies (total cost: $24.28 million).

Arges Basin in Romania

The Arges basin in south-central Romania contains 4 million people, of which 2.5 million live in urban areas. The largest cities are Bucharest, Pitesti, Cimpulung, and Curtea de Arges. The basin's stream flows are highly regulated for hydropower, water supply, irrigation, and flood control. An estimated 90 to 95 percent of the urban population is served by public water supply systems (mostly treated surface water), but approximately 1 million people in rural areas are served by shallow wells.

The largest source of pollution in the basin is the untreated sewage of Bucharest, followed by industrial wastewater from the Arpechim petrochemical complex. Other polluters are the treated wastewater from Curtea de Arges, which causes eutrophication in the water supply reservoirs serving Pitesti; and the treated wastewater from Pitesti, Cimpulung, and Curtea de Arges, which causes eutrophication in Bucharest's water supply intake. Industries place a significant burden on surface water quality in the basin by discharging organics and nutrients into the municipal systems as well as directly to the rivers. In the lower basin, shallow wells are highly contaminated with nitrates, primarily from agricultural sources.

The Ministry of Environment has been incorporated into the Ministry of Waters, Forests, and Environmental Protection. The reorganized ministry has a department for each of its three domains: Waters, Forests, and Environment. The Department of Environment has an inspectorate for the basin in Pitesti that monitors and tests the quality of streams and wastewater emissions, grants discharge permits, and reviews environmental assessments. The Arges River Basin Water Authority (part of the Department of Waters) is financially self-sufficient from tariffs on water supplies and fines on discharges. Municipal enterprises operate the area's municipal wastewater treatment plants. They are financially self-sufficient, but only take in enough funds to cover operation and maintenance costs. In general, however, sources of financing for wastewater treatment projects in the Arges basin in Romania are extremely limited.

Because the Bucharest and Arpechim pollution problems are being studied by others, prefeasibility studies were conducted for the next highest-priority projects: the municipal emissions from Pitesti, Cimpulung, and Curtea de Arges. These projects consist of rehabilitating and expanding sewer systems and existing wastewater treatment plants. Total capital costs for all three municipalities is $30.85 million. Up to 8 percent of the average household income will be required to pay for these improved wastewater services (less than 2 percent of average household income is required currently). Minimization of industrial waste and improvements in industrial wastewater pretreatment are also required.

Hornad Basin in Slovakia

The Hornad basin in eastern Slovakia has a population of about 650,000. It contains heavily polluted areas from ore mining and refining as well as major steel and copper smelters. In addition, the region contains significant agricultural areas and associated agro-processing industries. The two major conditions that affect water quality in the Hornad basin are long-term contamination from mining and ore processing, and the poor performance of municipal wastewater treatment facilities in every major town in the basin. Air emissions from the Kovohuty copper smelter at Krompachy are very significant and may be responsible for high contaminant levels measured in downstream waters.

At present, the water and wastewater sector in Slovakia remains highly centralized, although responsibility is shared among several different ministries and authorities. The main ministries are the Ministry of Environment (MOE) and the Ministry of Soil Management (MSM), formerly the Ministry of Forests and Water. The MOE is relatively new and is gradually taking over authority at the local level for monitoring water quality, setting fines, and granting pollution permits—functions previously performed entirely by the river basin authorities. The river basin authorities, which are under the jurisdiction of the MSM, remain responsible for water resource management, development of bulk water supplies, and collection of water-use (severance) fees and pollution fees. The delivery of water and sewerage services is vested in regional water works authorities (also under the MSM), which provide water supply and wastewater services to communities and industries on a monopoly basis.

The Hornad basin falls under the jurisdiction of the Bodrog-Hornad River Basin Authority (PBaH), with local water and sewer services provided by the East Slovakian Water Works Authority (VVAK).

Although decentralization in water and waste service delivery at the local level has been discussed often, the past system continues in force with these services managed by the regional water works authorities. Water and sewer rates are still set uniformly across Slovakia (by the MSM) and are currently at levels below full cost recovery, although rates were raised substantially in January 1993.

WASH conducted prefeasibility studies on projects to reduce both domestic and industrial contamination in the industrial town of Krompachy, located in the center of the Hornad basin adjacent to large ore mines. The highest-priority project was determined to be the control of

air emissions from the Kovohuty copper smelter. This project includes the development of an investment program for new production technology, production process changes, and environmental controls. Total cost is estimated at $7 million. Such an enterprise is currently profitable and should be feasible; however, the company involved is awaiting the outcome of Slovakia's privatization process.

Other high-priority projects include relocation of the Krompachy municipal solid waste dump, which contains lagoons filled with toxic sludge from copper and electrical industries, as well as municipal solid waste. Also considered high priorities are redesigning and completing construction of a municipal wastewater treatment plant for Krompachy, improving solid waste management, and improving the operation of water and wastewater agencies. Total cost is estimated at $5.01 million. The completion of the Krompachy wastewater treatment plant and sewer appears to be unaffordable at present for the users, given the very high cost per household served. The relocation of the Krompachy municipal waste dump was determined to be affordable if cost recovery agreements were developed and a municipal loan fund established.

Implementation of DEMDESS

The Danube Emissions Management Decision Support System (DEMDESS) was developed in the previous phase of the A.I.D.-funded Danube program, (see WASH Field Report No. 374 "Point Source Pollution in the Danube Basin" and DEMDESS User Manual, both published in July 1992.) For the current study, the four countries were assisted in the development and use of DEMDESS as an operational tool for water pollution decision-making support. Technical activities emphasized database and applications development, including use in the prefeasibility studies. Institutional activities focused on training and outreach to build the proper environment for using DEMDESS.

Some of the problems encountered were a lack of consistent technical support due to personnel limitations, information gaps that compromised the accuracy of decisions, and changing political and institutional conditions that resulted in uncertainties as to which institution was responsible for making environmental decisions. Recommended future activities include continued training through country-specific information management workshops, continued assistance in prefeasibility and feasibility studies, coordination of and support for the Danube Environmental Program Data Management Working Group, and assistance in developing basin and country water-quality management plans.

Cross-Cutting Issues and Recommendations

The following lists comprise some of the major common issues that the WASH study teams identified in the four river basins, as well as the recommendations for addressing these issues.

Legal and Regulatory

- *Responsibility for the cleanup of past industrial pollution has not been assigned.* As industries are privatized and environmental investments programmed, host-country governments should clarify who will be liable for existing pollution: the governments themselves or the industries. If the governments do not know who should take responsibility, they must sponsor studies to determine who is; otherwise, Western investors will be reluctant to move in.
- *Municipalities lack the legal authority to manage decentralized services effectively.* Legislation is needed to allow privatization of services, setting of tariffs, retention of local taxes, and incurring of debt.
- *Stringent water-quality objectives require large but unaffordable capital expenditures.* The timing of required improvements must be flexible so as to permit their phased implementation. Phasing in the improvements gradually would also make them more affordable.

Technical

- *Sludge treatment and disposal have been ignored in the past.* Residuals management must be addressed as an integral part of municipal and industrial wastewater project implementation.
- *Industrial pretreatment for wastewater discharged to municipal systems is not sufficiently monitored or controlled.* Municipalities require assistance to develop better monitoring and control of industrial emissions, including incentives for waste minimization.
- *Economic restructuring has created serious uncertainties in the planning and design of population projections, future industrial production levels and water usage patterns, and estimation of capital and operation costs.* New methods for demand analysis are needed. A system of indexing local costs to international costs should be developed.
- *Data on synthetic organic and metal contaminants are lacking, and priority setting for monitoring and control remains unclear.* Technical assistance is needed to improve capabilities for pollutant analysis and risk assessment.
- *Good-quality manufacturing and pollution control equipment cannot always be produced locally.* Joint ventures with foreign manufacturers should be promoted, including the possible conversion of military production facilities.

Institutional

- *Municipalities lack the capability to plan, implement, finance, and operate decentralized infrastructure facilities.* Institutional-strengthening assistance is needed at the municipal level to assist in municipalities' adaptation to decentralized responsibilities.

- *The young, and overburdened, ministries of environment are having difficulty in meeting their rapidly expanding responsibilities.* Institutional-strengthening assistance is needed at the national level to assist in defining and balancing ministries' multiple and conflicting roles.
- *Local water/sewer authority personnel and wastewater operators are often poorly trained.* Expanded training is needed, along with provisions for certification, incentives, and increased salaries.
- *Data analysis techniques for making public investment decisions are lacking.* Decision support modeling tools such as DEMDESS, which can link cost data with environmental objectives, are needed at the national and regional levels to assist in making public investment decisions.

Financial

- *Danubian governments perceive international lenders to be slow to respond.* Communication is needed to clarify terms, conditions, and schedules for international capital assistance.
- *The availability of foreign grants is limited, and no local long-term credit facility is in place.* It will be necessary to establish a transitional financing structure, in conjunction with international lenders, that initially relies on loans via national government agencies.
- *Local industries are seen by international investors as competitors to western industry rather than investment opportunities; it is difficult for investors to assess the economic viability of these industries.* A level playing field must be created by requiring and enforcing environmental protection measures.
- *Central governments alone lack sufficient funds to construct wastewater facilities.* The funding capacity of municipalities must be developed as responsibility for cost recovery shifts from national to local levels. The burden of raising the funds needed cannot be borne entirely by new taxes and budget allocations.
- *Income levels are too low to repay wastewater loans in the near future.* Central governments should establish a clear and predictable level of grants, along with a transitional financing structure in cooperation with international lenders.

Chapter 1

CONTEXT OF THE SUMMARY REPORT

1.1 Objectives of the Studies

The objectives of WASH's wastewater pre-investment studies on the four river basins were to assess major sources of water pollution in each basin; to develop a priority ranking of possible pollution control projects in accordance with criteria that include impacts on human health and the environment; and to prepare prefeasibility studies on high-priority projects suitable for consideration by potential donors and investors.

1.2 Background

The activities undertaken in these studies build on work completed in 1991-92, when A.I.D.'s Europe Bureau provided funds to the WASH Project to support the regional Environmental Program for the Danube River Basin (EPDRB) in four countries: Bulgaria, Slovakia, Hungary, and Romania. From that work came the July 1992 WASH report, "Point Source Pollution in the Danube Basin" (Field Report No. 374) and a DEMDESS user manual.

The EPDRB is also being supported by UNDP, UNEP, IBRD, EBRD, EIB, and the EC countries through a Program Coordination Unit (PCU) in Brussels. The program was jointly established by the Danube riparian countries in Sofia in September 1991 to develop a strategic action plan for water pollution control and to carry out institutional strengthening and human resource development activities during a three-year period.

The 1991-92 WASH Danube study accomplished three major tasks: (1) it identified high-priority, immediate investment needs to control municipal and industrial wastewater emissions, for which pre-investment studies might be funded by international donors and funding agencies; (2) it evaluated institutional conditions and needs to support implementation of wastewater emission control programs; and (3) it prepared an initial computer-based system (DEMDESS, the Danube Emissions Management Decision Support System) and user manual for decision-makers to help them manage a broad range of data (point-source emissions and emitters, river water quality, streamflows, emission standards, and so on).

As hoped, the findings and conclusions from Field Report No. 374 have been used by funding agencies to identify river basins and potential high-priority projects for pre-investment studies. Additionally, the DEMDESS software and databases have been developed and applied to pilot basins in the four countries.

A scope of work similar to that for these WASH studies is being used by other donors within other basins in the four countries. The International Bank for Reconstruction and Development

(IBRD), for example, is sponsoring four basin studies, as is the European Bank for Reconstruction and Development (EBRD).

1.3 Organization and Methodology of the Current Study

1.3.1 Counterpart and Support Services

The Ministry of Environment (or equivalent) in each of the four countries provided support for the WASH studies in several ways. These included acting as a liaison with other ministries, local environmental inspectorates, municipalities, and industries; providing data and previous studies on stream water quality, groundwater quality, municipal and industrial emissions, and water pollution control facilities; and offering advice on selecting high-priority projects for WASH's prefeasibility studies.

Local support for the WASH studies also was provided by private environmental engineering consulting firms within each country, under subcontracts with WASH. In Bulgaria, Hungary, and Romania, the local firms were the same ones that developed the reports on wastewater emissions for the 1992 WASH Danube study. The companies also arranged for technical services and field surveys conducted by private individuals and agencies within each country. The firms that assisted this year are Water Engineering Ltd. of Sofia, Innosystems of Budapest, Inginerie Urbana S.A. of Bucharest, and Drako and Associates of Bratislava.

1.3.2 WASH Staffing and Work Schedule

The WASH pre-investment studies began with a team planning meeting held at WASH September 9-11, 1992. The meeting was also attended by representatives of A.I.D./EUR/DR/ENR, EPA, IBRD, and contractors working on A.I.D.-sponsored environmental projects in Eastern and Central Europe: Research Triangle Institute (RTI), World Environmental Center (WEC), the Hubert Humphrey Institute for Public Affairs of the University of Minnesota, Center for Clean Air Policy (CCAP), and Environmental Law Institute (ELI).

Field work began in October 1992, when the WASH team leaders accompanied a USAID delegation of staff from U.S. agencies and environmental contractors to visit each country, make initial site visits, negotiate local subcontracts, and develop a work plan. The initial visits by the two three-man WASH teams were made in late October 1992.

In early December 1992, the WASH team members and country consultants met in Budapest for a team progress meeting. Representatives of USAID, EPA, the Danube PCU, and IBRD also attended the meeting, at which the objectives, methodology, approaches, and outputs for the basin studies were discussed.

In January 1993, the initial selections of the high-priority projects for WASH prefeasibility studies were made in consultation with USAID and ministry officials. These initial selections were subsequently modified and refined, and the four prefeasibility studies were completed in April 1993.

Draft basin reports were prepared in May 1993 and used as the basis of discussion by country and basin officials in wrap-up meetings held in each country. A DEMDESS workshop was also conducted in May in Budapest, and was attended by representatives from each country in order to discuss common issues and coordinate the development of compatible country databases and software applications of DEMDESS. In June 1993, this summary report and the final basin reports were prepared, based on the review and comments received on the previous draft reports.

1.3.3 Project Deliverables

The pre-investment studies included the development of the following interim reports, with various exceptions depending on country-specific situations:

- *Initial Assessment Report.* Available data were summarized and evaluated to identify pollution control problems and issues in each basin, and the most likely structural and nonstructural options for their solution. These included construction or upgrading of wastewater treatment systems for municipalities and industries, air pollution control projects, improved solid-waste disposal projects, and control of nonpoint source pollution from mining, agriculture, and animal feedlots. Technical, economic, financial, and institutional issues related to project definition and implementation were also identified.

- *Interim Basin Report.* Health, economic, and environmental impacts of wastewater emissions were evaluated to define potential projects. Criteria for selecting high-priority projects for prefeasibility studies were considered, including health and environmental impacts, affordability, willingness to proceed, and cost-effectiveness. High-priority projects were selected, as well as other longer-term program elements that may require donor assistance. For the highest-priority project(s), terms of reference for prefeasibility studies were included, and elements of a longer-term investment program or project "pipeline" were outlined.

- *Prefeasibility Studies.* In consultation with USAID and country officials, high-priority projects were selected and subjected to a more detailed prefeasibility analysis. This included a more detailed definition of project components, and a closer examination of the technical, economic, financial, and institutional feasibility of the projects.

- *Basin Report:* This report is the final product of the study incorporating the contents of the previous interim reports; refinements suggested from the review and comments on the interim reports by USAID, the ministries, and local agencies; and refinements to the data and conclusions arising over the course of the study.

This summary report, four basin reports, a DEMDESS summary report, and a supplement to the 1992 DEMDESS User Manual have been prepared as the final products of the WASH studies, based on review and comments by USAID and country representatives.

1.4 Relationship to the Danube Environment Program

The WASH studies have been coordinated with the activities of other agencies involved in the overall Environmental Program for the Danube River Basin (EPDRB). The WASH studies comprise the U.S. contribution to several elements of the Three Year Action Plan adopted by the Danube riparian countries in Sofia in September 1991. These elements relate to the definition of high-priority investment needs, development of analytical tools, data management, and institutional development.

Initial contacts with the PCU sponsored by the EC countries were established during the first WASH Danube study, and were continued during this study. As opportunity permitted during coincident field visits, contact was maintained with IBRD and EBRD staff during the WASH studies.

Chapter 2

YANTRA RIVER BASIN IN BULGARIA

2.1 Background

The Yantra River basin has a population of 541,000, which includes the major towns of Gabrovo (80,000) Veliko Tarnovo (74,000), Gorna Oriahovitza (45,000), Sevlievo (28,000) and 18 smaller villages. Industry is concentrated in Gabrovo, Gorna Oriahovitza, Sevlievo, and Biala, and accounts for a sizable portion of the employed population in these communities.

Principal features of the basin are shown on the location plan in Figure 2. The Yantra River is 286 km long, and has a drainage area of 7,862 km^2. Ground elevations range from 1,900 m in the mountains to 18 m at the Danube River. Forests cover 28 percent of the catchment, primarily in the mountains and foothills. The lower basin near the Danube is primarily agricultural land on hilly terrain.

Reservoirs have been built in the mountains for industrial and municipal water supply, while the Stambolijski Reservoir on the Rositza River and two smaller downstream reservoirs have been built to provide irrigation within the lower basin. A large portion of the population is served by safe public water supply systems, although there exist deficiencies and rationing of supply in several of towns, and nitrate levels are high in a small number of groundwater wells.

The average annual stream flow of 47 cu m/sec varies seasonally, with consistently low flows from August through November. The "design low stream flow," or the stream flow during drought periods, which will be exceeded 95 percent of the time, is about 280,000 cum/day (cmd). This provides minimal dilution of total wastewater discharges of 186,000 cmd within the basin.

2.2 Water Quality Conditions

Considerable amounts of water quality data are available on the Yantra basin, including the results from an extensive 1991-92 survey sponsored by the Ministry of Environment (MOE) on river water quality and emissions. This included sampling at 44 locations on 32 water-quality parameters, in addition to routine monthly monitoring at eight locations for which records since 1980 are available. As part of this WASH study, two traverses of water-quality sampling at 21 locations were conducted in November 1992, to verify the results of the previous studies and monitoring.

The Bulgarian government's water-quality objectives for the Yantra River are to maintain or achieve Category I water-quality standards (for drinking water) upstream from Gabrovo; Category II (irrigation, recreation, and fisheries) between Veliko Tarnovo and Gorna Oriahovitza; and Category III (nonpotable industrial use) downstream from Veliko Tarnovo.

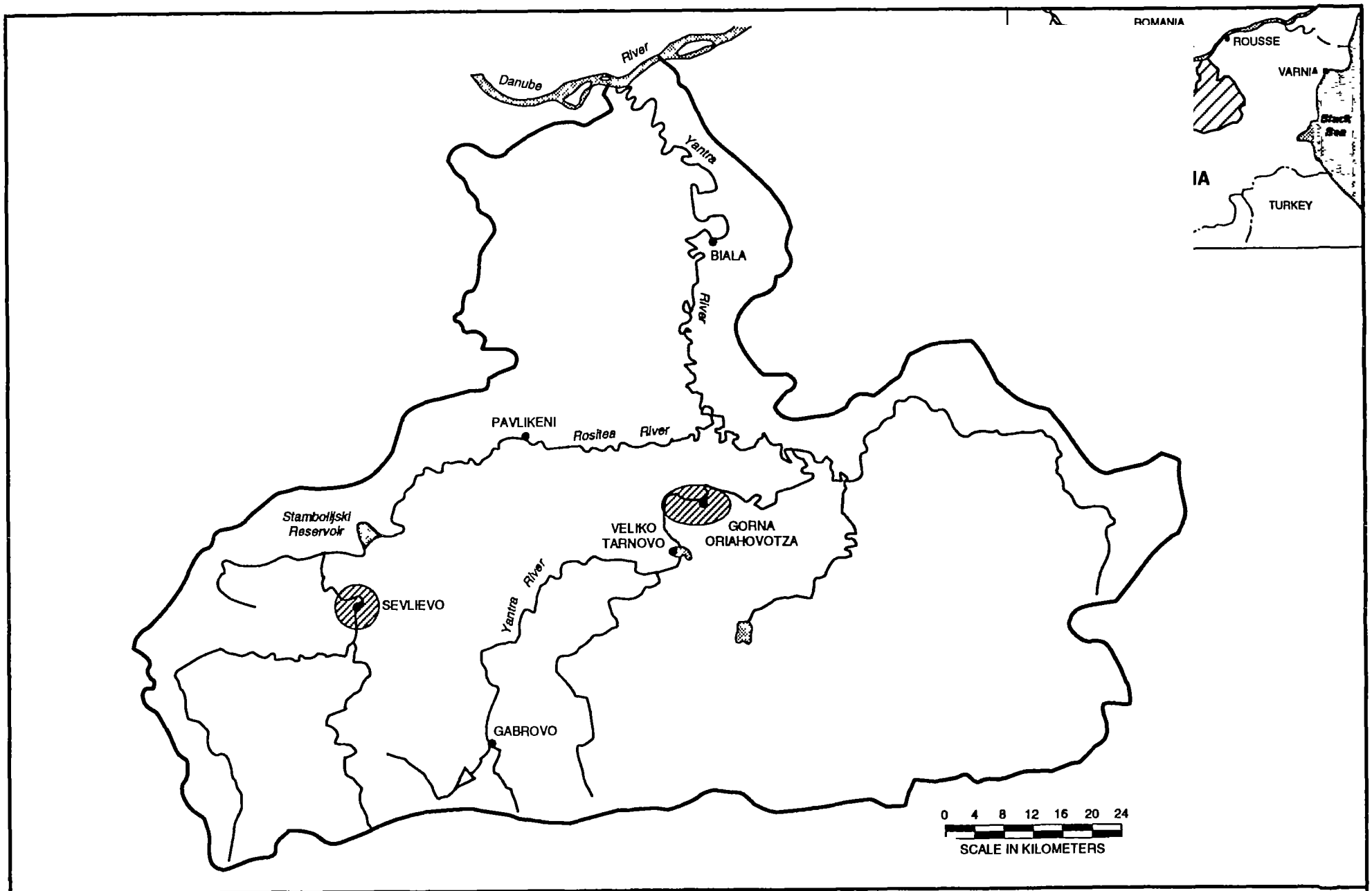

Figure 2
Map of the Yantra Basin Study Area

Downstream from Gabrovo, the water-quality objectives are not being met, as a result of the water pollution emanating from Gabrovo, Veliko Tarnovo, Gorna Oriahovitza, and the Biala region. Animal feedlots are a significant source of pollution in the lower basin, while industrial and municipal pollution sources predominate in the upper basin. Concentration limits for BOD, COD, and occasionally nitrites are exceeded. The worst water-quality location in terms of organic pollution is below Gorna Oriahovitza, where a maximum BOD concentration of 145 mg/L was measured in 1991; this value is equivalent to the organic pollution found in untreated domestic wastewater.

On the Rositza River, the water quality upstream from Sevlievo is generally good, but pollution from industrial and domestic wastewater in Sevlievo is affecting the downstream Stambolijski Reservoir. Pollution is preventing greater use of the reservoir as a source of treated potable drinking water to serve six communities in the lower portion of the basin. Under current plans, the six communities need 87,000 cmd for water supply by the year 2000, and 109,000 cmd by the year 2020 from the Stambolijski Reservoir. Water supply plans cannot be implemented, however, until wastewater treatment is provided at Sevlievo.

2.3 Wastewater Emissions

2.3.1 Municipal Emissions

Sixteen towns in the Yantra are served by sewers, and of these Gabrovo and Veliko Tarnovo have unfinished secondary wastewater treatment plants. The 1991-92 MOE survey included the collection of data on sewers and locations of industries within nine of the communities, and characterization of the wastewater emissions and the municipal and industrial treatment facilities for about 260 municipalities, industries, and animal feedlots.

Thirteen municipalities discharge a total wastewater flow of 164,000 cmd, of which the largest are Veliko Tarnovo, Gabrovo, Gorna Oriahovitza, Pavlikeni, Sevlievo, Triavna, and Biala.

Water quality in the Yantra above Gabrovo is good but is degraded by domestic and industrial emissions from Gabrovo, which has a municipal wastewater treatment plant but is only 50 percent sewered; Veliko Tarnovo, which has a municipal wastewater treatment plant and is 93 percent sewered but bypasses two-thirds of its sewage without treatment directly to the Yantra; and Gorna Oriahovitza, which discharges all of its sewage untreated into the Yantra and is the site of a sugar/alcohol plant that discharges large quantities of organics and nutrients to the river. Water from the Rositza River is of relatively good quality above Sevlievo but is degraded by untreated domestic emissions from that town and industrial wastewater from a tannery

2.3.2 Industrial Emissions

Industries in the Yantra basin include electroplating, metal finishing, food processing (canning, dairy, meat), sugar refining, alcohol production, textiles, and leather tanning. Most industries use wastewater treatment facilities, after which 38 industries discharge 22,000 cmd directly to rivers and 56 industries discharge 26,000 cmd to municipal sewer systems. Typical contaminants are heavy metals, oxygen consuming compounds (BOD and COD), and nutrients. In addition, there are 26 pig farms and 78 groupings of animal farms (cows, sheep, and chickens) that contribute a BOD load that is larger than the total municipal load; improvements in waste management practices on farms is under investigation by the Ministry of Environment.

The sugar/alcohol plant in Gorna Oriahovitza is the largest point source of organic pollution in the Yantra basin. It discharges an untreated waste stream to the Yantra that is high in BOD, COD, suspended solids, organic nitrogen, and phosphorus. Tanneries as a group contribute the second largest amount of organic pollution, followed by food and beverage manufacturers, and textile producers.

2.4 Institutional and Financial Conditions

2.4.1 Sector Organization

Although legislation on water pollution control was first enacted in the 1960s, rapid changes did not occur until 1991 and are ongoing. The Ministry of Environment was established in 1991 with broad jurisdiction for environmental management, including the preparation and implementation of a national environmental strategy. Adoption of amendments to the 1991 Environmental Protection Act are expected this year that would establish an environmental protection fund, a municipal fund, and a new schedule of fines on polluters that exceed standards.

Within the Yantra basin, the MOE is represented by regional inspectorates in Veliko Tarnovo and Gabrovo, and by two other inspectorates that cover smaller portions of the basin. The inspectorates monitor pollution levels, review environmental protection measures for investment projects, issue discharge permits, sample and analyze emissions, and have the power to impose fines on pollutant loads in excess of standards. The levels of fines are low, and fines are imposed leniently due to current economic conditions. Plant closures due to pollution are rare, but it is understood that the sugar/alcohol plant in Gorna Oriahovitza has been forced to reduce its production of alcohol by 50 percent to reduce pollution levels. The ministry is understaffed, and the inspectorates need better laboratory equipment and vehicles.

In 1991, the 246 municipalities in Bulgaria were given responsibility for providing municipal services, and can elect to own and operate water supply and wastewater facilities. Also at that time, the 28 regional water and wastewater companies were converted to limited commercial enterprises, although for the moment they continue to be tied closely to the Ministry of

Construction and Regional Development. A World Bank-sponsored sector study, initiated in late 1992, is preparing a strategic restructuring plan and a three-year public investment plan.

2.4.2 Capital Investment Financing

Under current economic and institutional circumstances, funding of capital improvements in municipal wastewater treatment is the major obstacle to river cleanup programs. Tariffs for water and wastewater service are low, sufficient only for operation and limited maintenance and repair of existing facilities. Government funding for the sector was only 150 million leva in 1991. Municipal and environmental funds have not yet been established. The municipalities have new responsibilities but limited financial resources.

Borrowing from a fund established from the proceeds of an external grant or loan is an often-used method for financing infrastructure in the West, but requires adaptation to local circumstances. Ordinarily, the national government guarantees repayment of the loan at interest rates ranging from 6 to 12 percent. Under the stipulation of the international lender, the central government uses the lender's loan to in turn make loans to the municipality or regional company at local commercial rates to prevent distortions of the local economy. (This procedure of "passing down" funds is called "on-loaning.") The interest rate the region's commercial banks currently are charging, however, is 51 percent—a figure no municipality or regional company can afford. Unless the normal stipulation for on-loaning is relaxed, no municipalities or regional water and wastewater companies will be interested or capable of affording an externally derived loan.

2.5 Priorities for Water Pollution Control

Completion of the Gabrovo and Veliko Tarnovo municipal wastewater treatment plants and associated wastewater collectors are obvious high-priority needs to improve environmental conditions in the Yantra basin. However, both Gabrovo and Veliko Tarnovo were included in the list of candidates for funding under the current World Bank-sponsored sector study and loan program. Although it now appears that completion of the wastewater treatment plants in Plevin, Pomorie, and Kazanluk will be the only wastewater facilities funded initially under the World Bank loan, the needs of Gabrovo and Veliko Tarnovo are well known to the donor community. As a result of these and other considerations, it was decided in consultation with local and national environmental officials that Sevlievo and Gorna Oriahovitza should be given priority for the WASH prefeasibility studies.

Municipal wastewater treatment and industrial pretreatment in Sevlievo will permit use of the Stambolijski Reservoir as a treatable source of drinking water. Municipal and industrial wastewater treatment in Gorna Oriahovitza will control the major point source of untreated wastewater in the basin, allow the sugar/alcohol plant to resume full production, and allow Yantra waters to be used for irrigation in the lower portion of the basin.

2.6 Prefeasibility Studies

2.6.1 Service Areas and Conditions

The prefeasibility studies for Sevlievo and Gorna Oriahovitza began with the development of a basis of planning, as follows: two planning horizons for flow and population projections were adopted; the year 2000 for Phase I improvements and the year 2010 for Phase II improvements. In addition, immediate improvements have been defined. Projections of population and flow from 1993 to 2010 are summarized in Table B.1 of Appendix B.

The increase in wastewater flow is projected to be very small between the years 2000 and 2010; hence the initial construction should be for facilities sized for the projected flows in the year 2010. It should also be noted that the service area for Gorna Oriahovitza includes the nearby town of Liaskovets.

Flow and cost allowances were made to extend local sewerage systems on pace with population growth. By the year 2000, it is assumed that industrial production will recover fully and use the full capacity of pretreatment units. In the case of the sugar/alcohol plant in Gorna Oriahovitza, major changes in the use of water for transport of sugar beets and in reduction of other wastewater flows is anticipated. A slight reduction of industrial wastewater flows between 2000 and 2010 is also anticipated. Industrial wastewater is expected to account for about half of the total wastewater flow at each of the municipal plants.

2.6.2 Project Components

Capital investments through the year 2010 have been estimated to cover the following: extension of sewerage systems; construction of collectors to treatment plant sites; and construction of tertiary treatment plants at both towns. Improved industrial wastewater treatment and changes in the types of industrial water-use and production processes will be needed, but capital and operating costs could not be estimated reliably at this prefeasibility level, because waste minimization may provide a substantial reduction in wastewater flows and loads at industrial treatment facilities. Nutrient removal is needed at the Sevlievo municipal treatment plant to allow use of the Stambolijski Reservoir as a treatable supply source, and is needed at Gorna Oriahovitza to meet the effluent criteria under Bulgarian standards. The possibility of providing secondary treatment initially, and delaying the provision of tertiary treatment, would save money and may be necessary depending on financial constraints.

In addition to the municipal facilities (branch sewers, collectors, and tertiary treatment plants), particular attention must be paid to the requirements of improving industrial wastewater treatment and waste minimization by industries, as alluded to above. These requirements are summarized in Appendix B. (See Table B.2 for Sevlievo and Table B.3 for Gorna Oriahovitza.) To illustrate the anticipated benefit of the suggested improvements, the pollution loads before and after the proposed changes in Gorna Oriahovitza are summarized in Tables B.4 and B.5, respectively, in Appendix B.

2.6.3 Costs and Financial Considerations

The required capital investments for municipal facilities only are estimated at $US 16.7 million for Sevlievo, and $US 23.5 million for Gorna Oriahovitza. Annual costs of operation and maintenance are estimated at $US 1.27 million and $US 1.65 million, respectively. The capital costs for the municipal facilities are summarized in Table 2. (The costs included for major collectors are provisional; at the time of this writing, municipal officials were in the process of selecting the sites for the new wastewater treatment plants, which will determine the lengths and costs of the collectors.)

The primary financial concern is whether the domestic users of the wastewater systems can afford to pay for the proposed improvements. The impact on households in the two systems has been estimated based on an average current monthly household income of $US 77 or 2,000 leva, and a conservative set of financial assumptions, as follows:

- No subsidy from the central government.
- A direct loan from an international donor to a municipality, repaid over 20 years, at an interest rate of 12 percent. (The municipality would repay the loan in hard currency, if available, and thus might pay a much larger amount in inflated leva.)
- Household incomes remain constant to the year 2010, when computed in terms of the current purchasing values of the U.S. dollar and the Bulgarian leva. (This is highly unlikely, because household incomes will rise substantially due to increased wages as government subsidies on housing, food, and many other consumer goods and services are reduced.)
- Continued disparity between the market foreign exchange rate and the actual economic quality of living in Bulgaria. For example, current government subsidies in essence make the average household income in Bulgaria 10 times its net value. As the country's economy moves closer to a true market economy, however, subsidies will, theoretically, be proportionately replaced by increased incomes.
- Minimal cross-subsidies from industry. The domestic share of total cost has been estimated on the basis of flow share, without taking into account the higher BOD loads and greater ability to pay of the industries. It is common in many countries for industries to pay higher rates than household users because industries obtain a savings in economy of scale at the municipal plant, compared with the cost of small industrial treatment plants designed for direct discharge of high-quality effluent to rivers.

For these very restrictive assumptions, the computed impact on households would be similar in both systems. At present, households in both Sevlievo and Gorna Oriahovitza pay less than 1.4 percent of income for wastewater service (including payments to the proposed environmental fund). At current income levels, by the year 2010 each household would have to pay an additional 20 percent of their income to repay the capital loan, as well as operate the proposed treatment facilities.

Table 2

Estimated Costs of Municipal Facilities, Yantra Basin Study

Component	Sevlievo	Gorna Oriahovitza
	Estimated Cost, $US	
Branch sewers and major collector sewers	3,700,000	3,000,000
Wastewater treatment plants	13,000,000	20,500,000
TOTALS	16,700,000	23,500,000

However, if salaries increase to replace public subsidies and exchange rates come to reflect the actual economic quality of living in Bulgaria, the equivalent $US incomes should increase by at least 10 times over the next few years. By this reasoning, households would then be able to afford the cost of improved wastewater service. For quicker implementation of the two systems, however, it may be necessary for the central government to subsidize a portion of the initial capital costs.

Chapter 3

SAJO-HERNAD RIVER BASIN IN HUNGARY

3.1 Background

The Sajo-Hernad basin is located in Borsod-Abauj-Zemplen County in northeastern Hungary and contains the second largest municipality in Hungary, Miskolc (population approximately 200,000 of the basin's 740,000) as well as a concentration of heavy industry. The Sajo River system is composed of three main subbasins with a total area of 4,214 km^2, comprising the main Sajo River stem, the Bodva River, and the Hernad River (Figure 3).

The main drinking water resources are located in the karstic limestone formations lying due west of Miskolc (and providing about half of the city's water supply; and in the alluvial aquifers underlying the Sajo-Hernad River system with the most productive areas occurring at the confluence of the Sajo and Hernad rivers, and at the confluence of the Bodva and Sajo rivers.

The major population settlements are located in the main Sajo valley, which contains Miskolc, the main urban center; as well as the industrial towns of Kazincbarcika, Ozd, Tiszaujvaros, Sajoszentpeter, and Putnok. More or less continuous settlement occurs from Miskolc to Ozd, with the major industrial concentrations at Miskolc (steel, ore refinery, paper, and mechanical equipment manufacturers); Kazincbarcika (chemical and fertilizer complex, electric power station); and Ozd (steel manufacturer). At the upper end of the Sajo are coal mines, which mainly are used for the electric generating plant at Kazincbarcika.

The Hernad valley contains two small towns (Szikszo and Encs) and numerous farming villages; the major industry is agriculture. In the lower Hernad valley lies the only major industry, a beer brewery at Bocs.

All three valleys in the study area (Sajo, Bodva, and Hernad) are experiencing high levels of unemployment, for slightly differing reasons. In the main Sajo valley, the general reduction in industrial activity has led to many plant layoffs; the most critical was the shutdown of the steel industry in the Ozd area, although Kazincbarcika and Miskolc were also hit hard. Coal mining activity has also declined in the Ozd-Putnok area, due to reduced demand in the industrial sector.

The economic downturn has affected population growth rates as well. In the past few years, there appears to have been a net outmigration. Miskolc, for example, has lost an estimated 3 percent of its population, while surrounding suburban municipalities have grown. The total population decrease for the greater Miskolc region since 1980 is approximately 1 percent.

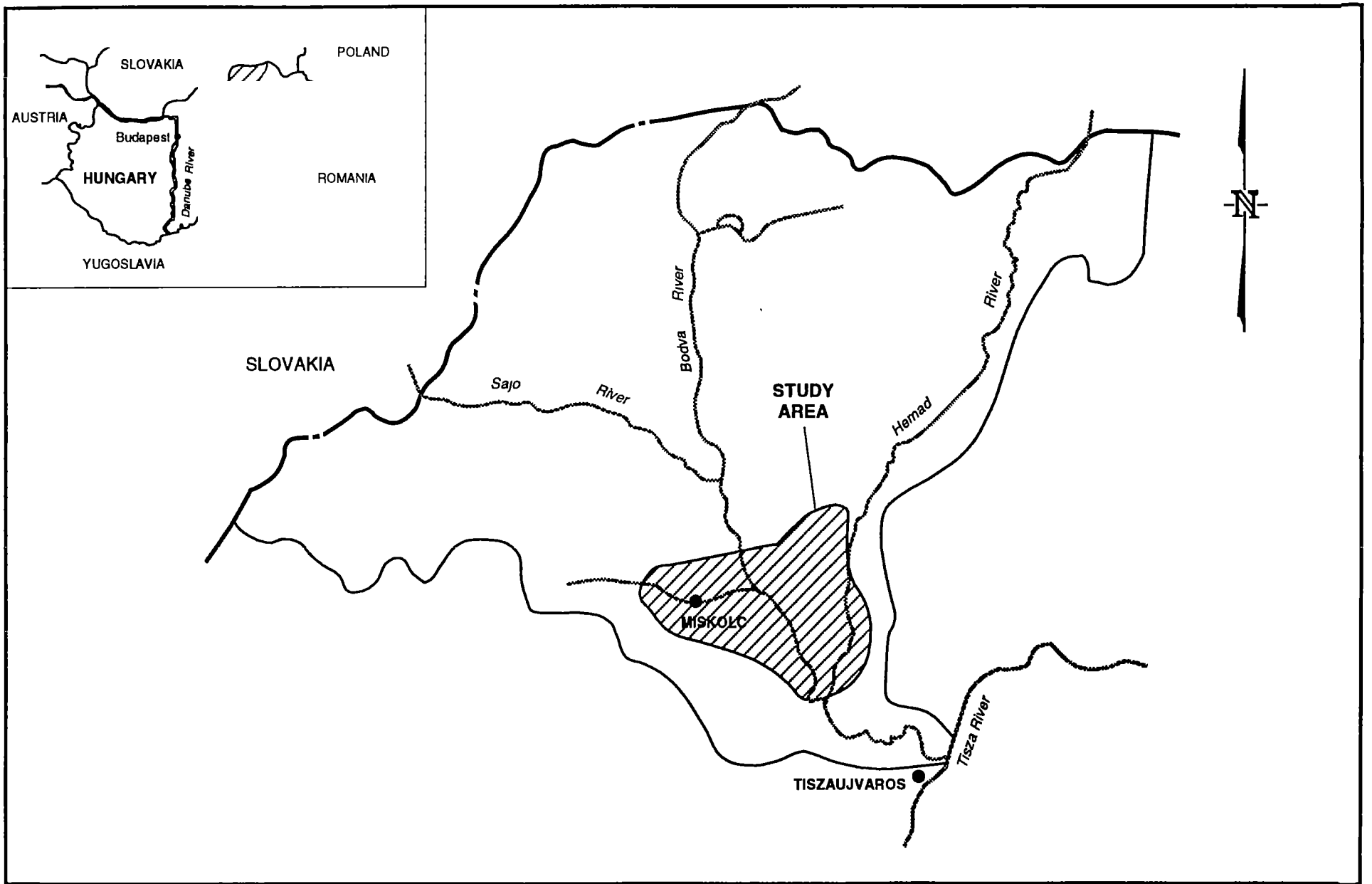

Figure 3
Map of the Sajo-Hernad Basin Study Area

3.2 Water Quality Conditions

Surface water quality in the Sajo basin has been regularly sampled and analyzed for 25 parameters since at least 1968. These data have been obtained at 15 sampling points in the basin plus 2 points along the Tisza River upstream, and downstream from its confluence with the Sajo River. Since 1989, heavy metal concentrations for nine parameters also have been determined. Based on analyses of these data, several observations may be made:

- Dissolved oxygen (DO) levels have risen consistently over the past 10 years, evidence of improving water quality.
- Nitrate (NO_3) concentrations are consistently higher than acceptable for drinking water and irrigation and are therefore a cause of concern.
- Fecal coliform (FC) levels are frequently above the acceptable level (1,000 FC/100 ml) for crop irrigation water, especially in upstream reaches of several streams.
- Chemical oxygen demand (COD) concentrations have tended to decrease with time, with the most dramatic decreases occurring along the whole length of the Sajo and below the Dimag Metallurgical Works in 1991 on Szinva Creek.
- Concentrations of heavy metals in streams below Ozd, Kazincbarcika, and Diosgyor show great reduction since 1989, in most cases to levels below those recommended in the World Health Organization's guidelines.
- Total dissolved solids (TDSs) in irrigation water must be held at or below certain concentrations to maintain soil productivity. TDS concentrations at most sampling stations in the basin have held at levels above the point that WHO deems suitable for crop irrigation (450 mg/L). However, concentrations are generally less than the WHO guideline level for drinking water (1,000 mg/L).
- Sodium (Na) concentrations must be maintained at low levels to protect plant life. All stations reported good to excellent levels of sodium.

3.3 Wastewater Emissions

3.3.1 Municipal Emissions

In the Sajo River basin, there are 15 municipal wastewater treatment plants serving approximately 290,000 people. The percentage of municipal population served by sewerage systems varies considerably, from a high of 83 percent in Miskolc to a low of 9.4 percent in Szikszo.

Wastewater flows into municipal plants have been reduced an average of 15 percent since 1990 due both to a reduction in industrial discharges and to reduced residential water

consumption. As a result, municipal plants within the basin are now performing within their design limits.

3.3.2 Industrial Emissions

The Sajo valley is one of the most heavily industrialized areas in Hungary. Industries there include iron and steel works, metal finishing, cement and concrete panel production, power, glassmaking, and chemical manufacturing. Recent political changes and the subsequent economic slowdown in the Eastern Bloc had a significant impact on the area's industries. Production levels, particularly in the steel industry, fell drastically due to market changes. These changes also significantly affected surface water quality. Review of available in-stream water quality data from 1989 to 1991 indicates a dramatic improvement in the quality of the Sajo that can only be attributed to the fall in industrial production. Evidence shows that similar changes in Slovak industries have also had a positive impact on the water quality in the Sajo, which has almost 60 percent of its tributary area in Slovakia.

The industries in the study area will continue to experience many changes in the coming years to adjust to new market realities. However, it appears that production levels now have stabilized at their reduced level. Wastewater volumes have also been reduced and stabilized. Industnes operating in the Sajo valley are already equipped with wastewater treatment plants of generally good design. In some cases, the treatment plants are working significantly below capacity. Because of these factors, control of industrial wastewater point sources does not appear to be of high priority in the Sajo valley compared with other sources.

Although industrial wastewater point sources are manageable, the large number of solid-waste and hazardous-waste sites in the basin are a potentially significant industrial waste problem. Data are being collected under new programs for Hungary but are limited. A very high priority for the Sajo basin is documentation of the extent of this type of pollution.

Nitrate levels in drinking water remain a constant problem and concern in the Sajo valley, although in-stream water quality data from 1989 to 1991 show significant reduction in nitrate levels every year. The closing of the fertilizer industry in the Sajo valley, as well as the drop in fertilizer use due to lifting of fertilizer subsidies, account for these reductions.

3.4 Institutional and Financial Conditions

3.4.1 Sector Organization

Hungary's water supply and wastewater sector is undergoing significant changes, primarily as a result of the decentralization of service delivery functions and of the service pricing policies adopted by the central government. The main organizational change in the sector is the transfer of water and sewer assets from the state-owned authorities to the individual municipal governments. In the past, Hungary's water supply and sewerage system networks were built

by municipal governments but were then turned over to water works authorities to operate. These municipal assets then became assets of the state authorities. Now, new legislation on municipal property transfer mandates a return of water supply and sewerage system facilities to the municipal governments. This legislation has had the effect of breaking up the regional and county water works authorities because many municipalities want to establish their own water enterprises, or at least negotiate new relationships with the water works authorities. For the majority of municipalities, however, the water and sewer systems will continue to be managed by the local water works authorities under contract.

The shifting organizational structure of local water authorities has been keenly felt in the Sajo area, where the institutional structure is somewhat more complex than usual. There, water and wastewater services are delivered by three different entities: the Miskolc Water Board (for the greater Miskolc area), the Borsod-Abauj-Zemplen County Water Works Company (BAZ Co.), and the North Hungarian Regional Water Works Authority (ERV). ERV was mandated to develop bulk water supply (selling to Miskolc and to BAZ Co. to supplement the latter entities' own water sources) and also to serve major industries in the Sajo. BAZ Co. was established to serve the smaller towns and villages in the area.

The central government has allowed water and sewerage prices to rise over the past three years to a level of "full" cost recovery. This figure is somewhat elusive; whether capital costs have been recovered is almost unknowable given the complicated system of capital financing, which incorporates multiple direct and indirect subsidies. In any event, water rates in the region have risen enormously during the past three years and now equal the prices found in other parts of Europe and in the United States. Hungarians are paying roughly 1.5 to 2 percent of total household income for water and wastewater services, much more than any country within the Organization for Economic Cooperation and Development (OECD).

3.4.2 Capital Investment Financing

The capital financing system employed in Hungary is complicated and unique. Although some variations to the model persist, in general capital financing is arranged by local municipal governments The municipality assembles funding from three main sources:

- a collection of central government grant programs;
- municipal budget funds (the largest share of which derives from central government transfers and shared taxes); and
- contributions from the project beneficiaries via participation in a "civil works association" formed specifically to raise funds.

Tariffs will be set by the municipalities. Although operating subsidies are being phased out of the system, capital grants will continue to be made.

3.5 Priorities for Water Pollution Control

The rapid decline in industrial activity in the Sajo valley and the decrease in agricultural fertilizer application in the Hernad valley has led to generally improved water quality throughout the Sajo-Hernad basin. In-stream water quality data show dramatic improvements in most parameters. In addition, the decrease in municipal water consumption (due both to lessened economic activity and much higher water tariffs) has lowered demand on municipal water supply and wastewater treatment facilities. A number of problems remain, especially in terms of threats to drinking water sources. These threats are caused primarily by insufficient municipal sewerage coverage in certain areas, the land application of unstabilized sludge from the Miskolc wastewater treatment plant (WWTP), industrial discharges, the overloaded Szikszo WWTP, and the existence of numerous waste dumps (including solid waste, hazardous waste, sewage lagoons, and sludge deposits) that are poorly monitored. In addition, nonpoint sources from agricultural operations in the area pose potential threats, but these are not yet well documented.

On the basis of the assessment of current wastewater pollution problems in the Sajo-Hernad basin, the WASH team identified seven potential projects (see Figure B.6 in Appendix B). These projects were classified in terms of size and severity of health and environmental impact, availability of technical solutions, and financial feasibility. In consultation with government officials, further prefeasibility work was targeted to the highest-priority project—protection of the aquifer lying at the confluence of the Sajo and Hernad Rivers. The principal health concern is the contamination of the groundwater aquifier by wastewater that has a direct interface with the source of the area's potable water.

3.6 Prefeasibility Study

3.6.1 Service Areas and Conditions

The WASH team has defined a comprehensive, phased effort to protect the critical groundwater resources of the Sajo-Hernad confluence. The overall project area includes the greater Miskolc metropolitan region.

The alluvial aquifer underlying the Sajo-Hernad river system is the main target for the proposed project, with the immediate vicinity of the main drinking water wells defined as a groundwater protection area.

The nature of the threat to the area's key groundwater resources is several-fold:

- A number of unsewered communities lie over and adjacent to the groundwater protection area (GPA). These communities are experiencing steady population growth even as Miskolc City is losing population.
- The Miskolc wastewater treatment plant discharges inadequately treated sewage into the Sajo as it skirts the GPA. The plant needs upgrading, including the completion of

secondary treatment facilities now under construction, addition of more secondary treatment capacity to meet the needs of increased sewerage coverage, and the upgrading of sludge processing and sludge management facilities.

- The town of Szikszo needs its poorly functioning wastewater treatment plant replaced and sewerage coverage extended to its unsewered areas.
- Miskolc requires a program to improve industrial pretreatment for industries discharging into the municipal sewer system (both to safeguard the treatment facilities and to permit sludge utilization in agriculture).
- A major brewery adjacent to the groundwater protection area will likely require upgrading of its wastewater treatment facilities. Additionally, a nearly abandoned industrial site within the GPA will require some hazardous waste cleanup.
- More than 90 potential sites of groundwater contamination (waste dumps, lagoons, livestock compounds, gravel, and sand pits) have been identified but not analyzed.

3.6.2 Project Components

The proposed project has been divided into three phases based on priority ranking. Priority phasing has been determined by the severity of the problem being corrected, availability of technical solutions to the problem, and availability of funding to undertake the work. While the overall program could be undertaken as a single package, it is more reasonable to expect that the separate components will likely be undertaken in stages, given the decentralized nature of wastewater responsibilities and financing in Hungary.

Phase 1: Highest Priority

The following activities are most critical and can be undertaken immediately. Technical assistance activities (notably the industrial pretreatment program noted in Component 1.3 below) should be considered high-priority candidates for donor grant funds now being programmed. Miskolc may serve as a model for developing an industrial pretreatment program since a wide range of industries are located within the city that contribute a high proportion of the municipal wastewater.

These three components are affordable, assuming the continued availability of existing national grant programs and stable levels of municipal revenue; however, as noted in Section 3.6.3, municipalities will also need access to long-term credit to finance the project.

Component 1.1: Extending sewerage coverage to 10 unsewered municipalities in and near the groundwater protection target area including connection to Miskolc Wastewater Treatment Plant. (Total cost: $15.87 million)

Component 1.2: Institute a program to identify, remedy, and control groundwater contamination from waste dump sites in groundwater protection area. (Total cost: $725,000)

Component 1.3: Institute an industrial pretreatment program for the Miskolc sewerage system. (Total cost: $200,000)

Phase 2: High Priority

The following activities should be undertaken as soon as financing arrangements can be secured. Technical assistance activities (notably the improvements to operating efficiencies cited in Component 2.2 below) should be considered high-priority candidates for donor grant funds now being programmed.

Expansion of the Miskolc Wastewater Treatment Plant should be affordable if agreement can be reached to spread the cost recovery among the facility's current and future users.

Component 2.1: Upgrade and expand the Miskolc Wastewater Treatment Plant to meet requirements to the year 2010, including expanding biological treatment capacity and upgrading the sludge processing system. (Total cost: $21.92 million)

Component 2.2: Improve operating efficiencies in water supply and wastewater agencies, including activities to increase connection rates, improve financial management, and improve operation and maintenance performance. (Total cost: $2.36 million)

Component 2.3: Improve the Borshod Brewery wastewater disposal system (filter field, conveyance, treatment). (Total cost: $1.2 million)

Phase 3: Lower Priority

The following activities have been ascribed less priority, primarily for financial reasons: they have relatively high unit costs (cost per household served) and may not be affordable in the near term.

Component 3.1: Extend sewerage coverage to unsewered and partially sewered areas of Miskolc and suburban municipalities. (Total cost: $19.15 million)

Component 3.2: Reconstruct the Szikszo Wastewater Treatment Plant and extend sewerage coverage. (Total cost: $4.72 million)

The project may be implemented as a single package or as individual components. While most of the project components are separate and may be implemented independent from one another, some important linkages exist between them. For example, unless the problem of household resistance to hooking up to the sewer system is overcome, investments in new sewerage networks will be unproductive. In addition, investment in new sewerage networks will also require expansion of the Miskolc plant beyond its current capacity. Furthermore, the

industrial pretreatment program in Miskolc is needed to ensure that the sludge from the wastewater treatment plant can be used in land applications in the area.

3.6.3 Costs and Financial Considerations

The proposed program is a mixture of technical assistance and capital investment activities that should be phased according to priority. As noted above, the financing for the different project components will likely come from different sources. Assumptions about financing sources are based on existing central government grant programs and patterns of central-local fiscal transfers and municipal revenues. Given that Hungary is going through a period of fiscal turbulence (high central government deficits, lower than expected revenues, persistently high inflation, and high market interest rates), these assumptions may not hold.

The following sections discuss the financing options for the technical assistance and capital investment components of the project.

Technical Assistance Components

The technical assistance components should be funded with the assistance of external donor grant programs. In many cases, the proposed activities fit into existing grant program work scopes. For example, assistance in management improvements to the local water and wastewater agencies (Component 2.2) fits partially within the proposed World Bank study for the northern Hungarian region. Similarly, the assistance in waste dump remediation (Component 1.2) follows up the current work being done by the EC PHARE in waste site identification.

Capital Investment Components

The investment components can only be financed at present by access to multiple sources, including central government grants and loans to municipalities, as well as direct cost recovery from service consumers. The central government has a set of grant programs in place that, when supplemented by municipal borrowing, should make feasible the investment projects proposed in Phases 1 and 2.

The existing central government grant programs are complex but, in general, should be able to fund 50 to 80 percent of the costs of new sewerage system construction, based on current eligibility requirements of the "targeted grants" program for municipalities. The smaller municipalities, and those without sewerage systems at present, qualify for the higher-percentage grants. In addition, competitive grant programs are provided via the environment fund and water funds, which can be used to supplement the targeted grants program.

The balance of the capital investment costs will have to be financed by loans to the municipalities and possibly to the Miskolc Water Board itself. Initial discussions with a number of the mayors of the 10 municipalities lying in and near the groundwater protection area

indicate they would be willing to take on loans for sewerage system construction and pledge the amount of their shared income tax revenues for repayment.

There is also a need to finance sewerage hookups to households. At present, the cost of connection is borne entirely by the individual households at a rate of 20,000 HUF per house. Such high costs discourage households from connecting with sewerage networks. A program to allow households to amortize these costs over an extended period of time (say five years) should be examined.

Recovering the capital costs of upgrading the Miskolc Wastewater Treatment Plant (Component 2.1) involves more difficult choices. It is unclear whether any central government grant programs can be used to fund part of these costs since wastewater treatment facilities do not automatically qualify for any targeted grant program but instead must apply for them on a competitive basis. Without such aid, the burden would fall on either the municipal budget or consumers or both. Alternatively, were the entire cost of upgrading the treatment plant to be financed by a loan to the municipality, debt service (principal plus interest over 15 years) would consume about 4 percent of total municipal spending based on 1992 amounts. Part of this debt obligation could be capitalized in the tariff rate base. However, tariffs are so high at present that such a move should only be contemplated if the current operating costs of water and sewer services can be reduced.

Two additional obstacles must be overcome in financing the project's capital investments. First, no channels exist for providing long-term loans to municipalities for infrastructure investment. While a communal bank is being proposed, it is not yet established and the terms and conditions for creating such a bank are unknown. Second, no established funds exist for project preparation studies, which are needed to enable municipal governments to apply for targeted grants and approach lending agencies for supplemental loans.

Chapter 4

ARGES RIVER BASIN IN ROMANIA

4.1 Background

The Arges River basin includes Bucharest, the capital city of Romania, (population 2.2 million), followed in size by the three municipalities of Pitesti (population 174,000), Cimpulung (43,000), and Curtea de Arges (33,000). The total population of the basin is about 4 million, of which 2.5 million are urban.

Industry provides about half of total employment in the basin, with Bucharest alone accounting for an estimated 18 percent of national production. Industry also dominates economic activity in the three smaller municipalities, and in Oltenita at the mouth of the Arges on the Danube. Principal features of the basin are shown on the location plan in Figure 4. Many water-resources control projects have been developed for hydropower, water supply, irrigation and flood control; as a result, stream flows in the basin are highly regulated and controlled. An estimated 90 to 95 percent of the urban population is served by public water supply systems. Public health statistics indicate low infant mortality and a low incidence of gastrointestinal disease; a relatively high incidence of hepatitis could be partly attributed to exposure to wastewater.

The average annual stream flow of the Arges River is about 65 cu m/sec, but large seasonal and yearly variations occur. Under drought conditions, the stream flows available for dilution and assimilation of wastes are limited. The natural low stream flow normally stipulated for use in pollution control planning (the minimum monthly flow exceeded in 95 percent of the years) is about 900,000 cmd, which is less than known point-source wastewater discharges of about 2,100,000 cmd within the Arges basin.

Reservoirs in the mountains augment the natural stream flows. At the Ogrezeni water supply intake on the Arges River serving Bucharest, the regulated stream flow is about 1,200,000 cmd, while the known wastewater discharges upstream from Ogrezeni amount to 300,000 cmd.

4.2 Water Quality Conditions

4.2.1 Stream Water Quality

The existing quality in 3,600 km of streams in the Arges basin is classified as follows: 35 percent in Category I (drinking water); 29 percent in Category II (water contact recreation and fishing); 14 percent in Category III (irrigation and industry); and 22 percent are degraded (not meeting the quality standards for Category III).

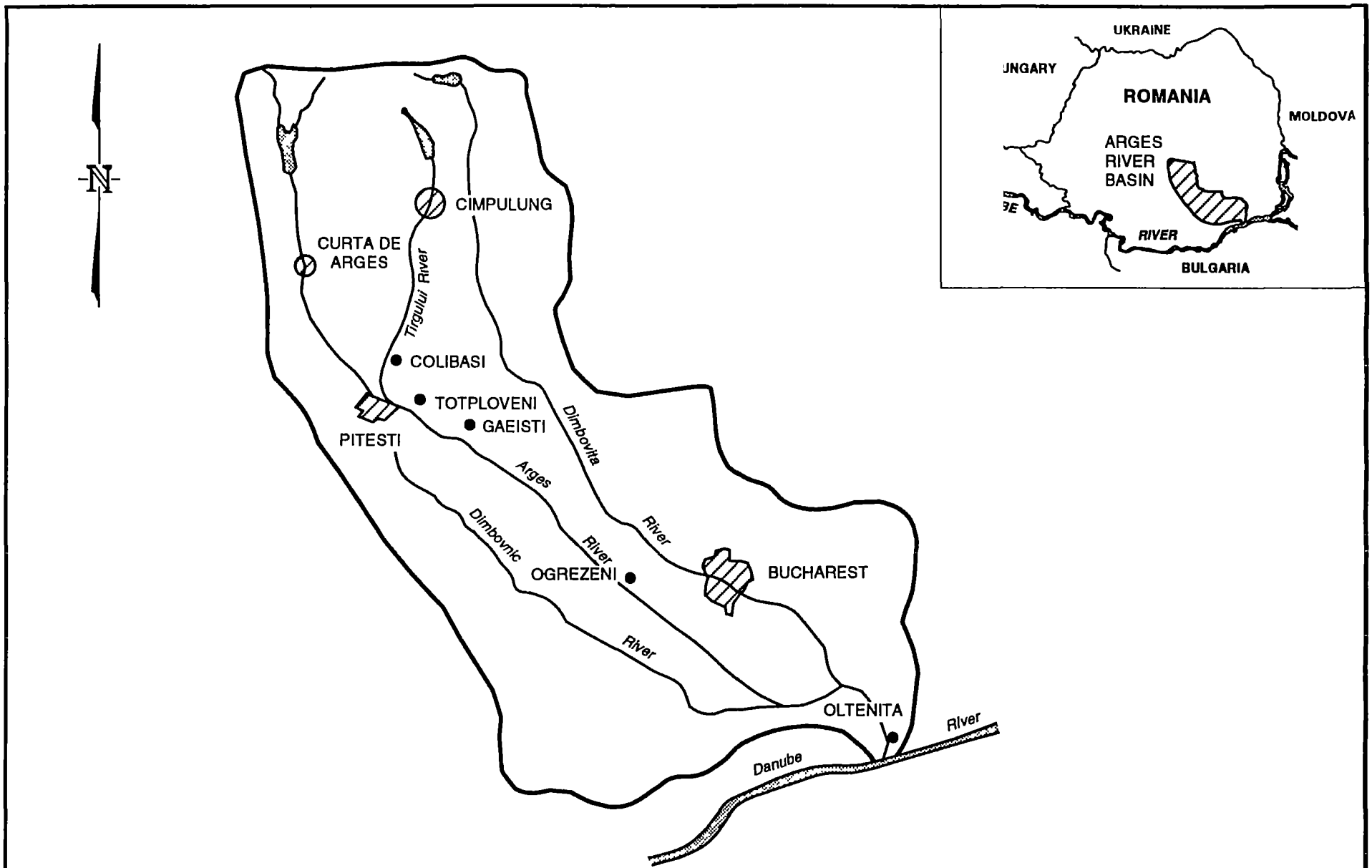

Figure 4
Map of the Arges Basin Study Area

Industries place a significant burden on surface water quality in the basin by discharging organics and nutrients into the municipal systems as well as directly to the rivers. Pollution is worst in the Dimbovita River after the discharge of untreated wastewater from Bucharest, followed by the Dimbovnic River after the discharge of industrial wastewater effluent from the Arpechim petrochemical complex near Pitesti. Additionally, organic pollution from Curtea de Arges is causing eutrophication in the water supply reservoirs serving Pitesti, and the Bucharest water supply intake at Ogrezeni is affected by eutrophication caused by organic pollution from Pitesti, Cimpulung, and Curtea de Arges.

An extensive amount of water quality data was collected by the environmental inspectorate in Pitesti during 1992: 7,630 values for 32 water-quality parameters at 32 monitoring stations. The data indicate that ammonia levels exceeded the Category I standard of 0.1 mg/L in essentially all samples. Organic pollution (BOD and COD) is seasonally high, but dissolved-oxygen levels are generally good except in the Dimbovnic River and the lower reaches of the Dimbovita and Arges. Testing for heavy metals, toxins, and pesticides has not been extensive, and therefore no conclusions on their existence or prevalence in streams can be made, other than the effects from known industrial discharges containing heavy metals. Some threats to health from toxins is assumed but cannot be quantified.

Nitrate levels are sufficiently high throughout much of the basin to support algae growth and occasional algae blooms. Phosphate and other forms of phosphorus appear to be the limiting nutrient for algae growth, rather than forms of carbon or nitrogen; reduction in phosphorus emissions from industry and municipalities should therefore be a priority to reduce eutrophication.

4.2.2 Groundwater Quality

Deep, confined aquifers having good water quality have been developed for water supplies for Bucharest, Gaiesti, Colibasi, Topoloveni, and various industries. However, an estimated 1 million people in rural areas use shallow hand-dug wells in the surface (or phreatic) aquifer, which is usually contaminated by nitrates, often in the range of 50 to 300 mg/L.

Based on the results of a monthly sampling program covering 99 wells in the phreatic aquifer within the area of the Danube plain downstream from Pitesti, drinking water limits for nitrates, COD, and phosphates are frequently exceeded. The levels of chlorides, sulfates, ammonia, phenols, and total dissolved solids also are too high in certain locations, due to local pollution sources.

Although not a focus of this report, the need is apparent for a rural water supply project to provide water from the deeper aquifers.

Groundwater infiltration to rivers within the Danube plain is apparently negligible, and thus the concentrations of pollutants in groundwater do not affect the feasibility of projects to reduce eutrophication and surface water pollution.

4.3 Wastewater Emissions

4.3.1 Municipal Emissions

Data for 1991 on wastewater flow are available for 400 dischargers in the Arges basin, and data for 1992 on wastewater flow and quality are available for 72 major dischargers. The total municipal wastewater discharge in the area is about 2 million cmd, of which Bucharest accounts for 88 percent. Pitesti, Cimpulung, and Curtea de Arges account for an additional 10 percent. Within the four largest municipalities, industry produces about half of the municipal wastewater. In general the effluent from the municipal treatment plants is of poor quality, and contains excessive amounts of organic pollution, indicative of substandard operation, insufficient capacity, or incomplete construction of facilities.

4.3.2 Industrial Emissions

Direct industrial discharges to rivers amount to 183,000 cmd from 62 industries. Many of the industrial wastewater treatment facilities are aging, overloaded, and in need of major upgrading or repair, although the expertise for operation is available. The potential risk is large for spills and upsets of pretreatment processes. The storage of spent plating baths (particularly at the car factories) and inadequate disposal of metal-containing sludges increase the probability of uncontrolled discharges of metals and cyanides into waterways and municipal wastewater systems.

Protection of the Bucharest water supply intake at Ogrezeni against algae blooms will most probably require a reduction in phosphate emissions. Phosphates can be consumed and settle out in reservoirs on the Arges before reaching Ogrezeni, which could mask the effect of other large sources of phosphates from agricultural runoff or feedlots. However, it is significant that the known point-source emissions are large compared with the average phosphate load measured in the Arges River near Ogrezeni of about 100 kg/day during 1992.

4.4 Institutional and Financial Conditions

4.4.1 Sector Organization

Although legislation on water pollution control was first enacted in 1973, rapid changes have occurred since 1989 and are ongoing in Romania. The Ministry of Environment was established in 1991 with broad jurisdiction for environmental management; it has now been incorporated into the Ministry of Waters, Forests and Environmental Protection. The new ministry includes Apele Romane (the Romanian Waters Authority), which is responsible for water resources management, including water quality. Adoption of a new environmental law is expected by mid-1993, and a new water law is in preparation. The new water law would

establish 14 river basin authorities (including the Arges basin), which would impose charges for raw water extractions and collect fees and fines for discharging wastewater.

The environmental inspectorate in Pitesti monitors and tests the quality of streams and wastewater emissions, grants discharge permits, and reviews environmental assessments of proposed projects. The Arges River Basin Water Authority is financially self-sufficient from tariffs on water supplies and fines on excessive withdrawals, or wastewater discharges that exceed quality standards; under the planned legislation, the water authority will become a semi-autonomous operating agency. Currently, tariffs and fines are too low to bring about improved pollution control by industries.

Municipal enterprises operate the area's municipal wastewater treatment plants, as well as providing water supply, heat, hot water, and solid-waste collection. The municipal enterprises are financially self-sufficient, but revenues are only enough to cover operation and maintenance costs. Under current circumstances, the enterprises are expected to raise sufficient revenues to cover capital investments in improved treatment facilities, but it is apparent from the analysis detailed below that domestic and industrial customers cannot afford to repay significant capital investments. The municipalities seldom impose fines on excessive pollution by industry, even though they themselves are required to pay fines to the river basin authority.

4.4.2 Capital Investment Financing

In general, sources of financing for wastewater treatment projects in the Arges basin in Romania are extremely limited. Industrial production has declined substantially since 1989, and industries are in too precarious an economic position to finance improved wastewater treatment. Capital funds for municipal works, formerly obtained from the central government, are very limited. At the recent rapid rates of inflation, municipal tariffs cannot keep pace to cover increased labor and materials costs, let alone provide funds for improvements. Current interest rates of 70 percent per year preclude local long-term borrowing, and could block the on-loaning of funds borrowed by the central government from international donors. An environmental fund is to be established under the draft water law, but until taxes, fines, and fees can be legally assessed and retained at the local level, self-financing by municipalities will not provide sufficient funds.

4.5 Priorities for Water Pollution Control

Completion of the Bucharest wastewater treatment plant and improved treatment for the Arpechim petrochemical complex are obvious high-priority needs to improve environmental conditions in the Arges basin and the Danube, but they are being studied by others; therefore, WASH did not conduct prefeasibility studies of these problems. Specifically, central government funding of the Bucharest plant has continued despite current economic conditions, and a related World Bank-sponsored water and wastewater planning study is about to begin.

Treatment problems at Arpechim have been studied by Romania's Engineering and Research Institute on the Environment (ICIM), and technical assistance in waste minimization is to be sponsored by USAID. Other USAID-sponsored studies are also under-way to determine which refineries are the most efficient in Eastern Europe and should be retained. Production at Arpechim was at 60 percent of capacity in February 1992, and at 30 percent of capacity in October 1992; thus, it would be risky to build improved treatment facilities in the near term.

Improved wastewater treatment plants in Pitesti, Cimpulung, and Curtea de Arges to protect the water supplies for Bucharest and Pitesti are the next-highest priority projects in the basin. Consequently, these are the areas on which the WASH prefeasibility studies focused. The Dacia car factory in Colibasi contributes to eutrophication and possible heavy metals (due to chemical spills) that affect water supplies, but it has the expertise and revenues to improve its treatment without foreign technical assistance or loans. Other contributors of pollution in the upper Arges basin, such as the municipalities of Colibasi and Topoloveni, are small in comparison. As a result, and in consultation with local and ministry officials, it was concluded that the WASH prefeasibility studies should encompass the wastewater management needs of the three municipalities of Pitesti, Cimpulung, and Curtea de Arges.

4.6 Prefeasibility Studies

4.6.1 Service Areas and Conditions

Possible changes in the limits of the existing service areas for the three municipal treatment plants have been considered, primarily for the Pitesti plant. It has been concluded, however, that for economic, technical, and political reasons, the existing service areas should not be greatly enlarged, except to accommodate expected increases in population.

Two planning horizons for flow and population projections have been adopted herein: the year 2000 for Phase I improvements and the year 2010 for Phase II improvements. In addition, immediate improvements have been defined. The two planning horizons have been selected to allow consideration of staged or phased construction, with initial construction to provide facilities sized to handle the projected flows in the year 2000; options on staging have been considered to minimize the total present-worth cost over the planning period to the year 2010. Previous studies and readily available data have been used in the projections of population and wastewater flow, which are summarized in Table B.7 in Appendix B.

Flow and cost allowances have been made to extend local sewerage systems on pace with population growth, such that 95 percent of the population of Pitesti will be served by the year 2010, along with 90 percent of the populations of Cimpulung and Curtea de Arges. Industrial production has been assumed to recover and resume its long-term growth trend by the year 2000. Industrial flows will account for about one-third of the total projected flow at each of the plants in the year 2010, and infiltration will account for 20 to 30 percent of total flow.

Per capita flow allowances, including unmetered public use for hot water and heat, are high (typically 400 to 500 L/capita/day) compared with those for domestic use in Western countries. These high flow allowances for domestic use have been retained because of the major costs and difficulties expected in changing from the present system of metering water for blocks of apartment buildings, to a system in which customers in individual apartments would be metered and billed for both cold and hot water.

4.6.2 Project Components

Capital investments required in the immediate phase and Phases I and II have been estimated for the facilities required, which include extension of sewerage systems; inspection via remote camera and rehabilitation of sewers to reduce groundwater infiltration; rehabilitation and expansion of existing secondary treatment plants; major rehabilitation and improvement in sludge processing; and, in the case of Pitesti, the provision of nitrification/denitrification treatment processes by the year 2000. Reduction of phosphates in the treated effluent from Cimpulung and Curtea de Arges would be accomplished primarily by improving the operation of secondary treatment facilities. The components of the proposed improvements for the three communities are itemized in Tables B.8 through B.10 in Appendix B.

Improvements in industrial wastewater pretreatment and in minimization of wastes created in industrial processes are also required. These improvements are needed in order to reduce the pollution loads on the municipal plants, to protect the biological treatment processes at the municipal plants from toxic industrial wastes, and to reduce heavy metals in the municipal sludge that might prevent agricultural reuse. The primary requirements for the major industrial dischargers in the three communities are summarized in Tables B.11 through B.13 in Appendix B.

4.6.3 Costs and Financial Considerations

The total estimated capital costs of the proposed project are summarized in Table 3. Costs for industrial facilities have not been estimated at this prefeasibility level, since the wastewater flows and loads may change significantly as a result of waste minimization and industrial process changes.

Of this total capital cost, an estimated 88 percent is needed for Pitesti, 2 percent for Cimpulung, and 10 percent for Curtea de Arges. Costs for Cimpulung and Curtea de Arges would increase substantially if nitrification/denitrification is found necessary after the year 2000; it has been assumed that this will be unnecessary, however.

Annual costs of operation and maintenance will increase above existing levels; these costs have been estimated using current prices for labor, electricity, and materials. After the immediate improvements, the total annual cost for the three communities is estimated at 470 million lei.

Table 3

Summary of Capital Costs, Arges Basin Prefeasibility Study

Construction Phase	Estimated Capital Costs by Phase	
	Million $US	Billion Lei
Immediate (needed in 1993)	5.207	3.124
Phase I (needed in year 2000)	18.001	10.801
Phase II (needed in year 2010)	7.640	4.583
TOTAL	30.848	18.508

By the end of Phase II in the year 2010, the annual cost would increase to an estimated 1,180 million lei. Pitesti would incur 84 percent of the total annual cost, Cimpulung 8 percent, and Curtea de Arges 8 percent.

The primary financial concern is whether the domestic users of the wastewater systems can afford to pay for improvements to them. The impact on households in the three communities has been estimated based on an average current monthly household income of $US 47, or 28,000 lei, and the following conservative set of financial assumptions:

- No subsidy is available from the central government.
- A direct loan from an international donor to a municipality, repaid over 20 years, would be charged an interest rate of 12 percent. The municipality would repay the loan in hard currency (if available), and thus would pay a much larger amount in inflated lei.
- Household incomes will remain constant to the year 2010, when computed in terms of the current purchasing values of the U.S. dollar and the Romanian leu. This is highly unlikely, because household incomes will rise substantially due to increased wages as government subsidies on housing, food, and many other consumer goods and services are reduced.
- Continued disparity will exist between the market foreign exchange rate and the actual economic quality of living in Romania. For example, current government subsidies in essence make the average household income in Romania 10 times its net value. As the country's economy moves closer to a true market economy, however, subsidies will, theoretically, be proportionately replaced by increased incomes.
- Cross-subsidies from industry will be reduced. At present, industries pay a tariff that is five to seven times greater per cubic meter of wastewater than the tariff domestic households pay. (The higher rate industries pay was set indiscriminately, and probably was chosen under the assumption that they can afford to pay more than household users can.) For

our analysis, therefore, the cross-subsidy has been cut in half in order to present conservative estimates, since no data were available to the WASH team as to how much the cross-subsidies will be reduced.

In addition, using available statistics, the impact on poorer households has been considered: the lowest one-third of households is estimated to earn less than 80 percent of the average wage.

The analysis of financial impacts is summarized in Table 4, in terms of the percentage of household income required to pay for existing and improved wastewater service.

Table 4

Financial Impact of Wastewater Fees on Households in the Arges Basin

Time Period	Pitesti	Cimpulung	Curtea de Arges
	Fees in Percent of Income for Average-Income Households		
Existing conditions	1.3	0.6	1.6
Immediate improvements	2.8	1.3	4.2
Phase I (1993-2000)	7.1	2.8	5.6
Phase II (2000-2010)	8.1	2.8	6.9
	Fees in Percent of Income for Low-Income Households		
Existing conditions	1.6	0.8	2.0
Immediate improvements	3.5	1.7	5.2
Phase I (1993-2000)	8.9	3.5	7.0
Phase II (2000-2010)	10.1	3.5	8.6

At present, households in the three communities pay between 0.6 percent and 1.6 percent of their income for wastewater service. The percentages shown in Table 4 indicate that in Phase II, beginning in the year 2000, lower-income households would apparently pay 10.1 percent of their income, or about 6 times the percentage of income they pay now. However, if public subsidies are eliminated, incomes should increase by 10 times. By this reasoning,

households should be able to pay for improved wastewater service, if free-market, unsubsidized salaries and prices are achieved.

Chapter 5

HORNAD RIVER BASIN IN SLOVAKIA

5.1 Background

The Hornad basin is located in eastern Slovakia and includes all of the administrative districts of Kosice, Presov, and Spisska Nova Ves (plus very small fractions of Poprad District to the west and Bardejov District to the northeast). The basin lies entirely within the region of the Hornad-Bodrog River Basin Authority (see Figure 5).

The Hornad River system is composed of two major subbasins (the main Hornad stem and the Torysa River), and one minor subbasin (the Hnilec River). Each of the subbasins contains important tributary systems. The Hornad River basin has an interior mountain climate with numerous closed valleys. The annual rainfall varies from about 580 mm in the lower part of the basin to about 850 mm in the upper parts. The temperature varies dramatically from the river valley floor to the mountains. In Kosice, the temperature ranges from about -3.6°C in January to 19.6°C in July. In Spisska Nova Ves, it ranges from -5.8°C to 17.3°C.

The total population of the basin was 656,600 in 1991, with 60 percent of the total concentrated in the six largest cities. The largest industry in Kosice is the East Slovakian Iron Works (VSZ), which is the largest steel complex in the country and the largest single employer in the eastern part of Slovakia.

The central region around Krompachy is dominated by mining, ore processing, and copper smelting. The main metal ores are copper, iron, and mercury. The ores are fairly complex and not particularly rich so that a considerable amount of processing is required, producing a high volume of waste. The area has been mined for more than 400 years with a significant amount of hazardous waste ore (especially mercury) finding its way into the Hornad River during that time.

Unemployment is quite high throughout the region as the industrial, mining, and agriculture sectors undergo restructuring. Most of the major industries and agricultural cooperatives have remained under state control; however, subsidies have been cut and the work force reduced in almost every enterprise. Kosice is experiencing growth in its service and retailing establishments, which is taking up some of the slack from major industry layoffs. The town is somewhat buffered by its wide employment base and the presence of a major university and governmental offices.

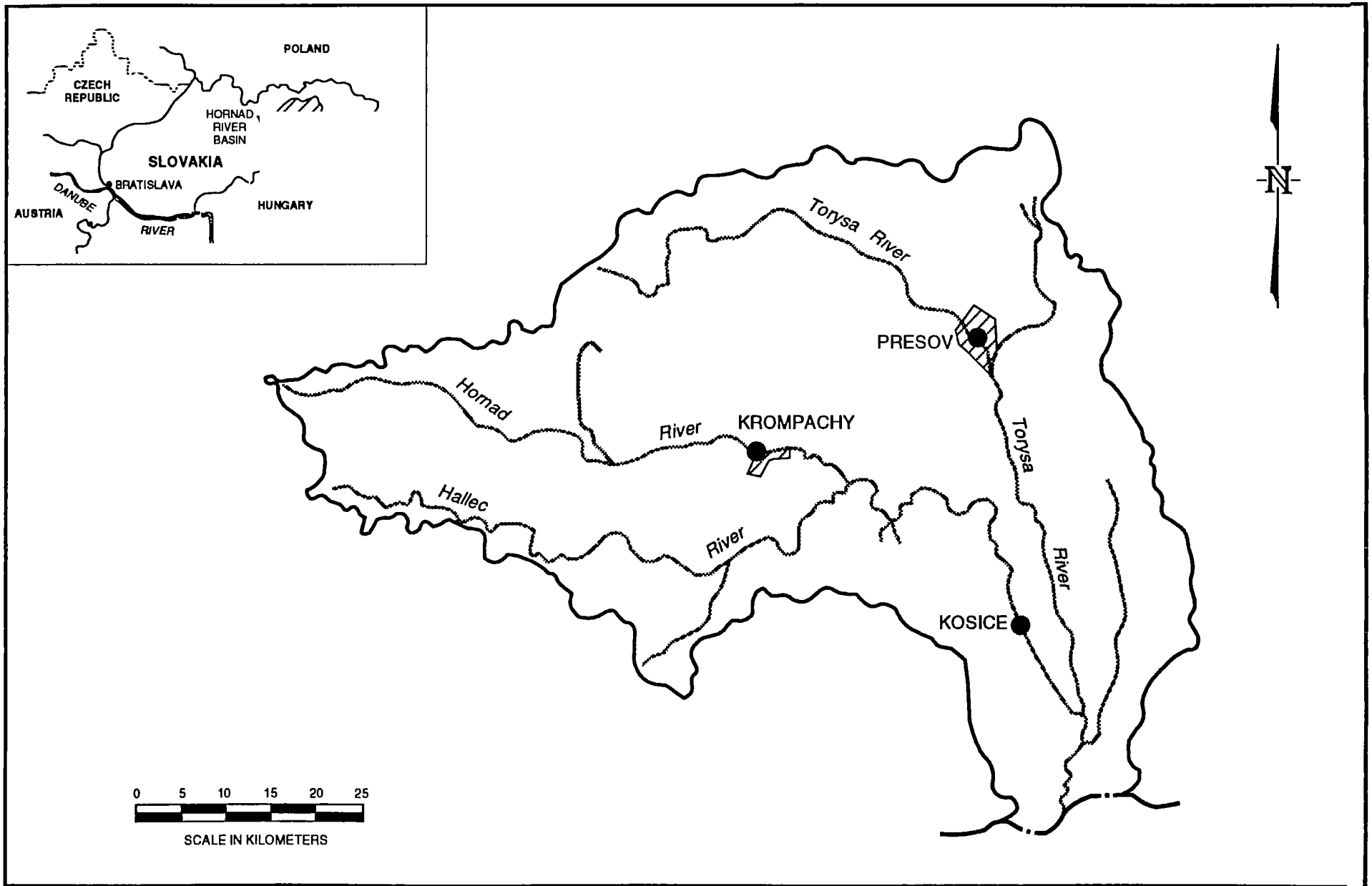

Figure 5
Map of the Hornad Basin Study Area

5.2 Water Quality Conditions

The Hornad basin is rich in water resources but, because of contamination problems in the main settled areas, much of the drinking water supply has to be brought in from outside the basin.

The upper Torysa is targeted for expansion as a main supply source in the basin with construction of a reservoir at Tichiny Creek (currently a surface water intake for Presov). The upper Hornad above Spisska Nova Ves in the Slovensky Raj is also a highly productive area; however, its designation as a national park complicates development of water resources within its borders.

The area below Kosice is rich in groundwater (from an aquifer fed by the Hornad and Torysa), but it is not used for municipal water supply because of high levels of nitrates (from agriculture and sewage contamination), as well as high levels of naturally occurring chloride. Currently this area is only used for well water supply for the VSZ plant.

The area below Presov along the Torysa is also rich in groundwater resources, but high levels of nitrates as well as naturally occurring iron and manganese make it unsuitable for drinking water. Many of the previously used bank filtered wells have now been shut down.

Surface water quality in the Hornad basin has been determined since 1985 by means of monthly samples taken by the Bodrog-Hornad River Basin Authority at 31 sampling points. At each sampling point, 24 parameters are measured to establish the stream classification. Also since 1985, the content of heavy metals in surface water and sediments has been monitored at 7 sampling points.

From inspection of water quality profile data in the Hornad, the Hnilec, and the Torysa rivers, there has been no significant change in water quality during the 1985-1990 period.

Several observations may be made from the data with reference to World Health Organization water-quality guidelines:

- Nitrate (NO_3) concentrations exceed the maximum allowable level of 10 mg/L for drinking water at all sampling points except one point (dam at water reservoir).
- Coliform levels greatly exceed the 10/100 ml standard at all sampling points. The highest levels, indicating the greatest danger to public health, are at three sampling points, one below Kosice, one below Spisska Nova Ves, and one below Presov. This condition appears to reflect the discharge of raw and inadequately treated sewage and animal waste into the rivers.
- The water in the reaches of the Hornad and Hnilec rivers upstream from the Ruzin Reservoir show high concentrations of heavy metals. Water quality leaving the reservoir is little better. Heavy metal levels are above allowable limits at almost all sampling points. Significant increases in concentrations of chromium, copper, mercury, nickel, lead, and zinc appear below Rudnany and Krompachy.

5.3 Wastewater Emissions

5.3.1 Municipal Emissions

Approximately 59 percent of the Hornad basin's inhabitants are connected to a wastewater collection system. The basin has 12 municipal wastewater treatment plants; 6 of the plants are quite small, serving a total of 5,000 inhabitants. The six large systems serve municipalities within the basin that have a combined population of 359,400 persons, or approximately 55 percent of the population of the basin. These six municipalities are Kosice, Presov, Spisska Nova Ves, Levoca, Sabinov, and Lipany.

The percentage of municipal population served by the sewerage systems of these cities ranges from 79 percent in Sabinov to 100 percent in Levoca. In each of the six cities, the percentage of industrial wastewater flow entering the WWTPs ranges from 9 to 53 percent, much of which receives little or no pretreatment.

The East Slovakian Water Works Authority (VVAK) operates all of the municipal WWTPs in the basin and is also responsible for upgrading existing facilities and constructing new ones.

5.3.2 Industrial Emissions

The recent political changes and subsequent economic slowdown in Central and Eastern Europe has had a significant impact on the industries of this area. Production levels, particularly in the mining industry, have fallen drastically. However, the VSZ iron works at Kosice is working at almost 70 percent of its capacity and appears to be in good fiscal health.

The basin's industrial plants have wastewater treatment facilities that generally perform well in terms of effluent quality. The recent drop in industrial production has resulted in a parallel drop in emissions and, therefore, has improved the control of point sources. Although the wastewater point sources are manageable, the basin has a large number of solid-waste and hazardous-waste sites that potentially pose a great environmental risk. The available data on priority pollutants—particularly toxic organics—are very limited in all media, including stream flows, industrial and municipal point emissions, groundwater, soils, and sediments. Contamination of surface and groundwater by mercury and other heavy metals is already documented to some extent, but many other priority pollutants may be present at unacceptable levels in all media. A very high priority for the Hornad basin is documentation of the extent of this type of pollution.

Major industrial water pollution problems in the basin include the following:

- Long-term heavy metal contamination (especially from mercury) in the Hornad River stretching from the Rudnany mine area through Krompachy to the Ruzin Reservoir;
- Current heavy-metal contamination (from arsenic, copper, and zinc) from air and water emissions of the Kovohuty copper smelter at Krompachy;

- Heavy-metal-bearing sludge lagoons adjacent to the two main mines (Rudnany and Slovinky) and at the Krompachy municipal waste dump (storing waste from the copper smelter and SEZ electrical works at Krompachy);
- Phenolic wastewater from the VSZ plant at Kosice (now treated at the overloaded Kosice municipal wastewater treatment plant); and
- Heavy loads from food processing industries that use municipal systems in Spisska Nova Ves, Levoca, and Presov.

5.4 Institutional and Financial Conditions

5.4.1 Sector Organization

At present, the water and wastewater sector in Slovakia remains highly centralized, although responsibility is shared among several different ministries and authorities. The main ministries are the Ministry of Environment and the Ministry of Soil Management, formerly the Ministry of Forests and Water. The MOE is relatively new and is gradually taking over authority at the local level for monitoring water quality, setting fines, and granting pollution permits—functions previously performed entirely by the river basin authorities. The river basin authorities, which are under the jurisdiction of the MSM, remain responsible for water resource management, development of bulk water supplies, and collection of water-use (severance) fees and pollution fees. The delivery of water and sewerage services is vested in regional water works authorities (also under the MSM), which provide water supply and wastewater services to communities and industries on a monopoly basis.

The Hornad basin falls under the jurisdiction of the Bodrog-Hornad River basin Authority (PBaH), with local water and sewer services provided by the VVAK.

Although decentralization in water and waste service delivery at the local level has been discussed often, the past system continues in which the regional water works authorities manage these services. Water and sewer rates are still set uniformly across Slovakia (by the MSM) and are currently at levels below full cost recovery, although rates were raised substantially in January 1993.

5.4.2 Capital Investment Financing

Slovakia's water and wastewater sector is highly subsidized, both for operating expenditures and capital investment. Although detailed figures have not yet been made available to the WASH team, the central government provided operating subsidies amounting to about 200

million Kcs (crowns)** in 1992. Of this total, about 150 million Kcs, or 75 percent, went to the VVAK. The MSM is proposing to raise tariffs in 1993 to reduce this operating gap, but still anticipates the operating subsidy requirement will reach 150 million Kcs in 1993.

Capital investment flows into the sector by two principal ways: the Environmental Protection Fund (which is controlled by the MOE) and capital grants to the regional water works authorities. Both of these sources are highly dependent on annual budget appropriations from the central government and are in considerable flux. The MSM provided about 700 million Kcs to regional water works authorities in 1992 and proposes almost doubling that amount to 1.3 billion Kcs in 1993. On the other hand, the Environmental Protection Fund is likely to drop from its 1992 amount of 1.46 billion Kcs to an uncertain amount in 1993. (At this time, it is difficult to say with any certainty just what investment levels are likely to be, because the Slovak Republic is undergoing substantial revamping of its overall revenue base.) With the restructuring of the regional water works authorities, however, it is likely that the Environmental Protection Fund will become the main source of capital investment funds for the sector.

The Environmental Protection Fund is capitalized by pollution fees and fines as well as by direct budgetary support from the central government. Indeed, in 1992, about 65 percent of the fund's revenues came from the central budget, while the remainder derived from a mixture of pollution fees, water-use taxes (severance taxes), and fines. The bulk of the fees originate from water-use and water pollution fees—about 30 percent of the total.

One of the main problems with the current system of capital investment financing is that the "demand" for funds is about 10 times greater than the supply, based on grant applications received by the Environmental Protection Fund. However, because these applications are for free grant resources, parties who are not especially needy may apply, making it difficult to know what the level of real need is. A second problem with the current system is that grant funds are rationed in such a manner that construction of new facilities is spread over a number of years. The WWTP at Presov, for example, has been under construction for 15 years. Such practices are incredibly wasteful, running up final costs and delaying the benefit of the investment stream.

5.5 Priorities for Water Pollution Control

Two overriding issues determine the potential for effective water-quality improvements in the Hornad basin. The first is long-term contamination from mining and ore processing in the central part of the basin; the second is the poor state of municipal wastewater treatment in every major town and city in the basin.

The long-term pollution from mining and ore processing waste in the area from Rudnany to the Ruzin Reservoir below Krompachy (mainly heavy metal sediments) has rendered this

** As of January 1, 1993 the Czech and Slovak currencies split In April 1993, the Slovakian monetary unit was renamed the Slovak crown (Sk). While this report uses the former symbol, Kcs, all values given are current.

stretch of the river unusable for drinking water. The government has adjusted to the longstanding pollution by developing a drinking water supply infrastructure that moves water over long distances. This approach is costly and has left the area with the highest costs of water services in the country.

The poor performance of municipal wastewater treatment adds to the problems of industrial and mine pollution. All municipal plants in the basin are overloaded, and plant expansions and replacements are being constructed piecemeal at a slow pace. Part of the problem is that realistic water tariffs have not yet been introduced so that there is no financial incentive to conserve. In addition, much of the industrial loading on municipal waste treatment plants in the basin comes from agro-processing companies that are surviving (until now) the country's economic restructuring. As a result, there has not been much reduction in industrial emissions to municipal waste treatment plants, though such reduction is common in surrounding countries.

On the basis of the assessment of current wastewater pollution problems in the Hornad basin, the WASH team has identified nine potential projects (see Figure B.12 in Appendix B). These projects were classified in terms of size and severity of health and environmental impact, availability of technical solutions and financial feasibility. In consultation with both local and national government officials, further feasibility work was targeted to the group of Krompachy water pollution problems.

5.6 Prefeasibility Study

5.6.1 Service Areas and Conditions

The grouping of projects at Krompachy combines projects 3, 4, and 7 from the list in Figure B.12. The problem to be addressed by the proposed project is the improvement of water quality in the Hornad River from Krompachy to the Ruzin Reservoir. Both the river and the reservoir are highly contaminated with heavy metals and untreated sewage, which affect downstream drinking water supplies for about 400,000 people. Contamination of the Hornad seriously threatens bank-filtered well supplies downstream from Krompachy as well.

The Ruzin Reservoir cannot be used as a source of drinking water because of its highly contaminated state. In addition, it is reported to contain about 5 million m^3 of sediments contaminated with mercury, cadmium, nickel, and copper. As a result, drinking water for Kosice must be imported from as far away as 140 km (the Starina Reservoir).

The most significant sources of water pollution in the proposed project area are as follows:

- The Kovohuty copper smelter in Krompachy, which discharges copper particulates, arsenic, and other contaminants into the air and water;
- The SEZ electrical components plant, which discharges metal-bearing wastewater from its galvanizing and electroplating operations;

- The municipal waste dump and lagoon along the Hornad River, which contains uncontrolled waste from industries, Krompachy, and six villages;
- The discharge of untreated municipal wastewater from residences and institutions throughout the city into ditches and the river; and
- Ore processing facilities and a tailings pond at Slovinky.

VVAK plans to complete construction of the new municipal wastewater treatment plant and the new main trunk sewer for Krompachy. In addition, it has been proposed to reconstruct and extend the Krompachy sewerage network, and also extend sewer service to Slovinky and Kolinovce. However, financing for this work is extremely limited.

In recognition of the above factors, a proposed project area is defined that encompasses Krompachy, Slovinky, and Kolinovce, and includes all of the significant sources of pollution identified above.

Although the discharges of air and water contaminants in Krompachy reach areas downstream and downwind of the proposed project area, the remedial work contemplated in the proposed project will be limited to the delineated area.

Of the significant environmental pollution sources indicated above, the one that stands out above all others is the atmospheric pollution contributed by the Kovohuty copper smelter. Atmospheric copper concentrations are the highest in Slovakia, and sulfur dioxide emissions consistently exceed established limits. Heavy fines are paid by the smelter for reforesting areas adversely affected by the air pollution.

5.6.2 Project Components

The proposed project is divided into three phases and provides a comprehensive effort to address the critical industrial and municipal wastewater pollution problems within the Krompachy area. Given the scarcity of financial resources for all types of infrastructure and environmental investments now in Slovakia, it is likely that the project components will be implemented as separate components.

Phase 1: Highest Priority

The following component addresses the biggest single pollution problem within the target area, namely the emission of large amounts of heavy metals through air exhausts of the Kovohuty copper smelter. These air emissions account for more than 90 percent of the heavy-metal contamination in the surface waters downstream of Krompachy and dwarf the impact of all industrial and municipal wastewater discharges.

The smelter is currently considering a package of investments and process changes, including the following: using alternative technologies in the copper smelting process that would both

improve production efficiency and reduce emissions; shifting to higher-grade ores; and installing emission control devices to meet environmental standards.

Component 1.1: Institute air emissions control for Kovohuty copper smelter. (Total cost: $7 million)

Component 1.2: Complete the SEZ industrial wastewater treatment facility improvements. (No cost)

Phase 2: High Priority

The following activities should be undertaken as soon as financing arrangements can be secured. Some of the technical assistance activities (redesign of the Krompachy municipal WWTP and main trunk sewer now under construction, the plan for remediating the solid-waste dump site, and assistance in agency operating efficiency) should be considered high-priority candidates for donor grant funds now being programmed. Special attention has been given to the capacity and design standards of the municipal wastewater treatment plant and trunk sewer. The WASH team recommends complete redesign of both facilities in order to reduce the plant capacity by half (in line with realistic demand projections) and replace the currently proposed trunk sewer tunnel with a lower-cost alternative. Given the current state of their construction, merely modifying the systems to lower their operating costs would not make them affordable.

Component 2.1: Krompachy municipal sewerage and wastewater treatment plant. (Total cost: $4.26 million)

Component 2.2: Relocate the municipal solid-waste dump site. (Total cost: $790,000)

Component 2.3: Improve wastewater sludge disposal from SEZ and the Kovohuty smelter. (Total cost: unavailable)

Component 2.4: Improve the operating efficiencies of the water supply and wastewater agencies. (Total cost: $200,000)

Phase 3: Lower Priority

Component 3.1: Monitor the groundwater impacts of mine tailings lagoon at Slovinky. (No cost)

Component 3.2: Design and construct sewer extensions in Krompachy (including hospital and industrial sanitary wastewater connections). (Total cost: $2.33 million)

The project components are divided between industrial sites and municipal sites. The highest-priority component, reducing heavy metals in Kovohuty air emissions, will depend largely on introduction of new technology to the production processes as well as switching to higher-grade ore. This new investment, in turn, depends on the long-term commercial viability of the enterprise, which may likely involve participation of outside joint venture partners. One of the

issues that must be dealt with before any such joint ventures will occur is the limitation of liability for hazardous waste cleanup. At present, the extent of hazardous waste accumulation in the area that is traceable to the copper smelter, is unclear, as is the extent of legal liability for cleanup that will be assigned to the enterprise after privatization.

The municipal government has a current mandate to manage the solid-waste facilities, and it may acquire additional responsibilities under proposed reform of the water supply and sewerage sector. Since the shape of reform in the sector is not yet clear, implementation responsibility for the municipal WWTP and sewerage network will remain with the regional water works authorities. Furthermore, tax reform for the municipalities has not yet been completed; therefore, the municipal governments are operating with greatly reduced revenues. It will remain uncertain whether they will have adequate resources to finance infrastructure investments until after the municipal tax reforms are put in place in late 1994.

5.6.3 Costs and Financial Considerations

Industrial Sites

Preliminary discussions with the management of the Kovohuty smelter indicate that the enterprise is profitable and that the level of investment needed to correct its air emissions problem should be within the means of the company. Furthermore, the company will be paying an increasing amount of fines each year as long as its air emissions exceed prescribed limits. However, the company is awaiting the outcome of Slovakia's privatization process before undertaking the investment in new technology. The new wastewater treatment facility at the SEZ industrial site has funds earmarked for its completion; the SEZ management foresees no problem in completing the facility.

Municipal Sites

The relocation of the municipal solid-waste dump will require a modest investment by the municipal government. However, the municipality has no investment funds at present and would require either a grant or loan to undertake the project. Currently, the only source of such funding would be a grant from the Environmental Protection Fund, barring some sort of special appropriation from the state budget.

Preliminary discussions are also under way to establish some form of municipal lending program, but that would take several years to establish and capitalize. In the meantime, the central government may want to consider establishing a "transitional" infrastructure financing scheme that can at least keep some funds flowing to high-priority projects.

The financing of the Krompachy municipal WWTP and main trunk sewer raises a set of special problems. First, the cost of the project is quite high in terms of cost per household served. Even with the lower-cost redesign proposed by the WASH team, the cost to complete only the WWTP and trunk sewer totals approximately $1,700 per household. This is in addition to the amount already invested in construction (about $1,300 per household) and the amount

required to reconstruct portions of the Krompachy sewerage network in need of rehabilitation (about $950 per household). In assessing affordability, we may compare this to an estimated annual average income per household in Krompachy of about $3,950. Amortizing the total cost of these investments over 15 years at the current (controlled) interest rate of 16 percent would require an amount equal to about $708 per year per household, or about 18 percent of total household income.

The East Slovakian Water Works Authority has budgeted a small amount to keep construction of the Krompachy project going, but that amount is less than the amount needed to match inflation on the remainder of the investment. VVAK itself might be expected to provide some funds toward capital investment with the increased revenue generated by recent large tariff increases. However, VVAK is projecting very large increases in its own operating expenses (up about 100 percent over the past two years) so that it predicts continued operating losses, requiring further state subsidies.

In summary, the mechanisms for generating cost recovery for major water and sewer investments are quite limited at present in eastern Slovakia. Municipal general revenues are insufficient and will not increase until some time after local tax reform takes effect.

The other potential source for cost recovery is via the water/sewer tariff. The tariff does have room for further increase, but the operating expenses of the water works enterprise must be much better controlled. We have recommended a component in the proposed project to provide this type of assistance (Component 2.4).

Chapter 6

IMPLEMENTATION OF DEMDESS

6.1 Background

The countries of central and eastern Europe have been collecting water quality-related data for quite some time, but their governmental bodies have not used this information when formulating relevant policies. Recent dramatic changes in these countries have put new demands on the data; consequently, the statistics are now forming a necessary component of important decision-making processes concerning water and wastewater investments. Country officials also are recognizing that they will need to use new and different types of data not previously collected, especially that regarding regulations and costs.

The four Danube countries in this study have enthusiastically embraced DEMDESS because they recognize that it is a technically sound approach to using both old and new data in the new decision-making modes being required. In addition, they recognize that DEMDESS is a very open approach to water-quality information management that will not become obsolete as new data and analysis requirements evolve.

DEMDESS is a comprehensive water pollution data management system. It cannot be classified into traditional categories such as "computer models" or "pollution management programs"; rather, these categories can be incorporated into DEMDESS, and as such they are optional components of DEMDESS. DEMDESS can provide basic information management and reporting requirements while operating with a wide array of models as needed. Using modern information management techniques, DEMDESS is suitable both for beginners, who may be most comfortable with simple, menu-driven programs, and experts, who may prefer to use sophisticated applications.

Although technical experts in the DEMDESS countries are inexperienced in building and applying water data in the decision-making modes now required, they are very proficient in the basics of computer software development and water engineering. DEMDESS builds on these existing strengths while providing a tool for training in the new analytical environment in which individuals must operate. Through DEMDESS development and training, country experts can "test" their existing data for sufficiency in addressing current analytical requirements, identify deficiencies, and modify their data collection procedures accordingly.

6.2 Objectives and Approach

DEMDESS is highly desirable as an operational tool because it can address several key technical and policy issues related to water quality and pollution control that face the environment ministries of the Danubian countries.

Making DEMDESS operational requires efforts at both the technical and institutional levels. Technical activities undertaken in A.I.D.'s Danube program emphasized database and applications development, while institutional activities focused on training and outreach to build the proper environment for using DEMDESS.

The specific activities undertaken to advance DEMDESS as an operational tool were as follows:

- Continued assistance in interfacing DEMDESS to country-specific water databases;
- Direct technical training of experts in each country;
- Coordination with related activities, especially those of the Program Coordination Unit Subgroup on Monitoring, Laboratory, and Information Management;
- Improvement of the user-friendliness of DEMDESS that offers routine reporting and decision-making support applications;
- Updating of the DEMDESS user guide;
- Application of DEMDESS in the WASH prefeasibility studies;
- A regional DEMDESS workshop held in Budapest in May 1993;
- Participation in the closeout prefeasibility study meetings held in each country in May 1993.
- A Bulgaria-specific workshop, held in July 1993;
- Provision computers and software to each country for using DEMDESS; and

6.3 Outcomes

The above activities produced several positive results and identified some additional problems. Major positive outcomes include the following:

- The computers and software supplied to each country have provided valuable assistance in support of pollution control activities in general, as well as of DEMDESS in particular.
- There has been a general growth in understanding of the decision-making components, especially the importance of collecting and performing reliable financial data and analyses.

- DEMDESS made a positive contribution to the WASH prefeasibility studies, which provided a forum for developing several important analytical routines that are now incorporated into DEMDESS.

- Technical and institutional development of DEMDESS in Bulgaria continued at a very high level. The Bulgaria-specific workshop in late June initiated the integrated use of DEMDESS at the inspectorate, Laboratory and Information Center (LIC), and ministry levels with a very strong commitment of resources from Bulgaria. DEMDESS is being expanded to include all of the Danube basins, and there are plans for its use throughout the entire country.

- Hungary, through its Ministry of Environment and Regional Planning (MERP) and Vituki (an institute within MERP) has become a strong supporter and active user of DEMDESS for integral use in its national water-quality management planning. Vituki is using DEMDESS and developing its own analytical routines.

- In Slovakia, DEMDESS implementation was expanded to include the Hornad River basin. Training activities were expanded to include staff from the Ministry of Environment as well as the Hydrometeorological and Water Research Institutes. Slovakia has instituted plans for continuing technical support at the Hydrometeorological Institute.

- In Romania, DEMDESS was completed for the Arges River basin and is currently being used by ICIM. The results have demonstrated that DEMDESS can work well in conjunction with existing national-level data systems. Strategies have been developed with Ministry staff to expand DEMDESS use to basin authorities and county environmental protection offices.

- The PCU has recognized DEMDESS as a valuable component in the Danube Program and has specifically requested use of DEMDESS in the Subgroup on Monitoring, Laboratory, and Information Management.

- The Budapest workshop was very successful, with significant advances made in the technical capabilities of participants, the sharing between country and WASH experts, the growth of a sense of a "user community," and enhanced presentation skills.

- The Bulgaria DEMDESS Workshop served as a prototype for possible training in the other countries and demonstrated the value for country-specific DEMDESS training.

Some of the problems identified in the course of this work are as follows:

- Consistent technical support from host-country experts has been difficult to acquire, primarily because of overwhelming, competing demands that sometimes occur within the countries. Officials have recognized, however, that consistent technical support is necessary for DEMDESS to become fully operational, and most of the countries are working on this problem.

- Some important data gaps prevail in the different country implementations of DEMDESS. Some of these gaps are simply a matter of insufficient resources being available to interpret and load the data; others involve short-term problems being addressed by the country experts; and some gaps pertain to longer-term issues. The identification and resolution of information gaps are integral to the development of a comprehensive system such as DEMDESS.
- Changing political and institutional conditions in some countries has in turn led to some confusion concerning the role and "home" of DEMDESS. This problem will probably be resolved as conditions stabilize.

6.4 Recommendations

Below are suggestions for DEMDESS-related follow-on activities. These suggestions are based on the current understanding of A.I.D.'s priorities in the Danube assistance effort, needs and desires as expressed by the host countries, and an aim toward closure of A.I.D. financial support for DEMDESS.

Activity 1: Continued training, especially country-specific information management workshops.

The country-specific workshops are directed at affecting sound, integrated water information management procedures (including DEMDESS) at the inspectorate, basin, and national levels. The current phase of WASH activities included a regional workshop involving representatives from all four Danube countries, plus a Bulgaria-specific workshop. These workshops were set up in direct response to host-country requests. Hungary and Slovakia have specifically requested country-specific workshops, and Romania has supported the idea as well.

In addition to the formal workshops, ad hoc one-on-one training has proven very effective in transferring the skills necessary to use and support DEMDESS. Support for such training will continue to be very effective and efficient.

Activity 2: Continued assistance with prefeasibility and feasibility studies.

DEMDESS is, in part, designed to address many of the information management and analysis requirements needed in prefeasibility and feasibility studies. DEMDESS has been used effectively in direct support of the WASH basin prefeasibility studies. More can be done, however, especially in incorporating of financial analysis components and refining basin assessment/prioritization analyses. This activity can be highly useful in basin studies being conducted by other donor organizations. Also, it will help alleviate the burdens being placed on the host countries to justify these basin studies.

Activity 3: Coordination and support of the Danube Environmental Program.

DEMDESS fits in with several DEP goals and activities, especially the monitoring, laboratory, and information subgroup. Specific areas of coordination and support include promoting information sharing through a common information structure, strengthening country information management systems, and supporting the evaluation of and updating of monitoring networks. DEMDESS coordination and cooperation with other donor organizations help A.I.D. "leverage" its assistance by extending support to other basin studies.

Activity 4: Assistance in developing basin and country water-quality management plans.

This is a specific request for support from Bulgaria and Hungary, with likely application in Slovakia and Romania as well. All four countries need to develop continuing water-quality management plans for use at the basin, ministry, and legislative levels. DEMDESS is considered by the host countries to be an essential tool for integrating the various information sources needed to develop comprehensive water-quality management plans. While many of the technical resources required to develop these plans are available in the countries, they could use some supplemental technical assistance to implement the plans.

Activity 5: Technology transfer support to host countries.

DEMDESS can be viewed as a "technology transfer" effort because its essential elements or techniques came from the U.S. Environmental Protection Agency's experience, such as Reach File, STORET, and PCS. Several other fruitful technology transfer techniques are related to DEMDESS as well. These include in-stream water-quality modeling, nonpoint source analysis, health and environmental risk assessment, and effective use of the Geographic Information Systems (GIS).

A particular opportunity presents itself to "leverage" the EPA's and PHARE's existing GIS activities with DEMDESS. GIS is resource intensive, typically requiring long lead times from start-up to meaningful application. DEMDESS has incorporated elements that permit "links" to GIS technology that can be implemented in a short to medium time frame. These elements and links have been developed in the United States at significant expense and over a period of several years. Support in this area could help encourage timely and efficient use of the GIS technologies being provided.

Chapter 7

CROSS-CUTTING ISSUES

7.1 General

The purpose of this section is to identify the common issues that affect water pollution control programs in all of the four countries that are the subject of this report. The intent is also to provide a non-country-specific identification of needs that otherwise might seem to be sensitive or selfish when assigned to an individual country. As a result, various issues discussed here may apply to a greater or lesser extent in any of the countries discussed.

The issues this section addresses are grouped under five topics as follows:

- **Investment issues**: The water pollution control problems identified in the WASH studies are symptomatic of larger problems requiring assistance from foreign donors and lenders. Considering the broad spectrum of investments that foreign lenders might consider, one might ask why they should invest in water pollution control. For example, how do the wastewater projects studied in the basin reports compare in priority with other environmental projects related to air pollution, safe drinking water supplies, and stopping irreversible environmental damage?
- **Technical issues**: What are the common technical problems facing the tributary basins, and what is needed to solve them?
- **Financial issues**: Lack of capital is the critical constraint; thus, the question becomes who should pay for wastewater services, and where will long-term financing come from?
- **Institutional issues**: The water and wastewater sectors in the four Danubian countries studied are evolving, and the relationships between ministries, municipalities, industries, and NGOs are changing. Consequently, what is needed to promote decentralization of responsibilities, and what roles must be strengthened within the environmental ministries in particular?
- **Regulatory issues**: Who should assume liability for past pollution? What legislation is required to provide decentralized management?

7.2 Investment Issues

From the perspective of the environmental ministries in the Danubian countries, tangible assistance from foreign donors and potential lenders has not been as rapid as expected. The ministries are typically understaffed, and contain a few key individuals who are often inundated by rounds of meetings and trips to talk with donors, potential lenders, consultants, and other members of the foreign assistance community. The countries are proud of the difficult road

they have selected, and are attempting a rapid transformation to democratic free-market societies. They look forward to Western assistance in recognition of these considerable efforts.

Often the environmental ministries have no clear understanding of the roles the staff of Western donors and lenders have played in the developing countries. Some in the Danube countries expect immediate grants to clean up the environment, while the foreign assistance community is prepared to provide only technical assistance and hard-currency loans, not grants. Both sides are learning more about each other and are searching for appropriate means of cooperation to bring about a cleaner, healthier environment.

For the following reasons, large grants of money for construction of environmental facilities will probably not be available for the Danubian countries in the near future (and in the longer term they are probably not expected or needed): Western governments are hard-pressed economically and financially, and public opinion does not favor giving large amounts of foreign aid to any countries (aside from humanitarian disaster assistance and the like); the Danubian countries are seen as potential economic competitors with Western Europe; available funds may be targeted to the former Soviet republics; and the turmoil and ethnic conflicts in the former Yugoslavia may affect the perceptions of Western political decision-makers. Loans from development banks (IBRD, EBRD, EIB), or loan guarantees by western governments on money from western commercial banks, are considered the most likely forms of financial assistance.

By definition, capital markets did not exist in the Danubian countries under communism. Since capital formation is just starting, local demands for capital are high. Municipal bonds, real estate taxes, tax assessments to build municipal facilities, and user charges that include repayment of loans are relatively new concepts in the Danubian countries. Borrowing from local banks requires payment of astronomical interest rates (e.g., 55 percent per annum in Bulgaria, and 70 percent in Romania). These interest rates are also a result of local inflation, as governments print money to prop up state enterprises in advance of privatization. Regardless of the causes, the local interest rates in some Danubian countries are beyond the capability of municipalities or industries to afford them, or to change user tariffs rapidly enough to pay them.

Why Should Foreign Lenders Invest in Water Pollution Control Projects?

While the priorities for other types of investments cannot be assessed fairly or knowledgeably within this report, the WASH teams advocate loans in the wastewater sector for the following reasons:

- Loans to municipalities and industries would assist with the development of local capital markets, and would be targeted at potentially creditworthy elements of a capital-starved economy. Foreign banks should be encouraged to set up joint ventures or branch offices in the Danubian countries and be given incentives or loan guarantees for loan activities in the wastewater sector.

- Loans to industries would promote their environmental awareness and ensure that, as potential competitors, they are playing on a level field with Western industries and have no cost advantage gained by polluting the environment.

- Negotiation of the terms of foreign loans, and the requirement to meet the conditions of the loans, would put the onus on the Danubian countries and would strengthen or hasten the development of appropriate municipal capabilities to plan, implement, finance, and operate infrastructure facilities. Such capabilities would include raising taxes locally, managing the facilities, monitoring industrial discharges to municipal systems, collecting user fees, improving the metering of water consumption, and the many other public-utility or local administration functions found in the Western countries. Many such functions cannot exist, however, and municipal capabilities cannot be strengthened, until the actual physical facilities are funded and built.

- Wastewater treatment requires good mechanical and electrical equipment, which can, for the most part, be manufactured locally with limited outside help. Investments in the wastewater sector would assist in the transition from military-industrial production toward the manufacture of pollution control equipment (among other things), and the formation of joint ventures with foreign manufacturers to improve and update the equipment available from local manufacturers.

- Environmental degradation was a major crack in the facade of communism, and contributed greatly to its demise. It should be shown expeditiously that market economies can effectively clean up the environment. The availability of loans from foreign lenders could be a key ingredient.

- Environmental investments (including air pollution control, safe water supply, and wastewater projects) should be selected based on a ranking of all categories and location-specific environmental projects in a unified list. Criteria for ranking the projects, such as cost/benefit, reduction of health risks, willingness to proceed, or intangible benefits should determine the mixture of projects selected for an investment portfolio. For the reasons noted in this section, many of the wastewater projects identified in these basin studies would rank as highly as projects in other categories, such as air pollution control, provision of safe water supply, and prevention of irreversible environmental damages.

- The environmental ministries in the Danubian countries are in their infancy and have been given broad responsibilities in all media (air, water, soil), but their responsibilities often do not include the development of potable water supply. Therefore, the momentum gained from water pollution studies and plans conducted to date should be continued rather than dissipated.

- Protection of the Danube Delta and the Black Sea should be included in any list of critical areas in which to prevent irreversible environmental damage. All of the wastewater projects on Danube tributaries address this problem.

- On the tributaries of the Danube, water is a scarce resource; safe drinking water supply and safe or usable irrigation water cannot be ensured economically without source protection by wastewater treatment. For example, Bucharest receives 70 percent of its water supply from the Arges River at a point where dry-season flows are about 25 percent wastewater. If wastewater treatment is not improved, a 100 km pipeline would be necessary to take water from upstream of the industries or communities causing the pollution. Alternatively, Bucharest could place its trust in the quality of the Danube and pump water from 60 km away. These alternatives are uneconomical and would be unacceptable on environmental, political, and social grounds, because of the increased public health risk associated with the Danube. A similar situation applies in several other of the projects studied, including Sevlievo in Bulgaria and the protection of the groundwater zone for the Miskolc region in Hungary. The point is that wastewater treatment cannot be separated from the provision of safe water supplies.

7.3 Technical Issues

Foreign donors and lenders play an important role in the provision of continued technical assistance to the Danubian countries. Although the countries have technically knowledgeable, capable, and dedicated staff, they need continued contact with Western countries to solve technical problems and to improve their awareness of current pollution control technologies. They also need better operator training, improved instrumentation and process control in wastewater treatment plants, greater use of pilot treatment studies in advance of design and construction, and improved awareness of the requirements for worker safety and health safeguards within treatment plants.

What Are the Common Technical Problems Facing the Tributary Basins, and What Is Needed to Solve Them?

Common technical issues that deserve more attention include the following:

- **Flexibility in project implementation**. In general, stream water-quality objectives are high, and advanced wastewater treatment levels are desired by the environmental ministries, but often they cannot be achieved within existing financial and institutional constraints. Phased implementation of wastewater facilities therefore would be more practical and affordable; for example, wastewater collection first, conveyance second, enhanced primary treatment next, secondary treatment last, and nutrient removal facilities only if proven necessary in the future. Trade-offs should be considered between the cost of wastewater treatment and the benefits of various stream-quality options (associated with downstream water uses to be protected). Phased compliance schedules for improvements in industrial pretreatment may also prove necessary, particularly when the economic viability of an industry becomes questionable in the near term.
- **Sludge treatment and sludge disposal.** In essentially all existing wastewater treatment plants studied, sludge treatment and sludge disposal are major problems. In partially built

plants, the sludge facilities are the last components to be built, and reliance is placed on sludge drying beds that do not function well in cold, wet climates. Agricultural reuse of sludge is often precluded by high levels of heavy metals caused by inadequate industrial pretreatment. Sludge generally is disposed of in municipal dumps or landfills, without isolation or control over leachate. Recovery of heavy metals from industrial sludges is generally not attempted.

- **Control over industrial pretreatment**. Monitoring and control of industrial emissions to municipal sewer systems are generally weak, and fines on industries for exceeding allowable limits on pollutants are generally not imposed due to poor economic conditions. Additionally, the agencies that operate the municipal plants usually lack necessary laboratory and technical resources, and the environmental inspectorates are more concerned with direct industrial discharges to rivers than with indirect discharges. Exacerbating the problem are older industrial plants, which spill chemicals from liquid wastes they store on-site.

- **Nonpoint-source pollution**. Stream-quality monitoring data are usually collected on a monthly basis, and have limitations for use in water quality planning. Generally it is impossible to use the available data to separate the effects of point-source emissions from municipalities and industries from nonpoint-source emissions from agricultural land, combined-sewer systems, and airborne pollutants.

- **Feedlot waste**. Liquid waste from large animal feedlots and breeding farms is a significant source of water pollution in several of the basins (for example, it constitutes the largest source of organic pollution in the Yantra basin in Bulgaria). Excessive amounts of water are used to transport manure to stabilization ponds, which do not work properly, and little attempt is made to reuse the manure as fertilizer. Changes in previous practices could be made at a low cost but are difficult to implement during this period because some of the feedlots may be broken up into smaller farms when land is returned to its former owners.

- **Technical specifications for equipment and construction**. Some Danubian countries formerly were restricted to using Russian technology or were required to manufacture their own pollution control equipment with limited awareness of Western technologies. This often involved an ad hoc collaboration between treatment plant designers and the manufacturers of the equipment when the market for such equipment was very small. Technical specifications from Western countries should be adopted to allow local manufacturers to aim toward acquiring higher-quality materials, workmanship, performance guarantees, efficiency, and user-safety features found in other countries. This would ensure that funds from foreign loans are not wasted on existing low-quality equipment, promote the formation of joint ventures with foreign manufacturers, and avoid potential conflicts of interest between foreign and local suppliers (in which existing state enterprises provide local employment but are high-cost monopolies).

- **Uncertainties in the basis of planning and design**. Reliable data are difficult to acquire for planning wastewater facilities in the countries studied because of the many

changes occurring there. For example, although the growth in national population is low in the four countries and population movements were restricted in the past, under current economic restructuring, populations will shift to match new employment opportunities, subject to the availability of housing. Industrial production has declined (and with it, industrial emissions) and may or may not recover in the future. Water usage will decrease as higher tariffs are applied. As a result of all these factors, in planning for wastewater facilities, projecting design flows and then matching the capacity expansion to meet those projections will require more detailed analysis than was applied in the past. In several of the countries, facilities are overdesigned and thus would be too costly under present circumstances. Additionally, as subsidies are removed, the costs of labor, energy, and materials will rise, and the criteria for minimum-cost design will change; for example, additional automation, instrumentation, and control systems will be needed to reduce the number of laborers when their wages increase under free-market conditions.

Obtaining reliable cost estimates for planning is also a significant problem. In Slovakia and Bulgaria, cost estimations for wastewater treatment facilities are apparently 30 to 50 percent higher than in the United States, while in Romania they are about 60 percent less. These may reflect inaccuracies in estimates caused by rapid inflation, or they may represent large differences in labor productivity in construction and manufacturing of equipment.

- **Municipal water supply**. Planning and implementing wastewater improvements should be considered in concert with improvements in municipal water supply for many reasons. In the Danubian countries in the past, the interrelationships between wastewater and municipal water supply have been generally ignored. Both systems were formerly designed to accommodate very high per capita demands, often on the order of 350 to 700 L per capita per day. In combination with low user prices and lack of household water meters, this has resulted in significant waste of water from leaking water taps and toilet tanks. Leakage in water distribution systems also is high, and may be contributing to infiltration into sewers. Where water meters are available, they are unreliable and are provided for blocks of apartment buildings rather than for individual apartments, which inhibits water conservation sought by raising water prices. Further, water supply is often rationed by hour of the day or portion of the city, which affects the flow and load variations seen at wastewater treatment plants. People are willing to pay for improved water supply, and could be induced to pay for wastewater improvements (benefiting people downstream) if financing and implementation of water supply and wastewater were linked.

7.4 Financial Issues

Who Should Pay for the Services?

Allocating the burden of cost recovery for water and sewer services is a complex and contentious issue. In general, there are three main sources of cost recovery for such services: the users, the local government and the central government. In the past in Central and Eastern Europe, the central government carried most of the burden. During the current economic transition, the burden is being shifted quickly to the local governments and service users. One serious problem in this rapid shift is that the old system of capital investment financing has been destroyed and not replaced with a new system. On the other hand, tariffs have been allowed to rise by differing amounts in each country, at least providing for O&M cost coverage.[1]

Central governments should be encouraged to adopt clear policies on how much support they will continue to provide to the water and sanitation sector. Financial support for capital investment will continue to be needed, especially for sewerage systems and wastewater treatment.[2]

From Where Will the Capital Investment Financing Come?

As the old system of central government subsidies is removed, the central governments of the countries are moving slowly to replace them with new channels for funds. It is clear that the reliance on grants and subsidies will be replaced with loans that are to be repaid via both user charges and municipal revenues. Several obstacles inhibit putting this new structure in place:

- **Absence of long-term credit systems within the countries.** The whole system of long-term credit (and institutional structure) does not yet exist for either the private or public sector.
- **Lack of experience with debt management.** Potential borrowers (either municipal governments or water/sewer authorities) have little or no prior experience in this area, making it difficult to assess creditworthiness.

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[1] In Romania and Bulgana, the tariff increases have been undercut by high inflation rates.

[2] Virtually every country in the world provides central government support for capital investment in wastewater facilities, in the U.S., between 1972 and 1987, approximately one-half of all such investment was provided by the U.S. federal government as direct grants.

- **Poorly functioning credit systems and high interest rates.** Existing credit systems deal largely with short-term lending; additionally, due to high rates of domestic inflation and institutional inefficiencies, domestic lending rates tend to be quite high.[3]

The development of new financing structures takes time since it requires the creation of new institutions and capabilities. In the meantime, some form of transitional financing structure may need to be established to keep capital flowing to high-priority investments within the sector. The key to this transitional financing will almost certainly be loans from multilateral lending institutions (e.g., the World Bank, EBRD), which will generally be borrowed by the central governments and "on-lent" to local borrowers, both local governments and possibly industries. In keeping with their mandate to strengthen the development of domestic financial markets, such lenders will also require that on-lending be at unsubsidized rates. Indexing of the capital and interest payments may be necessary in Romania, where the inflation rate is very high currently but is unstable over a normal loan repayment period of 20 years or more. Over time, such borrowing should be supplemented by the raising of capital via newly developed domestic capital markets.

The final issue of wastewater financing in the countries deals with two separate considerations of equity: How to ensure that poor and disadvantaged groups are not denied service under self-financing mandates; and how to balance the effects of past investments that have tended to favor large cities at the expense of smaller towns and villages.

The decentralization of water/sewer responsibility to local government should propel the sector toward financial self-sufficiency since localities will have little alternative but to recover a much higher percentage of costs from service users. This also means that affordability will become much more important in dictating sector investments, service levels, and performance. All of these factors should make water supply and sanitation (WS&S) services more efficient. At the same time, there will be a natural tendency to orient services more toward higher-income groups and commercial customers, therein lowering coverage of low-income areas.

Balancing past investments is also problematic. Some have even argued that municipalities should be charged for water and sewer assets that are transferred to them under decentralization schemes. However, given the low level of municipal revenues at present, such charges are unrealistic. Nevertheless, the imbalance of past investments should be accounted for in future central government support programs.

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[3] While there may be valid reasons for pressing for low interest loans to the water/sewer sector on social grounds, there is an overriding long-term need to dismantle directed and subsidized credit schemes throughout the countries studied in order to put the domestic financial systems on fundamentally sound ground The multilateral lending institutions, led by the World Bank, have reached the conclusion that subsidized credit schemes tend to retard the development of sound domestic financial markets that can mobilize savings and allocate credit efficiently

7.5 Institutional Issues

The WASH teams encountered a number of institutional and policy issues during its work. The two that have emerged as most dominant are decentralization of responsibility of water/sewer services from national to local levels; and changes in responsibility and authority at the national level, including the developing role of the ministries of environment.

What Is Needed to Promote Decentralization?

The turnover of responsibility for managing water/sewer services to local governments is moving at different speeds among the four countries studied, with Hungary being the most advanced. Decentralization sets in motion a series of changes in almost all of the roles and responsibilities in the sector, which in turn must be accommodated by changes in institutional structure. Six key areas should be addressed immediately to help advance the decentralization process.

- **Municipal capacity strengthening.** Municipalities have had limited roles in the planning and delivery of WS&S services. Thus, their new responsibility creates a need for municipal governments to acquire the capability either to manage WS&S systems directly or to contract for them. For this, they need adequate staff, training, and information with which to make decisions. Experience from other countries shows that technical engineering skills are most readily acquired, while managerial (and especially financial management) capacity building tends to lag.

- **Availability of experienced WS&S service providers.** Many municipalities may not choose to operate WS&S services directly, and as such need access to agencies or firms that can deliver WS&S services. While each municipality may retain the right to provide WS&S services on a monopoly basis within its jurisdiction, the municipality should be able to choose among a range of potential contractors (including private firms). This range of choices is necessary to ensure cost competition and provide incentives for managerial efficiency.

- **Regulatory functions.** The changes in the WS&S sector create some new needs for public sector regulation and may rearrange existing responsibilities. Four key areas require some higher level of government regulation:

  - ☐ Monitoring effluent water quality from municipal treatment plants and assessing penalties for noncompliance with quality targets;

  - ☐ Reviewing and approving municipal tariffs, fees, and fines (to ensure fairness in how they are applied and in rates);

  - ☐ Offering advice on special environmental problems with which the municipality may not be able to cope (e.g., specialized industrial pollution); and

  - ☐ Ensuring disadvantaged groups access to WS&S services.

- **Access to investment capital.** Municipalities need access to much larger amounts of investment capital than has been available to the sector during the last few years. This area is institutionally complex because it involves integrating existing capital disbursement channels (environment funds and central ministry funds) with new systems of municipal transfers and local government lending facilities.

- **Continued access to developed water sources.** The breakup of state authorities creates a question as to how local water authorities will now maintain access to regional water networks or distant water sources, especially in places such as eastern Slovakia. Local authorities need continued access to water sources and some guarantee that additional water will be available as needed, at an affordable price.

- **Clarification of national policies.** Local authorities need to establish clear policies regarding (a) the amount and types of subsidies that would be provided from the central government; (b) amount and pricing of bulk water (as noted above); (c) availability of general revenues for municipal governments, since a large percentage of local budgets are expected to be provided as transfers and shared taxes from the central governments; (d) access to credit for both general infrastructure projects and for special environmental projects; and (e) limitations on municipal borrowing and WS&S tariff setting.

What Roles Must Be Strengthened within the Environmental Ministries?

The general political and economic transformation going on is being matched by transformations in authority among the central government agencies entrusted with environmental management. Four key areas require attention in this regard:

- **Ministries of environment require strong support.** These ministries are young, typically understaffed, and usually battling to maintain "turf" against older, more established ministries. They have the added task of balancing their many mandates, which are often in conflict: environmental advocate, regulator, fund-raiser, borrower, lender, and technical advisor.

- **The environmental information base needs to be upgraded.** The Danubian countries studied need additional assistance in implementing monitoring programs, in analyzing the data that are collected, and in making data available across governmental units. The EPA and A.I.D. have helped greatly in this arena but much more needs to be done.[4] The DEMDESS system is well on its way to being institutionalized in several of the countries, not only in regard to improving the quality of the data but also to allowing it to be used effectively in national policy formulation. Problems of data access and reluctance to share information will remain, but mechanisms should be found to open up the system to the free flow of this information.

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[4] For example, the types of pollutants monitored need to be expanded to include the categories of micropollutants and toxic organics

- **Jurisdictional conflict over water quality monitoring and water resource development needs to be resolved.** In several of the countries, conflict remains over which agencies should be responsible for standard setting and water-quality monitoring. In the past, these functions have been combined with responsibility for water resource development and even water/sewer service delivery. In general, the regulatory functions should be segregated from the development functions. At the same time, however, the regulators cannot be totally divorced from the financial and economic realities that constrain the development process.

- **Training, licensing, and remuneration of professionals in the wastewater field need to be upgraded.** While university-level engineering education appears to be of a high level, gaps exist in technician-level training for mechanical, electrical, and process technicians in wastewater treatment. Testing and licensing are also deficient. As decentralized water authorities become more cost-efficient, staff levels will decline and more highly trained staff will be required.

7.6 Regulatory Issues

A number of legal and regulatory issues have arisen in the course of WASH's studies. The two principal issues that require attention across all the countries studied are: resolution of legal liability for cleanup of past pollution at industrial sites and provision of legislation for decentralized management of water/sewer services, including private sector involvement.

Who Should Assume Liability for Past Pollution?

One of the most pressing issues is the development of clear-cut policies regarding responsibility for cleanup of wastes at industrial sites, especially those sites that are in the process of being privatized. Central government sentiment usually favors passing on the liability for cleanup to the new owners. However, this approach discourages potential investors since the environmental liability may be quite large and is often poorly documented, especially in the cases of soil contamination and groundwater pollution.

In several of the sites the WASH team studied (e.g., at the copper smelter in Krompachy, Slovakia) the extent of past contamination by hazardous waste is almost impossible to separate from centuries-old ore processing contamination at the same site, as well as heavy metal pollution of the riverbed from multiple other sources upstream. In such a case, the central government may have to accept responsibility for past pollution or risk losing potential investors who are needed to modernize the plant (and make other environmental investments in the production process).

The liability issue also affects solid-waste dumps, including those belonging to local governments and industries (many now closed). A large number of these dump sites are within the WASH study sites. Few are well documented or studied, however. In several areas, these sites threaten important groundwater aquifers (notably in the Sajo valley), and the

responsibility for their cleanup is uncertain. In Hungary, municipal governments are trying to tackle the problem since they have now inherited responsibility for water supply as part of the country's decentralization program, but they have little expertise in assessing these sites, in developing solutions, or in mobilizing funds to remedy them.[5]

What Legislation Is Required to Provide Decentralized Management?

Local authorities require legislation to allow them to undertake the range of functions needed to manage local water and sewer services efficiently. Chief among these functions are the powers to do the following:

- **Contract with private firms to operate or invest in local water/sewer systems.** A number of good reasons exist to encourage the participation of private management firms in running local water/sewer systems. However, numerous barriers persist to both the creation of new local firms and the entry of foreign firms. The first barrier (to all types of firms) is the lack of legal foundation and experience with this type of contracting. For foreign firms, issues of taxation, repatriation of profits, and foreign exchange risks, among others, must be considered.
- **Set tariffs to recover costs.** All of the countries studied still approve tariffs at the central level, and in some, tariffs are still set at uniform national rates.
- **Raise local revenues and incur debt.** In all four countries studied, local governments lack significant local taxing authority or control over their revenues. Only in Hungary are the municipalities truly able to incur debt at their own initiative.

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[5] A.I.D 's Local Environmental Management (LEM) program in Hungary is focusing on this problem on a pilot basis in several cities in the Sajo valley by providing technical assistance to the municipal governments there

Chapter 8

RECOMMENDATIONS FOR FUTURE ACTIVITIES

8.1 General

General recommended activities that apply to all four countries are listed below, and recommendations specific to each country and each river basin are described in Section 8.2. The former include recommendations that address the five groups of issues identified in Section 7 (investment, technical, financial, institutional, and regulatory issues), and general recommendations that apply to all four basin reports.

8.1.1 Response to Investment Issues

Recommended activities by potential international donors and lenders include the following:

- Continued and increased support for wastewater projects, when these compare favorably with other potential environmental projects (such as air pollution control, provision of safe water supplies, and prevention of irreversible environmental damages).
- Improved clarity of communications between the environmental ministries and the foreign assistance community, as to the combination of grants, loans, and technical assistance that can be made available from each donor or lender.
- Improved assistance in tapping the resources of Western private capital markets and commercial banks, in which international banks would be involved in establishing loan guarantees or in acting as program manager or financial overseer of loans from the Western private sector. This is based on the assumption that very little grant money will be available compared with the needs of the Danubian countries studied.
- Resolution of the means by which municipalities or industries that will own and operate the facilities would repay loans from Western sources, including a sharing of costs with the central governments of the countries in question, particularly when currency inflation is beyond the control of the borrower (a municipality or industry).
- Opening of discussions between lenders and borrowers to establish the conditions for loans, in terms of municipal organization, operation, financial operations, technical specifications for pollution control equipment, loan grace period, interest rate and repayment period, and other items of concern to the lenders. The loan conditions would assist the municipalities in developing decentralized capabilities in infrastructure planning, implementation, and operations.

8.1.2 Response to Technical Issues

Recommended activities for central governments, local governments, and international donors and lenders include the following:

- Developing a participatory process for river basin water-quality planning. More flexibility to accommodate discrepancies between achieving river water-quality objectives and maintaining affordability of wastewater facilities could be achieved in several ways. For one, municipalities, industries, NGOs, taxpayers, and water-quality beneficiaries within a water basin should be enlisted as active participants in the planning process. Second, greater long-range basin planning is needed that would induce consideration of water resources management (particularly the operation of reservoirs, hydropower facilities, irrigation, and municipal water supply systems), health and environmental impacts, municipal finance, and industrial waste-minimization and pretreatment requirements. The WASH pre-investment studies comprise a first iteration that has proven very useful, but time and resource constraints did not allow further, more interactive, efforts toward solutions more agreeable to the affected parties.
- Addressing the needs for sludge treatment and sludge disposal as integral parts of the planning and implementation process, rather than continually deferring these problems.
- Providing improved regulation, monitoring, and enforcement of industrial pretreatment as a condition for loans or government funds given for municipal wastewater systems.
- Conducting field studies and special water-quality sampling programs to better define the contribution of nonpoint sources to river pollution.
- Conducting demonstration projects on reducing water pollution caused by animal feedlots and supporting outreach programs to disseminate the results of these projects.
- Supporting improvements in technical specifications for higher-quality construction and equipment, through pilot installations of equipment subsidized by foreign manufacturers; exchange programs involving planners, designers, and operators of wastewater facilities; and contacts between potential joint venture partners in manufacturing pollution-control equipment.
- Incorporating municipal water supply as an integral part of wastewater projects.

8.1.3 Response to Financial Issues

The central governments should address the following:

- Establishing clearly the level of grants (both the amounts available and the criteria for allocation) for construction of municipal wastewater systems and associated requirements of the municipalities for industrial cost recovery, amortization, and sinking funds for future system rehabilitation and replacement.

- Establishing a transitional financing structure in cooperation with international lenders that will allow capital to continue to flow to high-priority investments until local capital markets have grown sufficiently to support them.
- Resolving the issues of ownership of existing assets and whether municipalities should repay the value of their wastewater systems, so that municipalities can begin to take responsibility for the upkeep and improvement of such systems.

8.1.4 Response to Institutional Issues

Donors or lenders could assist institutional strengthening at the local and national levels via the following activities:

- Promoting decentralization of water and wastewater services to the local level by strengthening municipal government capabilities and capacities; establishing a legal basis for and promoting the development of agencies or firms for privatized construction, operation, and maintenance of municipal wastewater systems; and defining central government regulatory functions that will be applied to municipal operations.
- Strengthening the environmental ministries and assisting them in defining and balancing their sometimes conflicting roles as environmental advocate, regulator, fund-raiser, and technical advisor.
- Upgrading the qualifications and public recognition of professionals in the wastewater field.

8.1.5 Response to Regulatory Issues

Recommended activities the central governments can take include the following:

- Establishing the legal liability for past pollution at industrial sites and municipal landfills and the baseline monitoring required before new owners or investors assume responsibility for environmental damages caused by future activities.
- Passing legislation that will enable local authorities to privatize wastewater services, to set tariffs that will recover their costs, to possess local taxing authority, and to incur debt at their own initiative.

8.1.6 Other Recommendations for Donors and Lenders

Two additional recommendations are offered to donors and lenders to the four countries studied:

- Conducting the feasibility studies, designs, and implementation plans for the facilities proposed in the four basin reports. This would occur after the initial activities of defining

the arrangements for a loan and of negotiating a loan agreement between lender and borrower.

- Providing DEMDESS assistance. The DEMDESS software and database capabilities developed by WASH should be supported so that the Danube riparian countries can continue to cooperate effectively. Assistance would include adding user-friendly elements to the software for its use by decision-makers; expanding the types of cost data available; and continued training of users both in the environmental ministries and in the river basin environmental inspectorates.

8.2 Country- and Basin-Specific Activities

8.2.1 Bulgaria, Yantra Basin

Opportunities for follow-up activities in the basin are summarized below, including those involving technical assistance and investments by international donors or lenders. Details are provided in the Yantra basin report.

- **Feasibility studies.** In addition to the municipal and industrial wastewater improvements suggested for Sevlievo and Gorna Oriahovitza, rehabilitation and completion of the municipal wastewater treatment plants in Gabrovo and Veliko Tarnovo should be given high priority. These plants were candidates for the first sector loan from the World Bank, but were not included in the final selection. A diagnostic report on the plants' needs, including operational, hydraulic, civil, structural, mechanical, and electrical deficiencies, is called for in order to clarify the requirements for their rehabilitation and/or expansion. The report should also review the procedures established for on-loaning to municipal and regional water and wastewater companies, and the business organization and management structures planned, under the World Bank sector loan. It should develop appropriate suggestions and an implementation plan as well.

- **Environmental management training and assistance.** Technical assistance to improve the effectiveness of the ministry and the inspectorates in the Yantra basin is needed as they assume their new roles and responsibilities. Staffing and organizational requirements should be formulated, and the activities and procedures of each unit delineated.

- **Institutional development.** Training of municipal and industrial treatment plant operators and modest investments in laboratory and operations equipment could provide immediate improvements in stream quality at low cost, and provide a more detailed knowledge of the needs for rehabilitating the existing plants. The municipalities in the Yantra basin need exposure to the methods of municipal finance, organization, and management that have proved successful in other democratic free-market countries.

- **Technical assistance to industries.** Large industrial dischargers in Bulgaria share many common problems in controlling industrial emissions; any improvement in their wastewater operations could provide an immediate low-cost improvement in Yantra stream-water quality. Assistance would include technical audits of industrial processes, waste minimization, and advice on process changes, spill prevention, and other emergency procedures. Help could also be provided to establish a program for national certification of industrial treatment operators to upgrade their training, qualifications, and pay.

8.2.2 Hungary, Sajo-Hornad Basin

Opportunities for follow-up activities in the basin are summarized below, including those for technical assistance and capital investment. Further details are provided in the Sajo-Hornad basin report.

- **Detailed feasibility studies.** The highest priority in this area is to conduct the feasibility study and detailed design of the sewerage network for the 10 municipalities in the groundwater protection area. This action is needed not only to prepare the project for long-term financing but also to secure governmental approvals (the so-called "Water Rights Authorization") for it, as well as the approval of the targeted grant application.

- **Prefeasibility studies.** The project to upgrade and expand the Miskolc wastewater treatment plant needs final definition in terms of sludge handling processes (including disposal options); the institutional arrangements for managing the facility as a regional asset; and required cost recovery mechanisms. Once these items are resolved (which could take some time), the project could move quickly to the feasibility and detailed design stages. Also, the project to upgrade the Borshod Brewery wastewater treatment system needs further definition and elaboration.

- **Technical assistance to industries.** The highest-priority technical assistance activity is development of a pretreatment program for industries that discharge to the Miskolc municipal sewerage system. A broad-based program is needed that includes effluent monitoring, regulatory improvement, technical assistance to individual industries in waste minimization and selection of treatment options, fee setting, and financial packaging.

- **Technical assistance to water/sewer authorities:** Local water and sewer authorities need assistance especially in improving financial management and cost controls. The recent, very high increases in operation and maintenance costs must be reversed in order to allow some capital cost recovery through the tariff process.

- **Technical assistance to local governments in hazardous waste dump assessment and remediation.** Municipalities have inherited responsibility for dealing with a large number of industrial waste dumps that threaten local water supplies. These municipalities require assistance in how to monitor groundwater contamination and in how to select cost-effective countermeasures, secure financing for the measures, and implement

them. A.I.D.'s Local Environmental Management Project is developing assistance strategies in selected towns in the Sajo basin on a pilot basis.

- **Assistance in establishing and capitalizing loan programs for environmental infrastructure.** Efforts now under way to establish lending programs for both municipal and industrial facilities should be moved ahead quickly. Among the issues addressed should be the needs of local governments for training and technical assistance in debt management since they are largely inexperienced in this area.

8.2.3 Romania, Arges Basin

Opportunities for follow-up activities in the basin are summarized below, including those for technical assistance and investment by international donors or lenders. Details are provided in the Arges basin report.

- **Environmental management training and assistance.** Under the country's new environmental and water laws, a decentralization of responsibilities will occur at the local level, including a new, strengthened Arges River basin authority and a new environmental inspectorate with responsibility for overseeing all media (water, land, air) and for developing and reviewing environmental impact statements. Assistance should be provided in defining appropriate national and river basin organizational and managerial responsibilities and roles, activities and procedures, staff training and personnel qualifications, and needs for laboratory equipment, transport, and communications.

- **Rural water supply.** Approximately 1 million people supplied from the polluted surface aquifer should instead be served by rural water systems supplied from deeper, confined aquifers. Assistance should be provided in developing a project paper or scope of work to investigate this problem, including such aspects as public health impacts (from high nitrate concentrations affecting infants), an inventory of existing rural supplies (which are reportedly from hand-dug wells in the polluted phreatic aquifer), and the technical, institutional, and financial considerations involved in developing safe rural water supply systems.

- **River basin water-quality master plan.** Under draft legislation, the Arges River basin authority and the environmental inspectorate are given responsibility for developing a long-range water-quality improvement plan. Many technical, institutional, financial, and organizational issues require further study and broader participation, including development of a politically acceptable method of waste load allocation and development of a staged financing and implementation plan that is affordable to the users.

- **Arpechim wastewater facilities plan.** Should the petrochemical complex be judged economically viable (a decision expected during 1993), its treatment requirements could be considered in combination with modernization of its production facilities.

- **Heavy metals recovery plant.** The Aro and Dacia car plants cannot safely dispose of their metal-containing sludges, but the sludge could be processed and the heavy metals recovered and recycled. The cost of a recovery plant could be funded under a grant to introduce modern industrial treatment technology, but may require a study to identify a sufficiently large market that would ensure economic viability of a recovery plant.

- **Studies on solid wastes and hazardous wastes.** Identification of suitable sites for sanitary landfills and provision of suitable equipment for collection, hauling, processing, and disposal of solid and hazardous wastes are needed.

- **Institutional development.** The country's municipalities need exposure to the methods of municipal finance, organization, and management that have proven successful in other democratic free-market countries. Training of municipal and industrial treatment plant operators and modest investments in laboratory and operations equipment could provide immediate improvements in stream quality at low cost, and provide a more detailed knowledge of the needs for rehabilitating existing plants.

8.2.4 Slovakia, Hornad Basin

Opportunities for follow-up activities in the basin are summarized below, including those for technical assistance and capital investment. Details are provided in the Hornad basin report.

- **Feasibility Study (credit-financing package).** The highest priority is to implement process changes and install air pollution abatement equipment at the Kovohuty copper smelter in Krompachy. This activity depends on the infusion of new capital, which, in turn, hinges on attracting foreign investors through privatization. The main obstacle at this time is uncertainty about who is liable for cleanup of past pollution. Potential investors require a reasonable policy on limitations of liability and, in some cases, negotiated schedules of compliance for meeting current environmental standards once industries are privatized.

  As the liability issue is resolved, technical selection of process changes and equipment also needs to occur. This will likely be undertaken by private owners without outside assistance; however, assistance may be required in assembling the credit financing of the investment (see below).

- **Feasibility study (cost-recovery assistance).** The municipality of Krompachy requires assistance in assembling financing and designing cost recovery mechanisms for relocating the municipal waste dump to a new regional facility. In addition, the town needs help in developing a plan to improve the existing dump site which contains industrial and municipal waste.

- **Assistance in establishing and capitalizing loan programs for industrial environmental investments.** Industries have no ready access to medium- or long-term credit for financing environmental projects. Especially needed is for a pool of capital to

finance projects in the range of $1 million to $15 million, an amount that is too small for creating a single loan project from one of the international lenders (e.g., EBRD).

- **Assistance to local water/sewer authorities in financial management and cost-effective facility design**. One of the main obstacles to affordability of municipal water/sewer facilities and progress in completing projects under way is the very high cost of those facilities. Local authorities need assistance in lowering their construction and operating costs and in designing facilities that are less costly to build.

- **Assistance to the central government in restructuring the local water/sewer authorities**. Improvements in management of local water/sewer authorities are being held up by a lack of resolution on restructuring and, possibly, on decentralizing the existing delivery systems. This is a complicated issue, as it also involves the reform of local government structures and tax reform. The central government needs help in evaluating options for reform and assessing the fiscal impact of those options.

Appendix A

Persons Contacted

BULGARIA

Ministry of Environment

Branimir Natov, Deputy Minister
George Karagiozov, Head, Water Protection Department
Dr. Ilya Natchkov, Bulgarian Focal Point, Danube Environmental Program
Marieta Stoimenova, Water Protection Department
Nikolay Kujumdgiev, Water Protection Department; and Deputy Director, World Bank-sponsored Water & Wastewater Sector PMU
Ivan Milushev, Computer Specialist, Laboratory and Information Center
Kliment Dilianov, International Relations Department
Anton Gougov, Chief, Environmental Inspectorate at Veliko Tarnovo
Kolio Varbanov, Chief, Environmental Inspectorate at Gabrovo

Ministry of Construction and Regional Development

Nikola Videnov, Chief, Water Supply and Sewerage, Sofia Region
World Bank sponsored Water and Wastewater Sector Study PMU
Orlin Dikov, Director, Water Sector PMU
Vania Shopova, Water and Sanitation Engineer

Bulgarian Academy of Sciences, National Institute of Meteorology and Hydrology

Dr. Konstantin Tzancov, Deputy Director
Dr. Strahil Gerasimov, Chief, Hydrology Department
Lorra Shivarova, Head, Chemical Laboratory

Municipality of Sevlievo

Metodi Indzov, Mayor
Ivan Todorov, Secretary

Representatives of Local Industry

Representatives of the sugar beet factory and alcohol distillery in Gorna Oriahovitza; and of the tannery in Sevlievo

Municipality of Sofia

Georgy Faytondziev, Operations Chief, Wastewater Treatment Plant

Environmental Management Training Center

Dr. Dafina Gercheva

Halcrow & Partners Ltd.

Timothy Gross
Stuart Suter
Anthony Baker

U.S. Environmental Protection Agency

William J. Muszynski, Acting Administrator, Region II
Melissa Margetts Jaeger, International Activities Coordinator

USAID/Bulgaria

Gerald Zarr, Representative to Bulgaria
John Babylon, Project Manager
Bozill Kostov, Project Management Assistant

Water Engineering Ltd.

Avram Radev, President
Dr. Todor Gardanov, Environmental Engineer
Dimiter Angelov, Civil Engineer
Dr. Ilya Papazov, Environmental Engineer
Pavel Pavlov, Wastewater Treatment Specialist
Stela Ivanova, Chemical Engineer
Nikola Nikolov, Environmental Engineer
Georgy Slavov, Water Supply Specialist
Vasilka Pesheva, Solid Waste Specialist
Georgy Chobanov, Sewerage Specialist
Ivanka Misheva, Accountant and Office Manager

HUNGARY

Ministry of Environment and Regional Policy

Dr. Peter Ottlik, Head of Division, Water, Soil and Air Protection
Dr. Sandor Kisgyorgy, Head of Division, Water Quality
Eng. Istvan Tokes, Head, International Cooperation and Information
Ms. Ester Szovenyi, Senior Officer, Department of International Relations
Dr. Laura Raboczki, Head, Department of Economics

Vituki Water Resources Research Center

Mr. Janos Feher, Senior Research Scientist
Mr. Kalman Morvath, Head of Data Management Systems
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Appendix B

Additional Tables

Table B.1 Population and Wastewater Flow Projections, Yantra Prefeasibility Studies

	1993	2000*	2010*
		Total Population	
Sevlievo	30,000	32,000	35,000
Gorna Oriahovitza	55,000	58,000	62,000
		Total Wastewater Flow, cmd	
Sevlievo	10,600	20,500	20,500
Gorna Oriahovitza	34,000	50,000	53,000

*Estimated

Table B.2 Industrial Pretreatment Requirements for Sevlievo

Industry	Description	Flow Rate	Major Contaminants	Needs
Sevko	Tannery	1,300 cmd	BOD, TSS, total nitrogen, Cr	- Waste minimization - Physical chemical treatment - BOD removal facilities - Sludge management
D. Hinkov	Garment fasteners	5 cmd	Ni, Zn	- Waste minimization - Improved metals-removal facilities - Sludge management
Vidima	Plumbing fixtures	150 cmd	Good treatment	- Waste minimization - Sludge management
Avangard	Electric motors	30 cmd	Cu, Cd, Pb	- Waste minimization - Improved metals-removal facilities - Sludge management
Rositza Auto Repair	Car washes	70 cmd	Oil, TDS	- Waste minimization - Improved oil removal
Sevly Conserve	Canning	1,730 cmd	Good treatment	- Treatment for meat canning operations - Sludge management
St. Peshev	Machine manufacture			- Further industry evaluation
Dynamo	Diesel generators	145 cmd	Pb, Zn, Cu	- Waste minimization

Table B.3 Industrial Pretreatment Requirements for Gorna Oriahovitza

Industry	Description	Flow Rate	Major Contaminants	Needs
Sugar Plant	sugar/alcohol	8,000 cmd	BOD, TSS, total nitrogen	- Waste minimization - Water conservation - BOD-removal facilities - Sludge management
Appliances	appliances and warehouse equipment	135 cmd	Ni	- Waste minimization - Improved metals removal - Sludge management
Technomans	$CuSO_4$ producer	—	Cu	- Waste minimization - Improved metals removal - Sludge management
Railway Board	Train depot	1,200 cmd	Extractable matter	- Waste minimization - Sludge management
Yantra Transport	Bus company	220 cmd	Oil	- Waste minimization - Improved oil removal - Sludge management
Arkos	Metal finishing	960 cmd	Extractable matter, TSS, Cu, Zn, Ni	- Waste minimization - Improved metals removal - Sludge management
Analytical Balance	Metal finishing	15 cmd	Cr^{+6}, Cu, Zn, Ni	- Waste minimization - Improved metals removal - Sludge management
Pobeda	Motor vehicle maintenance	32 cmd	Oil	- Improved oil removal - Sludge management

Table B.4 Gorna Oriahovitza Sugar/Alcohol Plant: Existing Loads

Wastewater Stream	Flow	BOD_5	Suspended Solids
	cmd	Pollutant Load, kg/day	
Sugar beet transport water	9,000	7,500	6,000
Saturation sludge transport water	3,000	6,000	6,000
Chemically polluted waters	2,000	2,000	1,000
Distillery wastewater	1,500	40,000	10,000
TOTAL	15,500	55,500	23,000

Table B.5 Gorna Oriahovitza Sugar/Alcohol Plant: Projected Loads After Modification

Wastewater Stream	Flow	BOD_5	Suspended Solids
	cmd	Pollutant Load, kg/day	
Sugar beet transport water	8,000	4,400	2,000
Saturation sludge transport water	-	-	-
Chemically polluted waters	1,000	600	500
Distillery wastewater	1,000	1,000	2,000
TOTAL	10,000	6,000	4,500

Figure B.6 Potential Investment Projects for the Sajo-Hernad Basin in Hungary

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Project No. 1: Protecting the groundwater resources at the confluence of the Sajo and Hernad Rivers.

Project No. 2: Protecting the Lazberc Reservoir.

Project No. 3: Protecting the Bodva River as a drinking water source.

Project No. 4: Reducing nitrate levels in the Hernad River.

Project No. 5: Protecting water quality in the Sajo basin.

Project No. 6: Remediating scattered waste dump sites.

Project No. 7: Controlling industrial wastewater discharges to the Miskolc municipal sewerage system

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Table B.7 Population and Wastewater Flow Projections, Arges Prefeasibility Studies

	1993	2000*	2010*
		Total Population	
Pitesti	201,500	245,000	285,000
Cimpulung	48,700	54,900	60,600
Curtea de Arges	35,800	43,700	48,300
		Total Wastewater Flow (cmd)	
Pitesti	156,000	254,000	300,000
Cimpulung	22,300	28,000	38,000
Curtea de Arges	24,200	33,000	43,000

*Estimated

Table B.8 Proposed Improvements to Municipal Wastewater Facilities—Pitesti

	Investment Description	Cost[a]		Comments
		Million Lei	Thousand $[b]	
A)	Immediate Needs (existing flow is 156,000 cmd)			
1)	Improve existing sewer system.	60	100	Covers inspection of smoke tests of and repairs to the parts of the existing sewer system that are in very poor condition.
2)	Optimize WWTP operation; improve WWTP laboratory.	90	150	Optimize plant operation to improve phosphorus removal. Improve laboratory capability and municipal monitoring to detect and control industrial sources of phosphorus and nitrogen.
3)	Rehabilitate WWTP mechanical and electrical equipment.	1,800	3,000	Much of the equipment is old and poorly maintained, and must be replaced for the treatment plant to be operated effectively.
4)	Expand preliminary treatment.	120	200	The existing preliminary treatment capacity is only 127,000 cmd. Add 63,000 cmd preliminary treatment capacity to match total plant capacity of 190,000 cmd.
B)	Phase I (year 2000 needs: flow of 254,000 cmd [existing flow + 98,000 cmd])			
5)	Extend sewer system.	270	450	Add new sewers to serve an additional 42,000 persons.
6)	Add primary, secondary, and sludge digestion.	2,880	4,800	Existing facilities should have a 190,000 cmd capacity when rehabilitated (item 3 above). Additional 64,000 cmd capacity includes primary treatment, secondary treatment, and sludge digestion added to existing WWTP.
7)	Add nitrification, denitrification, and filter presses.	7,200	12,000	Add nitrification, denitrification, and sludge filter press capacity for the full Phase I flow (254,000 cmd).

	Investment Description	Cost[a] Million Lei	Cost[a] Thousand $[b]	Comments
C)	Phase II (year 2010 needs: flow of 300,000 cmd [Phase I + 46,000 cmd])			
8)	Add primary, secondary, nitrification, denitrification, sludge digestion, and filter presses.	3,700	6,150	Additional 46,000 cmd capacity includes primary treatment, secondary treatment, nitrification, denitrification, sludge digestion, and sludge filter presses.
9)	Extend sewer system.	200	350	Add new sewers to serve an additional 38,000 persons.
	Summary			
A)	Immediate Costs: Items 1 - 4	2,070	3,450	
B)	Phase I Costs: Items 5 - 7	10,350	17,250	
C)	Phase II Costs: Items 8 and 9	3,900	6,500	
	TOTAL	16,320	27,200	

[a] Costs represent 1993 Romanian market costs and include 20% for contingencies.

[b] Per exchange rate of 600 lei per $US

Table B.9 Proposed Improvements to Municipal Wastewater Facilities—Cimpulung

	Investment Description	Cost[a]		Comments
		Million Lei	Thousand $[b]	
A)	Immediate (existing flow is 22,300 cmd)			
1)	Improve existing sewer system and WWTP laboratory; upgrade WWTP operations.	60	100	Covers the inspection of smoke tests of and repairs to existing sewers; laboratory upgrade; and O&M training needs.
2)	Rehabilitate digester.	36	60	Rehabilitate existing digester's mechanical and electrical elements. Provide adequate capacity for one-third of 1993 flow.
3)	Add new digester.	48	80	Additional capacity is needed for remaining two-thirds of 1993 flow (assuming item 2 above is completed). However, the additional cost to add capacity to accommodate total Phase II flow is small; therefore, size the digester for Phase II flow now.
4)	Expand preliminary treatment plant.	58	97	Existing preliminary treatment is adequate for only 13,000 cmd, and 9,700 cmd more is needed to treat existing flows. However, the additional cost to add capacity to accommodate total Phase II flow (10,000 additional cmd) is small; therefore, size the plant for Phase II flow now.
B)	Phase I (year 2000 needs: flow of 28,000 cmd [existing flow + 5,700 cmd])			
5)	Extend sewer system.	36	60	Add new sewers to serve an additional 6,700 persons.
6)	Add sludge thickeners.	34	57	Existing thickener capacity is adequate for existing flow. Incremental cost to accommodate Phase I flow is only slightly less than to accommodate Phase II flow; therefore, size the thickeners for Phase II flow.
7)	Add filter press.	24	40	No filter press exists currently. Incremental cost to accommodate Phase I flow is only slightly less than to accommodate Phase II flow; therefore, size the press for Phase II flow.

	Investment Description	Cost[a] Million Lei	Thousand $[b]	Comments
C)	Phase II (year 2010 needs: flow of 38,000 cmd [Phase I + 10,000 cmd])			
8)	Add aeration capacity.	104	174	Existing aeration capacity is adequate for Phase I flow (28,000 cmd). Add 10,000 cmd capacity to obtain Phase II flow (38,000 cmd).
	Summary[c]			
A)	Immediate Costs: Items 1 - 4	202	337	
B)	Phase I Costs: Items 5 - 7	94	157	
C)	Phase II Costs: Item 8	104	174	
	TOTAL	400	668	

[a] Costs represent 1993 Romanian market costs and include 20% for contingencies.

[b] Per exchange rate of 600 lei per $US

[c] No costs for nitrification/denitrification or phosphorus removal are shown. Strategy is to wait until year 2000 to determine if nutrient removal is needed at all. The assimilative capacity of the stream may be adequate to remove nutrients. Nitrification/denitrification for Phase I flow is estimated at 960 million lei or $US 1.6 million (1993 basis). Based on the magnitude of this cost versus the costs for the other improvements cited, it is logical to delay this expenditure until its need is established.

Table B.10 Proposed Improvements to Municipal Wastewater Facilities—Curtea de Arges

	Investment Description	Cost[a] Million Lei	Thousand $[b]	Comments
A)	Immediate Needs (existing flow is 24,200 cmd)			
1)	Improve existing sewer system and WWTP laboratory; upgrade WWTP operation.	30	50	Covers the inspection of smoke tests of and repairs to existing sewers; laboratory upgrade; and O&M training needs.
2)	Add preliminary treatment.	79	132	Add bar screens and grit removal to increase preliminary treatment capacity by 11,000 cmd to match capacity of plant as a whole.
3)	Rehabilitate digester.	90	150	Repair or replace heating equipment in existing units.
4)	Add aeration capacity and final settling tanks.	329	548	Use Bio-Protein treatment plant for added aeration capacity. Construct added clarifiers on part of sludge drying bed area. Costs include payment to purchase the Bio-Protein facilities; and yard piping, pumps, and clarifiers for half of total plant flow.
5)	Add sludge filter press.	324	540	Filter press is added for existing sludge production plus full Phase I capacity. Will free area of sludge drying beds to accommodate new clarifiers.
B)	Phase I (year 2000 needs: flow of 33,200 cmd [existing flow + 9,000 cmd])			
6)	Extend sewer system.	48	79	Add new sewers to serve an additional 8,800 persons.
7)	Add digesters.	106	176	Add complete new digester to accommodate Phase I flow. Some Bio-Protein treatment plant digestion facilities may be used.
8)	Add aeration capacity.	0	0	No capital cost because Bio-Protein plant will provide sufficient aeration for full Phase I flow. Assume pumps and piping in item 4 above are adequate.
9)	Add final clarifiers.	203	339	Construct new secondary clarifiers. More land must be purchased.[c]

	Investment Description	Cost[a] Million Lei Thousand $[b]		Comments
A)	Immediate Needs (existing flow is 24,200 cmd)			
C)	Phase II (year 2010 needs: flow of 33,200 cmd [Phase I + 10,000 cmd])			
10)	Extend sewer system.	54	90	Add new sewers to serve an additional 10,000 persons.
11)	Add digester, filter press, and secondary clarifier.	510	851	Additional land is needed for clarifiers; it is assumed that adequate area exists for the digester and filter press.[c]
12)	Add aeration equipment.	15	25	The Bio-Protein plant is assumed to have adequate aeration capacity. Capital costs are for additional pumps and piping.
	Summary[d]			
A)	Immediate Costs: Items 1 - 6	852	1,420	
B)	Phase I Costs: Items 7 - 9	357	594	
C)	Phase II Costs: Items 10-12	579	966	
	TOTAL	1,788	2,980	

[a] Costs represent 1993 Romanian market costs and include 20% for contingencies.

[b] Per exchange rate of 600 lei per $US.

[c] Land cost included at current market estimates of $US 50,000 per hectare.

[d] No costs for nitrification, denitrification, or phosphorus removal are included; it is assumed that industrial waste minimization and improved municipal plant operation will be adequate for nutrient reduction.

Table B.11 Industrial Pretreatment Requirements for Pitesti

Industry	Description	Flow Rate	Major Contaminants	Needs
Alprom	Wood products	4,320 cmd	BOD, 3,500 kg/day;	- Waste minimization
			nitrate, 15 kg/day,	- BOD removal facilities
			ammonia, 95 kg/day	- Nitrogen removal facilities
Rotan	Leather products	1,397 cmd	BOD, 485 kg/day;	- Waste minimization
			ammonia, 201 kg/day;	- BOD removal facilities
			phosphate, 6 kg/day	- Nitrogen removal facilities
Novatex	Textiles	4,320 cmd	Ammonia, 212 kg/day	- Waste minimization
				- Nitrogen removal facilities
Argesana	Textiles	3,456 cmd	COD, 4,285 kg/day	- Waste minimization
Divertex	Textiles	2,592 cmd	Phosphate, 12 kg/day	- Waste minimization
				- Phosphate removal facilities
Pitbere	Beer	259 cmd	Phosphate, 18 kg/day	- Waste minimization
				- Phosphate removal facilities

Table B.12 Industrial Pretreatment Requirements for Cimpulung

Industry	Description	Flow Rate	Major Contaminants	Needs
Aro	Vehicle manufacture	8,640 cmd	Ammonia, 64 kg/day	- Waste minimization
			Phosphate,	- Nitrogen removal facilities
			heavy metals	- Phosphate removal facilities
				- Additional metals removal
				- Effluent monitoring
				- Spill plan
				- Sludge management
				- Metals reclamation
Grulen	Synthetic fibers	2,458 cmd	Ammonia, 13 kg/day	- Waste minimization
				- Nitrogen removal facilities

Table B.13 Industrial Pretreatment Requirements for Curtea de Arges

Industry	Description	Flow Rate	Major Contaminants	Needs
Abator Pasari	Chicken processing	691 cmd	Nitrogen compounds	- Waste minimization
				- Nitrogen removal facilities
Arpo	Porcelain	1,356 cmd	Ammonia, 19 kg/day	- Waste minimization
				- Nitrogen removal facilities
Electroarges	Electronics	2,160 cmd	Heavy metals,	- Waste minimization
			ammonia	- Effluent monitoring
				- Additional metals removal
Icil		259 cmd	BOD, 454 kg/day;	- Waste minimization
	Dairy		nitrate, 29 kg/day	- BOD removal
				- Nitrogen removal

Figure B.14 Potential Investment Projects in the Hornad Basin

Project No. 1: VSZ WWTP upgrading for phenols and oil sludges.

Project No. 2: Rudnany mine sludge lagoon remediation.

Project No. 3: Krompachy copper smelter air and water emissions controls.

Project No. 4: Krompachy municipal waste dump and industrial sludge lagoon remediation.

Project No. 5: Mercury deposits (Ruzin Reservoir) remediation.

Project No. 6: Presov municipal WWTP replacement.

Project No. 7: Krompachy municipal WWTP and trunk sewer completion.

Project No. 8: Spisska Nova Ves WWTP expansion and rehabilitation.

Project No. 9: Kosice municipal WWTP expansion and upgrading.