PN-ABQ-384

Wastewater Project Analysis With Recommendations for The Municipality of Miedźna, Poland

Local Environmental Management (LEM) Project

October 1993

Prepared by:
Research Triangle Institute (RTI)
Research Triangle Park, NC 27709

Funded by
U.S. Agency for International Development
Washington, DC 20523
Contract No. EUR-0039-C-00-2065-00

Cover photo: Typical open wastewater ditch in Poland, of the type to be replaced by LEM-assisted solutions.

Photo by Al Sharp

PN-ABQ-384

WASTEWATER PROJECT ANALYSIS WITH RECOMMENDATIONS

FOR

THE MUNICIPALITY OF MIEDŹNA, POLAND

LOCAL ENVIRONMENTAL MANAGEMENT (LEM) PROJECT

Prepared by:
Research Triangle Institute (RTI)
Research Triangle Park, NC 27709

Funded by:
U.S. Agency for International Development
Washington, DC 20523
Contract No. EUR-0039-C-00-2065-00

October 1993

TABLE OF CONTENTS

Section		Page
Tables		v
Figures		v
Abbreviations		vii
Executive Summary		ix
1	INTRODUCTION	1
1.1	LEM Project Overview	1
1.2	Profile of Miedźna	2
1.3	Miedźna Survey Objectives	6
1.4	Survey Methodology	7
1.5	Survey Team Profile	8
2	TECHNICAL ANALYSIS	9
2.1	Existing Conditions	9
2.2	Conclusions	9
2.2.1	Evaluation of Proposed Technologies	9
2.2.2	Evaluation of Submitted Turnkey Bids	11
2.2.3	System Design	12
2.2.4	Collection System	13
2.2.5	System Costs	15
2.2.6	Operations and Maintenance (O&M)	17
2.3	Health Situation in Miedźna	18
2.4	Concluding Remarks	19
2.4.1	Contract Negotiations	19
2.4.2	Detailed Project Design	19
2.4.3	Project Construction	20
2.4.4	Utility Operations	20
3	MANAGEMENT ANALYSIS	21
3.1	Existing Conditions	21
3.2	Utility Management	22
3.3	Recommendations	22
3.4	Organizational Alternatives	22
3.4.1	Creation of a New Budget Unit	23
3.4.2	Wastewater as a Public Enterprise	23
3.4.3	Wastewater as a Private Enterprise	23
3.4.4	Regional Cooperative Agreements for Wastewater Operations	23

TABLE OF CONTENTS (continued)

Section		Page
4	FINANCIAL ANALYSIS	25
	4.1 Existing Conditions	25
	4.2 Conclusions	29
	4.2.1 Available Local Resources	29
	4.2.2 Project Capital Costs	29
	4.2.3 Available External Resources	31
	4.2.4 Cost Recovery/User Fees	36
	4.2.5 Summary of Conclusions	37
	4.3 Recommendations	38
5	TRAINING AND OUTREACH NEEDS	39
	5.1 Training Course for Treatment Plant Operators	39
	5.1.1 Introduction to Treatment Plant Operations	39
	5.1.2 Advanced Course in Treatment Plant Operations	39
	5.2 Training in Management and Operations of Water and Wastewater Organizations	40
	5.3 Financial Administration of Water/Wastewater Organizations	40
	5.4 Planning for Water/Wastewater Management	40
	5.5 Developing and Writing a Project Business Plan	41
	5.6 Management of Infrastructure Projects	41
	5.7 Design and Implementation of Public Information Programs on the Environment	41

APPENDICES

A Regulations of Tender (Bid) Competition
B Scope of Work: Miedźna, Poland
C Wastewater Project Bid Evaluation Checklist and Weighted-Sum Method for Quantitative Evaluation of Bids
D Miedźna Contract Issues
E Policy Issues Regarding Privatization of the KWK Czeczott Mine
F System Design Considerations
G Miedźna Management and Organizational Structure
H Miedźna Community Projects

TABLES

Number		Page
1.1	Population and Economic Characteristics for Gmina of Miedźna	5
2.1	Lengths of Collector Pipe Required for Various Pipe Diameters	15
2.2	Number of Pump Stations and Force Main Lengths Required for Wastewater Collection	16
2.3	Preliminary Estimates of Capital Investment for Collection and Treatment of Wastewater in Miedźna	16
4.1	Average Monthly Utility Charges for Miedźna	25
4.2	Budget Performance Chart, 1989-1993	26
4.3	Gmina Budget, 1993: Revenues	27
4.4	Gmina Budget, 1993: Expenditures	28
4.5	Miedźna Wastewater Project Preliminary Bid Costs vs. Amended Cost Projections	30
4.6	Scenario 1: Noncontributing Option of 8-Fiscal-Year Loan Repayment	32
4.7	Scenario 2: Noncontributing Option of 8-Fiscal-Year Loan Repayment	33
4.8	Scenario 3: Contributing Option of Reduced 8-Fiscal-Year Loan Repayment	34
4.9	Scenario 4: Contributing Option of Reduced 7-Year Loan Repayment	35

FIGURES

1	Map of the Katowice Voivodship	3
2	Map of the Gmina of Miedźna	4

ABBREVIATIONS

BOD	biochemical oxygen demand
CEE	Central and Eastern Europe
ENR	Environmental and Natural Resources Division, USAID
EUR	Europe
FM	force main
LEM	Local Environmental Management [project]
O&M	operations and maintenance
P&I	principal and interest
PREP	preparatory [year]
PS	pump station
RTI	Research Triangle Institute
USAID	United States Agency for International Development
VAT	Polish value-added tax [podatek od towarów i usług, or podatek VAT]
WWTP	wastewater treatment plant

May 1993 monetary conversion rate:

zł 17,000 = US $1

EXECUTIVE SUMMARY

The need for improvements in environmental management in Central and Eastern Europe has gained the attention of development organizations worldwide in recent years. Furthermore, in light of the scarcity of resources at the national level, efforts to assist local governments in the implementation of environmental projects have become increasingly important as development strategies. Through such assistance, municipalities can learn to discern appropriate technologies, develop proposals for procuring funding, coordinate the necessary training for operation and management of new infrastructure, and design "outreach" programs that foster education and involvement of citizens. In addition, successful local environmental projects serve as models for other municipalities to follow in addressing their own environmental problems.

The Local Environmental Management (LEM) project, supported by the U.S. Agency for International Development, is working with small municipalities in Poland (and Hungary) to strengthen their abilities to manage environmental problems. On the basis of a pre-developed set of criteria and consultations with national and local officials, three municipalities or gminas were chosen to participate in the LEM project in Poland. All three gminas expressed a desire for assistance with wastewater collection and treatment projects. LEM survey teams composed of consultants with expertise in wastewater engineering, municipal finance, and utility management were sent to each gmina to assess the current situation and provide recommendations regarding the design and implementation of the proposed wastewater project.

As one of the participating LEM municipalities, Miedźna was visited between March 15 and April 17 by a team of engineers who assessed the wastewater situation in each of the gmina's six villages and assisted the gmina in analyzing various technology options. The wastewater engineer returned in May for approximately 10 days to assist local officials with a bid evaluation process for the design and construction of the wastewater facility. During the period from May 2 to May 26, a LEM municipal finance specialist analyzed the gmina's fiscal and managerial structure with a view towards meeting the organizational needs of the proposed wastewater project. Miedźna proposes to implement a sewage collection and treatment system that would serve 80% of the unsewered population. To this end, the gmina has budgeted funds and investigated technologies currently being used by other communities with similar problems. As a result, in February of 1993, the gmina invited a select number of companies to submit bids for the design and turnkey construction of a wastewater collection and treatment system. The purpose of this report is to present: (1) the results of the survey team's analysis and recommendations regarding the technical, managerial, financial, and training aspects of this project's implementation; and (2) an evaluation of bid documents associated with the proposed wastewater project.

Assisted by LEM, the council technical committee evaluated the submitted bids using criteria such as complexity and cost of operation and maintenance of the proposed technology, capability for expansion of service levels, staffing requirements, and availability of maintenance supplies and equipment. The committee concluded that a lagoon system is most appropriate for Miedźna, for several reasons: (1) the lagoon process requires the aeration compressors to work less and therefore use less electricity, (2) the operating costs are two to five times less than for other proposed technologies, (3) the total surface area required for installation is substantially less than for other technologies, (4) average construction time is approximately 2 months, (5) maintenance includes harvesting of plant by-products 3-4 times a year and removal of sludge every 20 years compared to daily or weekly removal of debris and sludge with other technologies, and (6) the lagoon process can absorb a range of influent flow loads.

Although a land-use plan completed in 1991 concluded that the gmina is not likely to experience significant increases in population before the year 2000, the committee decided, upon LEM's recommendations, to build two facilities with a capacity of 800 m^3/day each, providing a 60% margin for possible commercial investment and future growth in the area. The LEM survey team also suggested that effluent limits be set and that pretreatment be required of all industrial discharges failing to meet these parameters. This decision is in keeping with the desire of Miedźna officials to develop economic opportunities for the gmina that will both create jobs for local residents and protect the environment and special attributes of the community. In order to make the system equitable, the gmina also developed a plan to operate, either directly or by contract, a "pump-and-haul" operation that would serve the 20% of households in outlying regions not directly served by the new sewer system. Finally, the LEM survey team proposed that additional technical assistance might be required during contract negotiations, design review, and construction stages to ensure that the project is actually implemented according to the proposed design as well as to provide cost and quality control.

Gmina officials are aware of the serious dangers to public health that exist as a result of current methods of wastewater disposal, particularly the discharge of raw sewage into open ditches. During periods of insufficient rain, lessened flow in drainage ditches has resulted in stagnant water, exposing the public to odors and bacteria. In the summer of 1992, the public health situation from these conditions prompted the gmina to move ahead quickly with plans for a new system. In addition, inadequately treated sewage from Miedźna households contributes to regional pollution in the Vistula and Pszczynka Rivers. The solution chosen by the gmina and supported by LEM would provide cost-effective service coverage, and thereby improve public health conditions, for the entire gmina. Furthermore, improvements in the system design suggested by LEM regarding the minimization of costs, standardization of facility design, and mandatory pretreatment of industrial wastes would ensure the optimum use of resources while allowing some excess capacity for growth to avoid overwhelming the system in the future.

The management analysis revealed that the gmina has been effective in the area of project planning. For example, gmina officials have worked with residents to develop a set of priorities regarding their wastewater treatment needs and have developed and executed a bid tendering process. As a result, there is currently broad-based support from the community for the project. However, the gmina administration lacks experience in the area of public utility operation since utility services have

always been managed by regional or national authorities. Gmina officials have expressed an interest in acquiring the existing water distribution system so as to combine water and sewer operations for greater management efficiency. This action may require a capital payout or attachment to the water rates to allow the regional authority that currently owns the system to recoup its initial investment.

The LEM survey team suggested that the gmina begin to develop a plan for operating the proposed wastewater system before construction of the facility is completed. The planning process should include a comparison of various management options, particularly regarding costs, in order to determine the most efficient and appropriate system for Miedźna. The gmina should also examine its potential role in project design, construction supervision, and project turnover, and determine future needs for operations and maintenance. Because acquiring the water facility may require the gmina to take on additional financial and organizational burdens, the team recommended that the gmina instead focus its current efforts on implementation of the new wastewater system. Finally, the team proposed five management alternatives for consideration: (1) creation of a new budget unit, (2) establishment of a public utility enterprise, (3) private operation of the entire wastewater system, (4) contracting of a private company for operations only, and (5) cooperation of local units in operation of a regional wastewater utility.

Miedźna has completed a number of capital-intensive projects in recent years while maintaining an annual budgetary surplus. These funds have been invested in an interest-bearing account and the accumulated amount has been earmarked for the proposed sewer project. In addition, the gmina has allocated an annual amount from future budget revenues toward construction of the system. However, as Miedźna is reluctant to consider increasing budget revenues through sewer tariffs, some outside sources of funding will be needed to complete the project. The LEM survey team developed four capital investment scenarios based on annual transfers of tax receipts from the general budget, allocation of user tariff collections to debt-service payments, an 8-fiscal-year repayment cycle, and estimates of needed grant funding from external sources.

In the first scenario, only accumulated reserves and annual transfers from the gmina budget are available for the project. Scenario two introduces utility tariffs which increase, along with the number of connections, in year 4. Both of these scenarios project a fund deficit by the end of the eighth year. The third scenario uses the same assumptions as the second with the addition of an outside grant that reduces but does not eliminate the deficit. Scenario four relies on the injection of a large external grant to allow retirement of the debt in the eighth year even though revenues from utility charges are reduced. Because the survey team determined the debt service schedule to be the critical factor in structuring the project construction timetable, the team recommended that the gmina: (1) attempt to secure alternative funding for the project; (2) perform a more detailed estimate of projected operations and maintenance costs over the life of the project, including adjustments for the Polish value-added tax (VAT); and (3) develop a business plan that includes a capital debt repayment schedule and capital equipment depreciation schedule.

Finally, the survey team identified general training and outreach needs: (1) introductory and advanced courses in treatment plant operations, (2) management and operations of water and wastewater organizations, (3) financial administration of water/wastewater organizations, (4) planning for water/wastewater management, (5) developing and writing a project business plan, (6)

management of infrastructure projects, and (7) design and implementation of environmental public information programs.

A draft written report containing the analysis and recommendations of the survey team was submitted to the municipality and provided the "baseline" data for a regional planning workshop held in Wrocław from July 14-16, 1993. Over 100 people attended the workshop, including many representatives of the Wrocław, Wałbrzych, and Katowice voidvodships as well as other voidvodships in southwestern Poland; local, regional, and national levels of government; and nongovernmental organizations. The results of workshop discussions held by LEM consultants and Miedźna officials were incorporated into the final survey team report and submitted to Miedźna and USAID.

1 INTRODUCTION

1.1 LEM Project Overview

Local Environmental Management (LEM) is a project of the US Agency for International Development (USAID)/Washington based on a contract between Research Triangle Institute (RTI) and the USAID/Europe (EUR) Environmental and Natural Resources (ENR) Division. The contract is for 3 years, beginning in July 1992 and ending in July 1995.

Originally the LEM project began as a USAID effort to coordinate and/or operate through a variety of environmental projects at the subnational/local level throughout most of the countries of Central and Eastern Europe (CEE); however, USAID program reconsideration narrowed the project focus. RTI and USAID/EUR/ENR agreed to focus LEM on specific municipal government environmental projects in Poland and Hungary.

RTI undertook preliminary field trips to Poland in September and November 1992, which included members of RTI, USAID/ENR, USAID's Office of Housing and Urban Programs, and the USAID Representative's Office in Poland. These field trips confirmed the need and importance of working with "local" environmental projects as well as the necessity of narrowing the focus to three or four municipalities and establishing a set of criteria for setting both the project focus and the choice of specific municipalities to be included in LEM.

The LEM project purpose in Poland is threefold: (1) to demonstrate the extent to which local governments can effectively manage their environmental problems if given adequate and consistent support; (2) to assist project municipalities, or gminas, in producing reliable and technically acceptable proposals for the funding of environmental projects for presentation to national and international funding agencies; and (3) to make available for use to other municipalities the replicable details as a result of the former two activities. A project subpurpose is to act as liaison by matching municipal requests for technical assistance not supplied by LEM with various USAID-supported projects that may be able to provide information, data, or assistance.

The overall strategy is to implement project activity in three municipalities in Poland, each of which has the specific focus of sewage collection and wastewater treatment systems.

Municipality	Population
Miedźna	14,500
Święta Katarzyna	12,000
Ziębice	20,400

Poland's project may be expanded to include a second tier of municipalities based on the experience with the first group.

Municipality	Population
Nowa Sól	43,000
Namysłów	15,000

1.2 Profile of Miedźna

The gmina of Miedźna encompasses more than 50 km^2 of land which is characterized by three main uses: agricultural, industrial, and forest preserve. The gmina has six villages: Miedźna (the municipal seat), Gilowice, Góra, Grzawa, Frydek, and Wola.[1] (See Figures 1 and 2 for maps of the region.)

Miedźna's largest industrial establishment, the KWK Czeczott mine, is located in Wola. At the same time, Wola retains, in part, an agricultural character; it shares a border with a large forest preserve. Frydek, although primarily agricultural, also borders on a forest preserve. The other four villages are primarily agricultural. Village population and economic characteristics for the gmina are presented in Table 1.1.

[1]The term "gmina" refers to the entire group of villages within a geographical area, similar to the concept of a township in the US or a commune in France.

KATOWICE

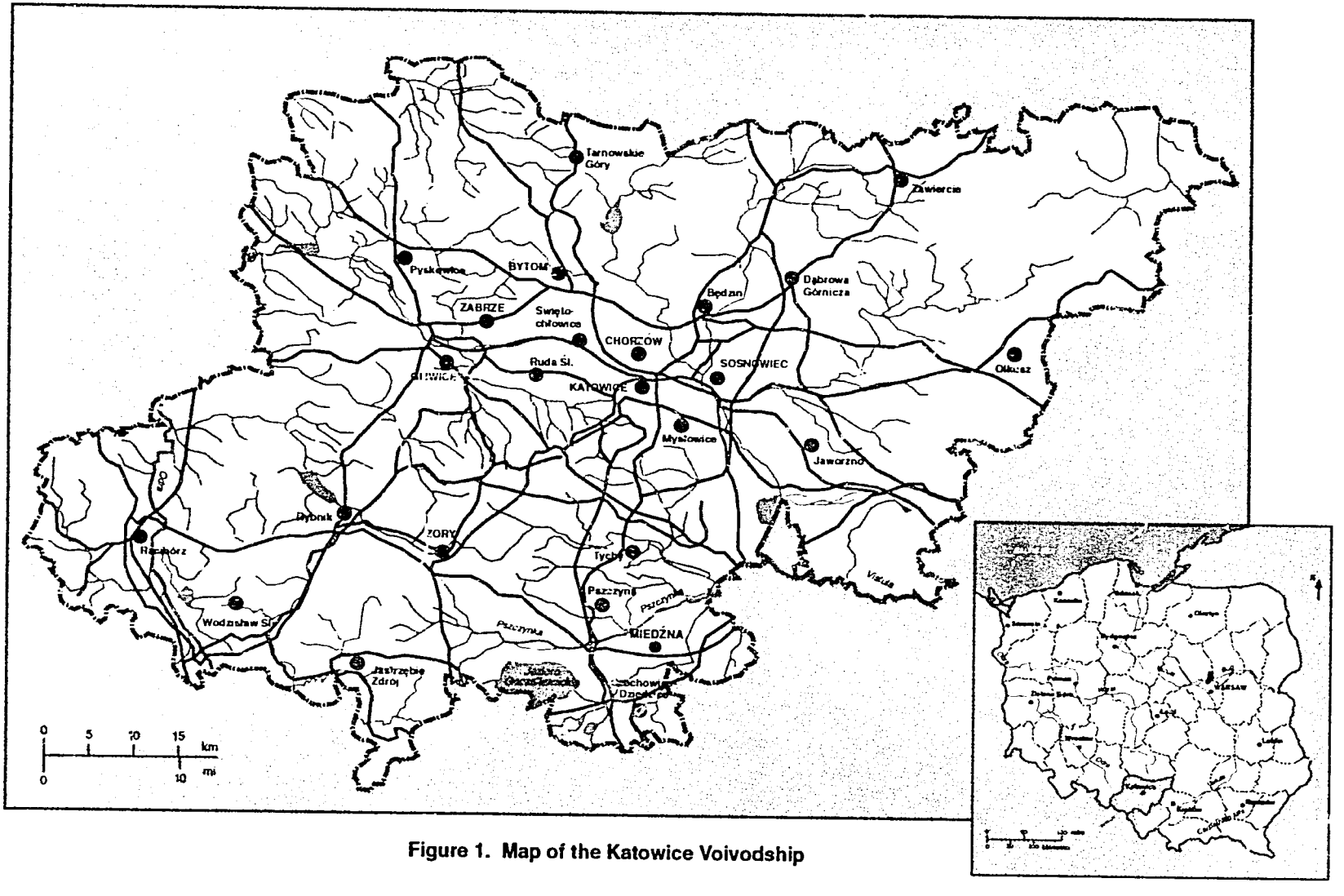


Figure 1. Map of the Katowice Voivodship

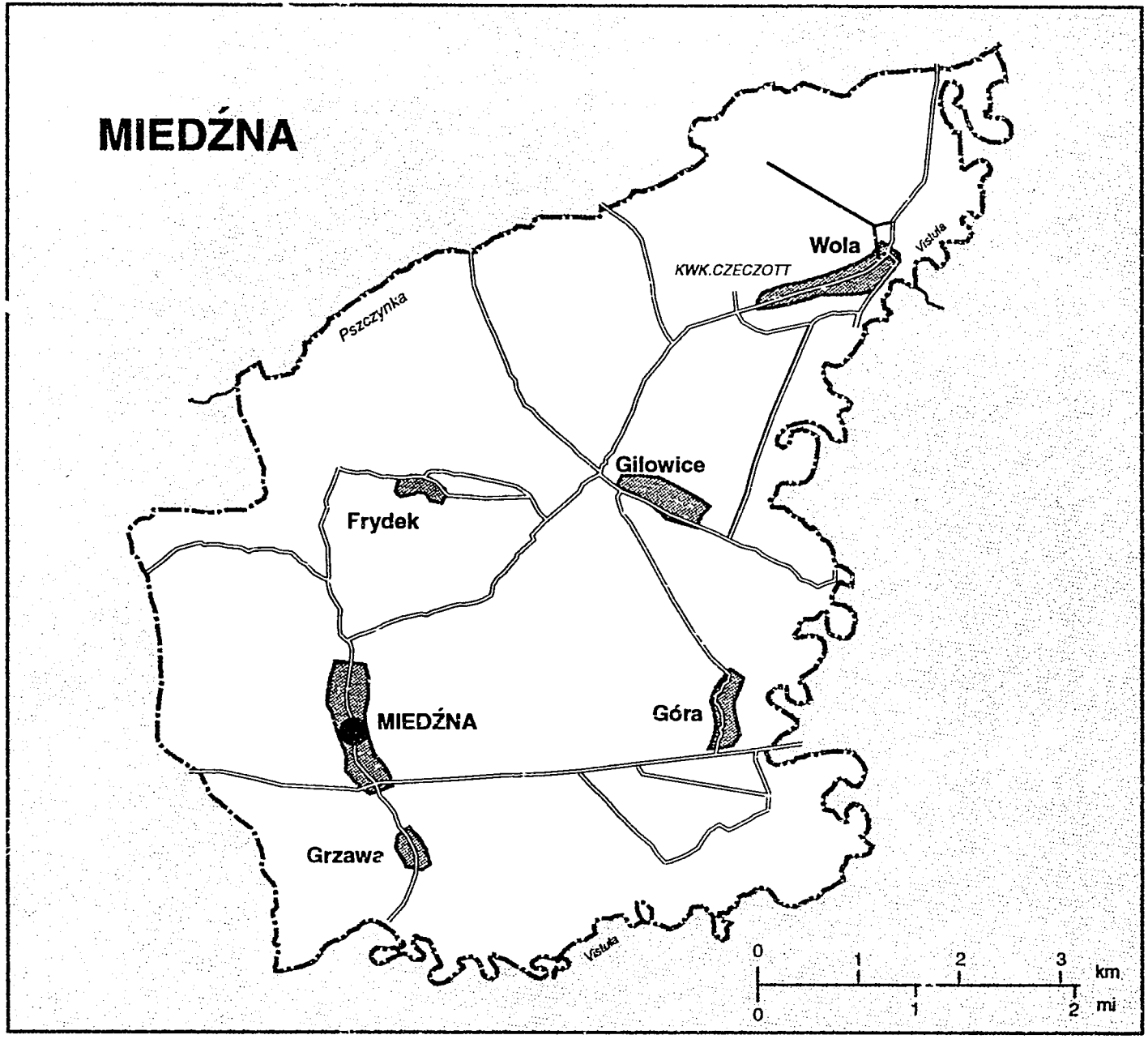


Figure 2. Map of the Gmina of Miedźna

Table 1.1

POPULATION AND ECONOMIC CHARACTERISTICS FOR GMINA OF MIEDŹNA

Village	Population	Economic Characteristics
Miedźna	1,430	257 farms 220 residential units 7 commercial enterprises 2 school complexes
Gilowice	808	182 farming operations 87 residential units 1 commercial enterprise
Góra	2,223	497 farms 244 residential units 8 commercial enterprises 2 school complexes
Grzawa	463	94 farms 60 residential units 3 commercial enterprises
Frydek	763	196 farms 58 residential units 1 commercial enterprise 2 school complexes
Wola	7,440 1,360	2 mine housing estates 280 farms 173 residential units 1 commercial enterprise 6 school complexes

The gmina has 14,500 inhabitants. Slightly over half of the gmina residents live within the two housing estates in Wola provided by the KWK Czeczott mining operation. This industry is a state-owned enterprise that began operation in 1985. The capacity of the mine is reported to be approximately 24,000 tons per day; however, daily production averages about 8,000 tons, peaking during the winter and decreasing significantly during the nonheating months. Although production is currently only one-third of capacity, employing about half of the gmina work force, employment has not been reduced. Tax revenues from the Czeczott mining operation constitute at least half of total tax receipts for the gmina and have supported investments in various capital projects in recent

years. Revenues from the mine have also enabled the gmina to enjoy an annual budget surplus, which has been set aside for future community investments.

The remaining 7,050 inhabitants are spread over three geographical regions: 1,360 people live in the northeast section of the gmina outside the mining estates in Wola; 3,030 people reside within the villages of Góra and Gilowice located in the central part of the gmina, Gilowice to the north and Góra to the south; and 2,660 inhabitants live in the Miedźna-Frydek-Grzawa area that lies in the western part of the gmina (Grzawa in the south, Miedźna in the center, and Frydek in the north).

Aside from Wola, the only industrial area, the communities of Góra and Miedźna are the most developed commercially, with slaughterhouses and dairy produce purchase centers. All of the communities have some commercial enterprises including bakeries, health service facilities, and catering businesses. There are also 12 schools within four of the communities.

The primary occupations are mining and agriculture. About 5% of commercial agricultural enterprises are small farms. Traditional crops are small grains and potatoes; farmers also raise hogs, cattle, and dairy cows. Farm homesteads number approximately 1,510 units of the 3,000 total housing units in the gmina. Aside from the Czeczott mine housing in Wola, farm units represent 50% of the dwellings that are part of this study. The remaining 1,490 housing units are residential.

1.3 Miedźna Survey Objectives

Miedźna's existing wastewater system is limited and does not cover the entire population. The gmina, aware of environmental problems caused by septic drain field percolation, point-source (open ditch) discharge, and nonpoint source (agricultural) runoff, is determined to prevent the contamination of its ground water supply and to reduce its pollution of the Vistula and Pszczynka Rivers. Community leaders are also concerned about environmental conditions locally, within the context of Silesian problems. They recognize that the absence of sewage treatment facilities in the community is a deterrent to investment in the local economy and the creation of nonagricultural jobs.

Miedźna proposes to implement a sewage collection and treatment system that initially would serve at least 80% of the 1,500 rural households that are not located in the apartment blocks of the mining estate. They have budgeted funds for this purpose and have undertaken several preliminary steps to develop an action plan, including commissioning a study regarding the development of wastewater services for the villages of Góra and Gilowice. This 1992 study was approved by the Katowice Voivodship technical office. Although the report was considered adequate, the gmina felt the proposed costs of over zl 220 billion for the new facility were excessive, considering that the plan covered only one-third of the gmina; it decided to pursue alternative methods.

After consulting with other communities with similar problems and reviewing existing technology in operation, the gmina requested technical assistance from the Silesia Ecological Foundation in the development of specifications for tender (see Appendix A). The gmina then published a request for proposals. In response, 10 limited-scope contractors submitted general proposals that were

considered acceptable and these were invited to submit bids for the design and turnkey implementation of a wastewater system.

In response to a request from Miedźna for technical assistance in addressing its wastewater problems, the LEM project sent a team of technical and financial experts to Miedźna. The scope of work for the Miedźna survey team is provided in Appendix B. The objectives of the Miedźna survey included: (1) detailed analysis of wastewater problems in each village, including the evaluation of the 1992 study and bid documents, and development of a set of recommendations for a wastewater treatment implementation plan for the gmina; (2) development of a financial/management plan to use in securing funding from the central government, commercial banks, and/or international lending institutions; and (3) identification of particular training needs necessary for the gmina to carry out the overall wastewater plan.

1.4 Survey Methodology

Under the direction of the LEM Resident Project Manager, team members met with local officials in Miedźna and in several villages to gather technical, organizational, and financial data regarding the current wastewater situation. Team members also reviewed pertinent documents, including the submitted bid proposals, in order to assist the gmina in assessing and comparing bids and negotiating a contract. Upon analysis of the data, the team provided recommendations to the gmina council regarding the most appropriate technology, in keeping with Miedźna's capacity to manage and finance the proposed system.

Before departure from Poland, the team members orally presented their recommendations to Miedźna officials in order to solicit feedback. Within 2 weeks of their return to the US, the team members drafted a written report for translation into Polish and submission to the gmina. The Miedźna draft, as well as the drafts from the two other Polish municipalities participating in the LEM project, provided "baseline" data for a regional planning workshop held in Wrocław from July 14-16, 1993. Over 100 people attended the workshop, including representatives of many municipalities in the Wrocław, Wałbrzych, and Katowice voivodships, and other voivodships in southwestern Poland; local, regional, and national levels of government; and nongovernmental organizations.

The two major goals of the workshop were: (1) to obtain feedback from participating LEM municipalities on the analysis and recommendations of the survey teams (as found in the submitted draft reports) as well as ideas for future technical assistance and training; and (2) to provide information to participants on technical and financial issues concerning wastewater management. The results of the workshop discussions held by LEM consultants and Miedźna officials were incorporated into the final survey team report and submitted to Miedźna and USAID.

1.5 Survey Team Profile

The Miedźna survey team consisted of: (1) Mr. Michael Jamiolkowski, a US wastewater specialist; (2) Mr. Marek Jasinkiewicz, a Polish engineer who served as interpreter and consultant to Mr. Jamiolkowski during the survey; and (3) Mr. A.R. Sharp, Jr., a US financial analyst.

Mr. Jamiolkowski arrived in Kraków on March 12, 1993, and worked in Miedźna from March 15 until April 17 when he returned to the United States for consultation with RTI. Assisted by Mr. Jasinkiewicz, Mr. Jamiolkowski provided technical expertise in assessing the wastewater situation for each of the six villages and analyzing various technology options. He returned to Miedźna on May 5 for approximately 10 days to assist the Technical Committee in the bid evaluation process.

During the period from May 2 to May 26, Mr. Sharp consulted with local officials in Miedźna regarding the financial and organizational needs of the proposed wastewater project resulting from the earlier work of Mr. Jamiolkowski. Mr. Sharp analyzed the gmina's organizational and financial situation as it related to the cost requirements of the proposed wastewater system. In addition, he provided recommendations regarding a plan to finance both projected capital construction and long-term operations and maintenance (O&M) costs.

2 TECHNICAL ANALYSIS

2.1 Existing Conditions

Water distribution in Miedźna became possible in 1968 after a regional water pipeline was built across the community. Water lines were extended into each of the villages between 1976 and 1990. Most village families as well as those located along the main road are now connected to a distribution line. The water distribution system is operated by a quasi-public firm from Czechowice-Dziedzice, which is responsible for service connections, repairs, billing, and collection. There is a master meter for all water entering into the gmina distribution system.

Natural gas is available and widely used throughout the community for heating and cooking. The cost of gas varies with consumption from zl 250,000 to 500,000 per month per household. Garbage collection is another billed service, costing zl 30,000 per month per household.

The Czeczott mine housing estates in Wola, including some 7,440 people, are supplied with water, sanitation services, gas, heat, and electricity directly by the mining company. For the purposes of this report, this segment of the population is not included for consideration regarding sewage collection or subsequent wastewater treatment. Aside from the Czeczott mine's housing complex, the only sewer facility is located in the community of Miedźna. It consists of a 2-kilometer storm sewer-collector which serves the central portion of the village.

The remaining residences of Wola as well as all residences of Gilowice, Góra, Grzawa, and Frydek are unsewered, relying on a combination of septic tanks, drain fields, liquid collection services, and open-ditch drains that carry untreated human wastes into the Vistula and Pszczynka Rivers. When there are periods of insufficient rain, as in the summer of 1992, the drainage ditches stand stagnant, with raw sewage creating odors and potential health hazards. The gmina's objective is to produce a wastewater treatment implementation plan that will culminate in a constructed sewer collection service for Miedźna, including an adequate number of wastewater treatment facilities.

2.2 Conclusions

2.2.1 Evaluation of Proposed Technologies

Ten preliminary proposals for wastewater systems were submitted to the gmina prior to the arrival of the LEM technical assistance team. These proposals were general in nature, presenting only the bidder's technological capability. The manufacturers described their equipment and processes, and, in some cases, provided a preliminary cost estimate for installation of a wastewater system in the

gmina. The latter type of response was limited to companies that had previous contact with the gmina and were apprised of the project's magnitude.

Of these ten proposals, nine are based on a component system design approach, i.e., small units sized to a certain capacity level and multiplied in number to match the existing requirements. Each is heavily mechanized, with a large number of moving parts, and is significantly dependent on electrical operation. The tenth proposal is based on lagoon treatment technology.

Most of these proposed systems include buried components, thereby complicating the issues of operation and maintenance access as well as personnel safety. Many of them claim to be highly automated and virtually maintenance-free, requiring little personnel oversight. These claims are unlikely in view of the many moving parts, electrical connections, and high-technology applications involved. A number of proposals call for the purchase of units fabricated and assembled outside of Poland; such proposals, if accepted, are likely to require an additional investment in foreign construction services, spare parts, and servicing.

All technological approaches appear to be based on the activated sludge process and exist on secondary kinetics with subsequent post-clarification. Various features include preliminary and primary treatment, rudimentary digestion at some point in the process, and sludge processing, either by the standard drying-bed technology or by mechanized screening (drum) press. Some technologies have incorporated a chemical addition dependency into the prime processes. One system offers the rotating biological disc process, which is not likely to work in the winter.

As part of its assessment of the lagoon technology, two members of the survey team accompanied by several gmina officials met with representatives of HYDRO, a Polish corporation that markets the lagoon system in Poland. HYDRO also provides design engineering and construction services in cooperation with the manufacturer as well as professional support services for installation. Comparison of the lagoon system with other proposed technologies revealed the following advantages regarding possible selection:

- Aeration compressors required by the lagoon process use only 0.4 kilowatt-hours of electricity per cubic meter of influent flow. This is extremely low in comparison to the other proposals.

- The lagoon process requires the compressors to operate only 4 hours per day. By comparison, the other technologies require almost continuous aeration to maintain process conditions.

- The operating cost of the lagoon system is approximately zł 600/m^3 of influent flow, not including facility life-cycle amortization. Other proposal costs are estimated to be at least zł 1,500/m^3 of influent flow. Some suggest a cost of more than zł 3,000/m^3 of influent flow.

- Total surface area required for a lagoon wastewater treatment plant (WWTP) installation is approximately 7,500 m^2 with a depth of 2.5 meters in the aeration lagoon and 3.5 meters in the settling lagoon. Some of the other technologies require substantially more excavation and site dewatering.

- Average construction time for the lagoon WWTP is approximately 2 months. By comparison, other technologies will require this amount of time simply to order the equipment from the country of manufacture.

- Duckweed, a process by-product required by the lagoon technology for biological efficiency, requires harvesting only 3-4 times per year. By comparison, debris created by other processes requires daily or weekly removal.

- The lagoon process requires that settled sludge, generated by the biological process and necessary for its stability, be removed approximately once every 20 years. By comparison, the other technologies require daily or weekly removal.

- The lagoon process is capable of absorbing varied influent flow loads (200 to 1,000 milligrams per liter [mg/L] biochemical oxygen demand [BOD]) while consistently producing quality effluents (20 to 30 mg/L BOD). By comparison, the other technologies use constant projected loading factors of 500 mg/L BOD.

During the review and evaluation of the preliminary proposals, the survey team created the *Wastewater Project Bid Evaluation Checklist* (see Appendix C). The criteria established in the checklist are intended to assist the gmina technical personnel in comparing the levels of difficulty in operation and maintenance of the suggested wastewater treatment facilities. The checklist should also help to identify which technologies contain costs that are not readily apparent during design and construction but are likely to surface during the life cycle of the installation.

The *Wastewater Project Bid Evaluation Checklist* will be generalized and refined in order to make it available to all LEM municipalities and, eventually, to participants in the various proposed LEM training courses. It was also discussed at the LEM project workshop for possible additions, corrections, and omissions in light of common practice and experience from the other LEM participating municipalities.

2.2.2 Evaluation of Submitted Turnkey Bids

On February 12, 1993, the gmina invited a select number of companies to participate in a tender competition for the design and turnkey construction of a wastewater collection and treatment system for Miedźna. On April 14th and 15th, eleven sealed bids were opened in a closed session of the council technical committee. One bid was withdrawn. Two bids were disqualified either because they were not accompanied by security bonds or because documentation was incomplete. The eight remaining bids were evaluated for content and adherence to the requirements of the Request for Proposals. A grading system adapted by the Silesia Ecological Foundation from the *Wastewater Project Bid Evaluation Checklist* was used to track positive and negative aspects of each bid (the weighted-sum method; see Appendix C).

The bid prices ranged from a low of zł 75 billion to a high of approximately zł 136 billion (US $4.7-8.5 million). Some bids, however, did not include complete cost estimates—i.e., certain parts of the required work were not included in the bid and thus the high end of the range probably approaches zł 500 billion (US $31.3 million). Four bids were chosen for review by the entire council technical committee: those from HYDRO (Kielce), PBWI (Pszczyna), KONSORCJUM WODY (Katowice), and HYDROGAZ (Bielsko-Biała). On May 12, the technical committee voted unanimously to accept the lagoon system technology using HYDRO as the general contractors and PBWI as subcontractor for local labor and equipment. The HYDROGAZ bid was rejected due to the high capital and O&M costs of the proposed technology. Project responsibilities were allocated as follows:

- The lagoon system manufacturer will provide manufacturing and support services, design engineering and supervision services, limited financial management, and administrative and transportation services.
- HYDRO will provide general contract administration and project management, design engineering and supervision, procurement arrangements, construction management and supervision, and facility start-up services.
- PBWI will provide local labor and equipment, construction service, and supervision.
- The gmina will provide project contract administration, management support, and the services of an environmental officer/construction manager.

In their proposal, HYDRO outlined two options: (1) four standard-size lagoon facilities (1 each in Miedźna, Grzawa, Góra, and Wola), or (2) two large-size lagoon facilities (one 800 m^3/day capacity plant in Góra and one 500 m^3/day capacity plant in Miedźna) with wastewater from Miedźna, Grzawa, and Frydek pumped to the Miedźna facility and wastewater from the unserved residential areas of Wola pumped to the Czeczott facility. Both options include ten pump stations and approximately 45 kilometers of sewer line. The gmina administration and council committee agreed that Option 2 is the most suitable for Miedźna; however, upon the recommendation of the LEM technical consultant, the committee decided to increase the capacity of the Miedźna plant to 800 m^3/day, which will provide a 60% margin for possible commercial investment and growth in the Miedźna area system. The HYDRO proposal also contains several other points that are likely to be negotiable. Suggested issues to consider regarding these points are listed in Appendix D.

2.2.3 System Design

A 10-Year Land Use Plan was completed for the gmina in 1991 by a professional planning firm. After careful analysis of the trends and patterns of development, the consultants concluded that large increases in population are not likely to occur in the gmina before the year 2000. Household sizes have remained constant in recent years because many young people leave the gmina for employment and professional opportunities in more distant cities. Some additional households are being created,

however, as other couples choose to live in the community and drive to their jobs in larger cities nearby.

Because the gmina is not growing significantly in population or number of households, the proposed design capacity for the two wastewater treatment plants, with Wola's wastewater transferred to the mine's treatment plant, should be more than sufficient beyond the year 2000. Each plant could handle as much as 800 m^3/day and an additional 400 m^3 could be pumped to the existing plant. This arrangement would provide capacity of up to 2,000 m^3/day for the part of the gmina that is outside of the housing blocks. As long as there is surplus treatment capacity, the determining elements of the capital cost are the construction costs of the collection lines and pump stations. Very little would be saved by reducing capacity. In addition, the gmina is interested in diversified economic opportunities that can both create jobs for the local residents and protect the environment and special attributes of the community.

It should be noted that the households that will not be served directly by the sewer system (20% of the total) are isolated residences, mostly farms, for which providing feeder lines, trunk lines, and pumping stations would so increase the cost of the project as to make it economically infeasible to build. It also would create maintenance problems that, in turn, would cause the O&M costs to skyrocket. However, because public tax funds are being invested in the sewering of the 80%, and so that the system will operate equitably, the gmina leadership has planned for the gmina to operate, either directly or by contract, a "pump-and-haul" operation that would serve these outlying residences.

The proposed lagoon system is best adapted to household sewage treatment because of its simple biological processes. Therefore, the gmina will have to avoid industrial discharges that could overwhelm the treatment plants. Effluent limits will need to be set and pretreatment required of all discharges that fail to meet the parameters of the design.

While the immediate likelihood of the KWK Czeczott mine being privatized is remote, the gmina should, nevertheless, begin considering various policy questions should such an eventuality come to pass. To assist in the discussion of such policy, a series of issues have been framed for future review and are contained in Appendix E of this report.

As part of the evaluation of the appropriate wastewater technologies and capital investment strategies for Miedźna, the survey team also considered various issues related to system design, including the minimization of both capital investment and O&M costs and the use of appropriate technological equipment and processes. Recommendations regarding these issues are found in Appendix F.

2.2.4 Collection System

In order to identify and analyze the suitability of various wastewater collection systems, the survey team distributed the six villages in the gmina into three distinct geographical zones: the northeast zone, which contains Wola and the KWK Czeczott mine; the southeast zone, which contains Góra

and Gilowice; and the western zone, which contains Grzawa, Miedźna, and Frydek (see Figures 1 and 2).

The first geographical zone, Wola, is approximately 6 km^2 in total area. The area in Wola to be sewered under the wastewater project covers 2 km^2, and is located in the lowland area of the northeast/southeast sectors of the Wola village-map grid. The second geographical zone contains Grzawa, Miedźna, and Frydek in the western part of the gmina and encompasses approximately 16 km^2. The implementation area includes approximately 10 km^2 from the southern point, Grzawa, through the central point, Miedźna, to the northern point, Frydek.

The third geographical zone, Góra and Gilowice in the southeastern part of the gmina, encompasses approximately 10 km^2. The implementation area traverses an approximate 6.5 kilometers from the southern point, Góra, to the northern point, Gilowice. All areas to be sewered are relatively flat.

In the Grzawa-Miedźna-Frydek region, going northward from Grzawa to Frydek, there is a descending slope of 15 meters over a linear distance of 4 kilometers. This slope, 0.4 meters per 100 meters (or 0.4%), is sufficient for the construction of a gravity sewer collection system. Halfway through the Grzawa village region, there is a reverse slope southward toward the Vistula River. This area will require a collection system draining in that direction to a pump station discharging back over the hill northward to the gravity system.

Frydek, like Grzawa, is an area bisected by a plateau creating a slope and reverse slope. The slope drains north and northeasterly from the main plateau. The reverse slope runs easterly toward Gilowice. The design engineer should consider including the reverse slope within the Gilowice collection area. The remaining section of Frydek will require a separate collection system, possibly a pump station, discharging back to the northern part of Miedźna's gravity collection system.

The Góra-Gilowice area is considerably more complicated. Góra must be sectioned into three areas. The first, and most southerly, is Zawadka, a low-lying area adjacent to the Vistula. The next area of Góra is bounded by Zawadka on the south, the Vistula on the east, and highway 993 on the north. The third region of Góra is the village area north of highway 993. This area drains from the plateau southeasterly towards the Vistula. Both of the areas in Góra south of highway 993 will require pump stations. The first area, in Zawadka, should pump to the second area. The second station, larger in capacity to manage collection from both Zawadka and its own area, should discharge northwards across highway 993 to the marsh area bounded by highway 993 on the south, the Vistula on the east, and the village of Góra on the north.

Gilowice is also an extremely difficult area. It has a very shallow slope of 10 meters over a linear distance of 2 kilometers. This approximates a slope of 0.05 meters per 100 meters (or 0.05%). The eastern part of Frydek and the hamlet area of Piaski need to be collected within the Gilowice system. The collection system should drain in an easterly direction toward the Vistula River and Staw Dulnik, where a pump station could collect the flow, discharging to the Góra marsh area north of highway 993.

The Wola collection area is bounded by the main Miedźna-Tychy road on the west and the Vistula River on the east. Kolonia Wola should be considered part of the collection study. This collection area of Wola has a very shallow slope of 6.5 meters over a linear distance of 1.5 kilometers, approximating a slope of 0.043 meters per 100 meters (or 0.04%). Kolonia Wola is even shallower, with a slope of 1.5 meters over a linear distance of 1.5 kilometers. This approximates a slope of 0.01 meter per 100 meters (or 0.01%). A pump station should be located where the two collection systems will intersect in the northeast section of the Wola grid. A force main could then cut across Wola, discharging to the KWK Czeczott mine wastewater treatment plant.

2.2.5 System Costs

The gmina technical representative together with the survey team visited the six villages to be served in order to quantify the lengths and diameters of (main trunk) collector sewers, the number of pump stations, and the lengths of force mains required for wastewater collection. It should be noted that what follows in this section was calculated and written as part of the initial recommendations to the Miedźna Gmina Council and before any action was taken on the submitted bids. The data, however, were used by Miedźna officials in evaluating the bids and remain of value as references for the design of the system once Miedźna has officially contracted with the successful bidder.

Table 2.1 displays lengths of collector sewers based on different pipe-diameter sizes.

Table 2.1

LENGTHS OF COLLECTOR PIPE REQUIRED FOR VARIOUS PIPE DIAMETERS
(in kilometers)

	Pipe Length (in km) by Pipe Diameter				
Village	**100 cm**	**200 cm**	**300 cm**	**400 cm**	**Total**
Miedźna	2.0	9.0	3.8	0.2	15.0
Frydek	Included within the Miedźna estimates				
Grzawa		3.0			3.0
Góra		6.0	1.9	0.1	8.0
Gilowice		7.0	2.0	2.0	11.0
Wola		3.5	1.5		5.0
TOTALS:	2.0	27.0	10.7	2.3	42.0

The required number of pump stations and lengths of force mains are displayed in Table 2.2. The estimated diameter of force main piping is less than or equal to 150 mm.

Table 2.2

NUMBER OF PUMP STATIONS AND FORCE MAIN LENGTHS REQUIRED FOR WASTEWATER COLLECTION

Village	Force Main Length (km)	Pump Stations Required
Miedźna	None	None
Frydek	2.5	1
Grzawa	1.5	1
Góra	1.5	2
Gilowice	2.5	1
Wola	3.0	1
TOTALS:	11.0	6

Table 2.3 estimates capital investment needed for the proposed collection system, pump stations, and WWTPs. Investment cost estimates have not been adjusted for inflation. Neither do they reflect any additional fees associated with the design and implementation of turnkey projects, taxes, or purchases outside Poland. The WWTP capital construction costs reflect civil projects using lagoon process technology. Should mechanized component technology be utilized, the capital costs will be considerably higher.

Table 2.3

PRELIMINARY ESTIMATES OF CAPITAL INVESTMENT FOR COLLECTION AND TREATMENT OF WASTEWATER IN MIEDŹNA

Investment	zl (millions)	$US (millions)
Sewers	48,000	2.909
Services	30,000	1.818
6-PS/FM	19,800	1.200
2-WWTPs	19,800	1.200
TOTALS:	117,600	7.127

FM = force main; PS = pump station; WWTP = wastewater treatment plant

2.2.6 Operations & Maintenance (O&M)

Regardless of technology selected or time line for implementation, the project cannot be successfully implemented without proper attention to O&M factors. Some of these factors require consideration prior to the design phase; however, the majority of O&M issues arise after the construction phase. The survey team has included many post-construction O&M activities in the *Wastewater Project Bid Evaluation Checklist.* These O&M requirements are normally the responsibility of the utility department and require accountability through management planning.

For the first 2 years of the equipment life cycle, required costs for capital and preventive maintenance will be low. Beyond this point, however, sewers will require cleaning; pumps and motors will require maintenance overhauling; and valves, gates, and aeration piping will require monitoring and replacement. The maintenance of tools and safety and support equipment as well as solid waste disposal can all be considered recurring O&M functions.

The following two lists provide a means for addressing O&M issues. The first list relates to those concepts of O&M that should be considered prior to the project's construction. The second list includes items that will need to be addressed after construction is complete and the system is operational.

Preconstruction O&M Factors:

- The gmina should evaluate the reliability of the manufacturer's product(s).
- The gmina should assess the reliability of design, manufacture, and construction services not only during construction but also after warranty periods have expired.
- It should be determined whether the proposed O&M costs are adequate to ensure proper maintenance of the system while the gmina's utility department acquires the necessary experience and funding to assume primary responsibility.
- The designer, manufacturer, and contractor warranty periods should be sufficient to allow the owner to develop its own organization. Equipment and treatment processes should be the prime considerations.
- The O&M routines for the Wola system (sewer, pump station, and force main routines) should be the gmina's responsibility and should be explicitly defined.
- The gmina's technical O&M organization should take advantage of the knowledge and experience that could be gained from working in close association with the KWK Czeczott WWTP.
- The KWK Czeczott WWTP has offered the gmina the use of its laboratory for monitoring WWTP effluent conditions. In this regard, the gmina should consider the following issues: Are the mine's WWTP laboratory procedures accurate? How will the samples be collected

and delivered to the laboratory? Who will be responsible for sample preservation? Who will be responsible if samples are contaminated? What happens if the laboratory data are wrong and process conditions at the gmina WWTP are adjusted according to these data?

- The gmina should attempt to obtain in writing a statement of the charges that KWK Czeczott intends to levy against the gmina for use of the mine's WWTP. These charges should be compared with the potential cost of building and operating a WWTP in Wola.

- The gmina's O&M costs, once established, should include calculation of the annual cost of maintaining a service connection for the houses that are connected to the system. The utility operations unit should also plan a financial budget for future additions throughout the design life cycle.

- The gmina's administrative and O&M units should actively monitor all national and regional policies and laws that have an environmental impact or could affect system operations.

Postconstruction O&M Factors:

- There should be enough tools, spare parts, and pieces of support equipment on hand to maintain the sewers, manholes, service connections, overflow boxes, pump station wetwells, etc. Examples of such equipment include picks and shovels, jackhammers, pry bars, service vehicles, radios, dewatering equipment, extra sewer piping, gaskets for pipe sections, gravel and sand for re-laying broken pipe, excavation equipment, miscellaneous joint connection pieces for smaller service sections of piping, sewer cleaning equipment and utensils, clothing and safety equipment for laborers, etc.

- There should be enough tools, spare parts, and pieces of support equipment on hand to operate and maintain pump stations and mechanized equipment at the WWTPs. Examples of such equipment include spare motors, belts, gaskets, electric contactors, fuses, controllers, alternators, weights for compressor pressure regulation, oil and grease for mechanical equipment, hand tools for working with equipment, lifting and support equipment, safety equipment needed by maintenance personnel, spare pump impellers and gauges, spare valves and gates for isolation purposes, spare electric cable (sized for each requirement), yard maintenance equipment, painting equipment, cleaning equipment and supplies, etc.

2.3 Health Situation in Miedźna

Because only a small area of the gmina—other than the Czeczott mine housing estate—has access to sewer services, current practices of wastewater disposal include the use of septic tanks, usually combined with inadequate drain fields or liquid collection services, and the discharge of raw sewage into waterways through open ditches. As a result, a substantial health threat exists from potential contamination of ground water and exposure of the public to odors and bacteria, particularly during warm weather and periods of insufficient rain. During the summer of 1992, stagnant water from lessened flow in drainage ditches led to a public health situation of crisis proportions which became

a major factor in the gmina's decision to move ahead quickly with plans for a new system. When water is plentiful, open ditches and small creeks continuously carry untreated wastewater to the Vistula and Pszczynka Rivers, creating regional pollution of water supply and recreational areas.

The solution chosen by Miedźna and supported by LEM, a combination of two lagoon facilities and a "pump-and-haul" system, would provide cost-effective service coverage, and thereby improve public health conditions for the entire gmina. Although only 80% of households would be served by the new sewer system, manual collection of sewage would be an efficient and equitable means of serving outlying or isolated residences without incurring prohibitively high capital investment and O&M costs. Furthermore, improvements in the system design suggested by LEM regarding the minimization of costs, standardization of facility design, and mandatory pretreatment of industrial discharges would ensure the optimum use of resources while allowing some excess capacity for growth to avoid overwhelming the system in the future.

2.4 Concluding Remarks

Chapter 2 covers potential actions, along with the recommendations for the gmina, up to the point of the negotiations and establishment of a working contract with the successful bidder.

However, judging on the basis of the work done with the gmina up to this point, there is a likely need for additional technical assistance as the gmina moves into the successive stages of the project continuum: (1) contract negotiations, (2) detailed project design, (3) project construction, and (4) utility operations. While the latter two processes—i.e., construction and utility operations--may come to fruition after the LEM project ends in July 1995, until that time the gmina may well require specific assistance. A summary of the kind of assistance suggested under each of the four headings follows.

2.4.1 Contract Negotiations

While gmina officials are well versed in such negotiations, there are technical points related to design and construction, training, manualization and similar elements that may require technical consultation. This consultant participation might help to assure the gmina that it is protected by the terms of the contract and, for example, call upon the contractor to finish specified work within a defined period of time.

2.4.2 Detailed Project Design

It is of the utmost importance that the project be designed by the contractor according to the technical recommendations approved by the gmina. However, it is not enough to make this a requirement; the gmina must be in a position to carefully review the design features as the contractor makes them available. The gmina may want to avail itself of LEM's technical assistance to ensure that what has been accepted in principle is implemented in fact.

2.4.3 Project Construction

The gmina will hire a project inspector to check on construction progress, to see that the design is followed, and to spot-check quantities and the quality of work being done. Presumably, the project inspector will review all bills, matching them against work progress, material quantities, and labor usage. This should be developed into a definite routine along with systematic reporting on a weekly basis so that the gmina is kept informed of progress in detail. This plan will require well-organized inspections with careful attention to reporting details, project progress charting, time-line controls, bill checking, etc. The gmina may consider requesting technical assistance to help set up an inspection and control system as well as short-term training for the inspector. If this material is to be computerized, then appropriate software should be identified and persons trained in its usage.

2.4.4 Utility Operations

By the time construction is either partially or completely finished—depending on the finances available—the gmina should have a plan in place for operating its sewer system. The plan should not be drawn up after construction. Rather, alternative possibilities should be explored much sooner and these should, in turn, be costed out in order to devise the most efficient and economical system of utility operations. As noted in the following management/financial analysis (Chapters 3 and 4), the gmina has suggested the possibility of taking over the existing water distribution and collection system and combining it with the sewer operation, thus achieving a consolidated or integrated water/wastewater utility operation. While the current technical, managerial, and financial report has only touched on this need, the gmina might well seek LEM's assistance in doing a special study on the future shape of the gmina's utility operation.

3 MANAGEMENT ANALYSIS

3.1 Existing Conditions

A chart of Miedźna's general management and organizational structure is included in Appendix G of this report. The gmina has a three-part administrative operation.

The first is the elected gmina council consisting of 22 members elected for a 4-year term. The council than chooses a mayor for a 4-year term but whose continuation in office must be confirmed each year by the council after they have completed an evaluation of the mayor's performance. The council subdivides itself into both standing and ad hoc committees, which usually join with administrative officials in sorting out the business and decision-making requirements as set down in law and regulation. For the project under consideration, the gmina council set up a special committee to receive and review the wastewater bids. This committee, after several meetings, then reported its findings to the gmina council for action.

The second element in gmina administration is the administrative arm, which operates under the direction of the mayor and one deputy mayor. The mayor, as the chief executive officer, had served 3 years out of a 4-year term at the time of the visit. In Miedźna there are 23 employees in the administrative branch of gmina operations who take care of the regular administrative and technical operations. The gmina may also, from time to time, hire consultants to work with it on various technical problems and on capital construction.

The third element is the quasi-public companies that are engaged by the municipality to take on functions like public works, street cleaning, sanitation, etc. The gmina may also be served by other public companies. For example, potable water is sold to citizens through the water authority of a neighboring gmina.

The key player in the LEM project is the gmina administration. This operation appears to function at a high level of efficiency. There is continuity in many of the personnel positions; the treasurer and gmina secretary, for example, have been with the municipality for 20 years. Offices are adequately equipped with modern office machines and employees have been trained to use available technology in their routine work.

Miedźna boasts a new integrated financial system that has been installed on a Novell computer network. The system is menu-driven and has been distributed to all the clerks in the treasurer's office. The system is used for billing, collection, reconciliation, and reporting for all taxes, fees, and payments. The office uses a standard budget format consistent with Polish law.

3.2 Utility Management

As has been noted in the technical section of this report, the gmina has been effective in the area of project planning, having begun carefully by meeting with the residents on their priority needs respecting the sewer system, then using consultants to develop a general plan, and finally preparing very adequate specifications for public bidding.

The gmina has, as well, a long history of community participation, self-help, and contributions-in-kind. A partial listing of these "community" projects is given in Appendix H. As a result of this consistency in community effort, there now exists broad-based support for community improvement.

At the same time, Miedźna lacks hand-on experience in the operation of a public utility since all of its current utility services (i.e., gas, water, and electricity) are managed by regional or national authorities. Once the sewer utility is in place, or any part of it, the gmina faces the prospect of having to operate it at an efficient level. One possibility for added efficiency expressed by some gmina officials is to acquire the existing water distribution system and tie it in with the sewer system. The gmina would then have an integrated public utility to administer a combined water and wastewater operation.

However, acquisition of the water distribution system might require a capital payout or an attachment to the water rates so that the regional authority which owns the system could recoup its initial investment. If this were required, the gmina would be taking on another financial burden despite already being hard-pressed to finance the proposed wastewater system.

3.3 Recommendations

The gmina should begin organizing now for the administration of the sewer system and wait for it to be in operation before trying to acquire the water facility.

The gmina also should pay close attention to the portions of project management related to design, construction supervision, and project turnover, as well as future needs for operations and maintenance. These two management challenges—utility operations and the latter stages of project management—appear to be the most critical for the Miedźna wastewater system. These management issues are addressed in the technical portion of this report (see Chapter 2), in the financial section (utility operation needs; Chapter 4), and in the general statement of future training needs (Chapter 5).

3.4 Organizational Alternatives

Miedźna is considering available alternatives for organizing the proposed wastewater utility. While there are many alternatives and variations, four general possibilities are discussed below. If any one of these is chosen, or if parts of the alternatives are merged, a more detailed analysis should be done

in order to present Miedźna with a practical and manageable proposal. LEM technical assistance could be made available for this assignment.

3.4.1 Creation of a New Budget Unit

This is the easiest alternative to establish. A new budget unit only requires a budget adjustment and would be readily accepted by the gmina council and the public. Such a unit would be supported by a combination of revenues available to the municipality. Although general budget transfers are needed to finance the operational budget of the wastewater utility, the budget unit will have a direct link to Miedźna's council executive.

3.4.2 Wastewater as a Public Enterprise

Miedźna could establish a utility enterprise funded outside the regular budget; it would, in principle, be supported by utility fees generated by the public utility (e.g., charges for wastewater treatment based on a percentage of the water bill). This organizational alternative is widely used in the United States; it is also being used by Ziębice. The organizations, in turn, have varying degrees of autonomy. Because the public utility is a monopoly, the rates charged might have to be approved by the national government or by an independently appointed commission.

3.4.3 Wastewater as a Private Enterprise

The utility services could be sold or franchised to a private firm that would operate all wastewater units. This alternative is often employed for new towns or new developments. One of the problems with this alternative is that the rates charged do not usually make allowances for low-income groups or people on a fixed income. Again, because this alternative creates a monopoly, the rates charged could be reviewed by the gmina council or by an independently appointed commission.

A variation on this operation is for Miedźna to contract the operational activity of wastewater treatment to a private firm without giving up its general control over the utility. This option might work better for smaller wastewater operations, which cannot always justify the direct employment of highly trained technicians on a full-time basis.

3.4.4 Regional Cooperative Agreements for Wastewater Operations

Under this alternative, a group of local units would come together and operate a wastewater system. The local units might not be able to afford individual systems but, together, would be economically stronger and could build and operate a system to serve all their needs. However, such a regional system requires physical proximity and a strong motivation to work together to solve mutual problems.

4 FINANCIAL ANALYSIS

4.1 Existing Conditions

More than 1,400 households are connected to the gmina water system. Of those connected, 851 customers (60%) are metered. In 1992, approximately 350,000 m^3 of water were used outside of the mining enterprise and its housing blocks. Therefore, for the same customer base that is being proposed for sewer service, there is a combined use of approximately 350,000 m^3 per year, or slightly less than 1,000 m^3/d.

Average consumption of water is approximately 250 m^3/year (0.68 m^3/d) per household. The bill for this quantity of water is calculated on a fixed and flat rate of zł 3,500/m^3 and averages less than zł 75,000 per month. Average monthly charges for water and other services are displayed in Table 4.1.

Table 4.1

AVERAGE MONTHLY UTILITY CHARGES FOR MIEDŹNA
(in zlotys)

Type of Service	Cost
Garbage	30,000
Gas[a]	250,000-500,000
Water	75,000
Sewer[b]	38,000

[a]Based on consumption.
[b]If calculated as approximately 50% of water charge.

Sewer rates are tied to water rates throughout the region. In nearby Pszczyna, for example, sewer rates are set at 50% of the water bills. Gmina leaders would like to maintain a similar relationship between water and sewer prices in the new system; however, this may not be possible given the capital construction costs of the new system. Moreover, sewer rates should reflect the actual cost of providing sewer service. Arbitrary rate structures, such as those used in Pszczyna, do not.

Previous Page Blank

Polish law requires that gmina budgets be balanced at the end of each fiscal year. Miedźna has been able to generate a budget surplus in recent years as a result of favorable tax distribution laws and a local tax base that includes the KWK Czeczott Mine. Through responsible fiscal management, the gmina has accumulated planned capital reserves for community investments as well as surplus budget funds that can be allocated for the support of projects (see Table 4.2).

Table 4.2

BUDGET PERFORMANCE CHART, 1989-1993
(in thousands of zlotys)

Year	Revenues/ Expenditures	Budgeted	Actual	Surplus	Planned Reserve
1989	Revenues	1,242,024	1,319,872		
	Expenditures	1,242,024	1,241,677	78,195	1,448
1990	Revenues	15,661,511	13,787,090		
	Expenditures	15,661,511	13,337,509	449,581	13,789
1991	Revenues	53,049,207	57,235,657		
	Expenditures	53,049,207	53,498,171	3,737,486	3,000,000
1992	Revenues	48,316,462	48,898,984		
	Expenditures	48,316,462	48,191,920	707,064	3,625,520
1993	Revenues	44,535,256	6,404,310[a]		
	Expenditures	44,535,256	4,485,076[a]	1,191,234[a]	1,157,000
TOTALS:				6,163,560	7,797,757

[a]First quarter only.

Tables 4.3 and 4.4 provide more detailed information about the gmina's sources of revenues and expenditures using data from the 1993 budget.

Table 4.3

GMINA BUDGET, 1993: REVENUES
(in thousands of zlotys)

Item	Revenue Source	Amount Projected
1	Slaughter taxes	2,000
2	Cemetery payments	30,000
3	Ground leases	70,000
4	Agricultural taxes (state-owned farms)	25,000
5	Real estate taxes (state-owned companies)	24,200,000
6	Business income taxes	20,000
7	Individual income taxes	6,640,000
8	Private farm payments/taxes	620,000
9	Flat-rate small business taxes	300,000
10	Real estate taxes (private companies)	405,000
11	Local fees and payments (dog licenses, wills, marketplace charges)	73,000
12	Road and vehicle taxes	880,000
13	Forest taxes	2,000
14	Fees for administrative operations	600,000
		33,867,000
	Transfer payments (primary teacher salaries)	10,668,256
	TOTAL REVENUES	44,535,256

Table 4.4

GMINA BUDGET, 1993: EXPENDITURES
(in thousands of zlotys)

Item	Allocations for Services/Infrastructure	Amount Budgeted
1	Agriculture	200,000
2	Forests	50,000
3	Roads	7,000,000
4	Telephones	200,000
5	Communal open spaces (cemetery, parks, streetlights, etc.)	1,608,000
6	Communal housing	1,510,000
7	Primary schools and preschools	25,000,000
8	Culture and "arts"	1,400,000
9	Health protection	1,230,256[a]
10	Social welfare	1,100,000
11	Sports/recreation	300,000
12	"Miscellaneous"	80,000
13	Administration	3,500,000
14	Police	200,000
15	Reserve	1,157,000
	TOTAL EXPENDITURES	44,535,256

[a]The proposed expenditures for Health Protection salaries are included in 1993 expenditures although the corresponding transfer payments from the central government have not been budgeted as revenues.

4.2 Conclusions

4.2.1 Available Local Resources

The gmina has completed a number of capital-intensive projects over the past few years while maintaining an annual budgetary surplus. The accumulated surplus, which now amounts to more than zł 20 billion, is currently invested in an interest-bearing account, which is rolled over quarterly at an approximate earned annual interest rate of 45%. These funds are available to help finance the proposed sewer project.

Miedźna may also be in a position to dedicate certain discretionary revenues toward construction of the sewer system. Thus, it is possible that an annual surplus of zł 2 billion or more would be available for the next few years in addition to the current accumulated surplus noted above.

Voivodship funds are available to help finance capital projects; however, matching funds cannot exceed 25% of the local share and are not available during the current fiscal year. In addition, the gmina is attempting to prove its fiscal competence by undertaking some functions that have been delegated by the central government to local authorities. Each of these new areas of service brings transfer payments from the central government, but this source of revenue can be adversely affected or delayed by central administrative changes and fiscal constraints.

4.2.2 Project Capital Costs

The original estimated project costs for implementation of the lagoon system were approximately zł 86 billion. Review of the original modifications and time schedule by the LEM survey team has resulted in a more realistic cost estimate of zł 100 billion. Table 4.5 compares the preliminary bid costs with amended cost projections.

The low bidder estimates that the O&M costs will be less than zł 1,000/m^3. These figures are low because of the level of technology proposed. The two most significant expense items are the electricity costs (for pump stations) and labor. The vendor proposes that the two WWTPs can be operated by one well-trained employee. Also included in the vendor's overall estimate is a 43% increase in electricity rates that has already been announced for the end of 1993.

The gmina plans to staff the wastewater treatment plants with two half-time operators (@ zł 1 million/month each half-time), a technical manager/supervisor (@ zł 3.5 million/month), and an additional clerk in the Treasurer's office (@ zł 1.5 million/month). The clerk will handle billing and collection; the two operators can provide flexible labor and back-up support until they are needed on a full-time basis; the responsibilities of the supervisor could also be expanded if the gmina were to become involved in public water distribution or in communal housing. The monthly labor costs are estimated at zł 10.5 million, which includes both salary and fringe benefits.

Table 4.5

MIEDŹNA WASTEWATER PROJECT
PRELIMINARY BID COSTS vs. AMENDED COST PROJECTIONS[a]
(in billions of zlotys)

Project Element	Preliminary Costs	Amended Costs
Miedźna:		
WWTP	6.7[b]	10.5
Grzawa/Miedźna	12.0	13.2
Frydek	9.8	10.8
Subtotal	28.5	44.5
Góra:		
WWTP	9.6	10.5
North Góra	9.1	10.0
Gilowice/Frydek	14.2	15.6
South Góra	13.1	14.4
Subtotal	46.0	50.5
Wola (collection only)	11.0	12.0
Contingency[c]	0.0	3.0
Project Totals	85.5	100.0

[a]Projected costs assume a 1-year delay to secure project funding and are increased 10% for a minimum margin.
[b]Miedźna WWTP increased from 500 to 800 m^3/day.
[c]Contingency funding should be included even in preliminary precontract projected costs.

The costs of having the Czeczott Mining Company treat the Wola effluent have not yet been identified; however, gmina officials are confident that the Czeczott WWTP charges will be reasonable because the mine has excess treatment capacity.

In addition, to offset some capital costs, the fish farming enterprise located on the Vistula may wish to use the discharge water from the WWTP at Góra and might be willing to exchange some of its land in return for treated water. The Miedźna lagoon site is located on publicly owned forestry land and may be available to the project by a simple process of application and transfer. Gmina officials have already made application for the land. This will also reduce investment costs.

4.2.3 Available External Resources

Other potential sources of funds are charges levied on the households connecting to the new sewer—e.g., tap-on fees, front footage assessments, and/or access charges. The gmina, however, is reluctant to apply these additional charges, which would add to the individual burden of citizens already faced with inflationary pressures and price increases for gasoline, electricity, transportation, etc. If these sources of additional funds are not used, then the gmina may have to consider alternatives ways to achieve its goal. Some of these are listed below:

1. Reduce the scope of the project to equal the available funds.

2. Build the project in phases using gmina general budget transfers to fund each succeeding phase.

3. Borrow all additional funds needed to construct the project at one time, increase the budget, and repay the debt from budgeted general revenues.

4. Borrow sufficient additional funds to construct the project, and create a rate-generated revenue stream within the utility enterprise fund sufficient to repay the debt.

5. Use capital reserves to provide local matching funds for national or international grants.

6. Borrow the full construction amount and use capital reserves to pay for capitalized interest during construction and early debt service payments until the utility is self-sufficient.

7. Reconsider customer contributions to reduce the need for capital borrowing.

While a number of combinations of the above are possible, the important conclusion is that Miedźna will not be able to undertake the full sewer project without outside funding.

To illustrate the financing problems involved, four capital investment scenarios are presented below. They are based on annual transfers of tax receipts from the general budget, use of an 8-fiscal-year repayment cycle, allocation of user-fee collections to debt-service payments, and, finally, estimates of funding grants needed from other sources.

The first scenario, shown in Table 4.6, assumes a repayment schedule of 7 years spread over 8 fiscal years, an annual transfer of zł 2 billion from general revenues, and zero utility revenue. Debt service payments begin in the middle of year 1. As the model demonstrates, a fund deficit of zł 79 billion is created by the eighth year.

Table 4.6

SCENARIO 1: NONCONTRIBUTING OPTION OF 8-FISCAL-YEAR LOAN REPAYMENT
(in billions of zlotys)

[Accumulated Reserves by 1994 (PREP Year) = zł 22 billion]

Year	Current Reserves	Fund Transfer	Utility Revenue	Reserves Balance	P&I[a] Costs	Net Fund Balance
PREP	22	2	0	24	0	24
1	24	2	0	26	8	18
2	18	2	0	20	17	3
3	3	2	0	5	17	-12
4	-12	2	0	-10	17	-27
5	-27	2	0	-25	17	-42
6	-42	2	0	-40	17	-57
7	-57	2	0	-55	17	-72
8	-72	2	0	-70	9	-79

P&I = principal and interest; PREP = preparatory [year]

[a]Calculated at 10% interest rate for 7 years with payments spread over 8 fiscal years.

The second scenario, Table 4.7, assumes utility revenues from 1,200 households by the second year calculated at a rate of zł 90,000/month/customer for Years 2 and 3. In Year 4, the rate is raised to zł 140,000 and the number of connections increases by 250 customers (20%). Transfers from gmina general revenues are zł 2 billion for the PREP year and Years 1-3, increasing to zł 3 billion by Year 4. The result is still a deficit of zł 61,500,000,000 by the eighth year.

Table 4.7

SCENARIO 2: NONCONTRIBUTING OPTION OF 8-FISCAL-YEAR LOAN REPAYMENT
(in billions of zlotys)

[Accumulated Reserves by 1994 (PREP Year) = zł 22 billion]

Year	Current Reserves	Fund Transfer	Utility Revenue	Reserves Balance	P&I[a] Costs	Net Fund Balance
PREP	22	2	0	24	0	24
1	24	2	0	26	8	18
2	18	2	1	21	17	4
3	4	2	1	7	17	-10
4	-10	3	2.5	-4.5	17	-21.5
5	-22	3	2.5	-16.5	17	-33.5
6	-34	3	2.5	-28.5	17	-45.5
7	-46	3	2.5	-40.5	17	-57.5
8	-58	3	2.5	-52.5	9	-61.5

P&I = principal and interest; PREP = preparatory [year]

[a]Calculated at 10% interest rate for 7 years with debt service payments spread over 8 fiscal years.

From these examples, it is clear that capital costs are controlling. Total capital costs are projected to be zł 100 billion, averaging more than zł 83 million per connection, or approximately US $5,000 per household. The per unit capital cost is estimated to be twice the average annual income of a typical family in the gmina.

The third scenario, Table 4.8, uses the same assumptions as the second regarding utility rates and transfers from the general revenue fund but also projects a grant to the gmina of zł 40 billion, which reduces the deficit to zł 10.5 billion.

Table 4.8

SCENARIO 3: CONTRIBUTING OPTION OF REDUCED 8-FISCAL-YEAR LOAN REPAYMENT
(in billions of zlotys)

[Accumulated Reserves by 1994 (PREP Year) = zł 22 billion]
[Grants equalling 40% of project capital costs]

Year	Current Reserves	Fund Transfer	Utility Revenue	Reserves Balance	P&I[a] Costs	Net Fund Balance
PREP	22	2	0	24	0	24
1	24	2	0	26	5	21
2	21	2	1	24	10	14
3	14	2	1	17	10	7
4	7	3	2.5	12.5	10	2.5
5	2.5	3	2.5	8	10	-2
6	-2	3	2.5	3.5	10	-6.5
7	-6.5	3	2.5	-1	10	-11
8	-11	3	2.5	-5.5	5	-10.5

P&I = principal and interest; PREP = preparatory [year]

[a]Calculated at 10% interest rate for 7 years with debt service payments spread over 8 fiscal years.

Consequently, the annual principal and interest payments to service a debt of zł 60 billion are more manageable for a new utility. Again, this model demonstrates that it is the capital costs, and therefore, the debt service payments, that are the driving factor. The assumptions of 100% connection rate, customer growth of 20%, continuing transfers of tax receipts, and enterprise proceeds in excess of O&M needs are probably overly optimistic.

The major assumption of the fourth scenario, Table 4.9, is the injection of zł 60 billion of capital from external sources. Transfers from gmina general revenues are zł 2 billion for the PREP year and Years 1-3, increasing to zł 3 billion beginning in Year 4. Utility revenues are reduced to an average of less than zł 100,000 per month per customer (assuming 1,200 connections for the entire payback period). Considering the income of the residents in the gmina, such a structured payback might be realistic if operating costs were as low as estimated by the consulting engineer. This scenario allows for the retirement of the debt at the end of 7 years.

Table 4.9

SCENARIO 4: CONTRIBUTING OPTION OF REDUCED 7-YEAR LOAN REPAYMENT
(in billions of zlotys)

[Accumulated Reserves by 1994 (PREP Year) = zl 22 billion]
[Grants equalling 60% of project capital costs]

Year	Current Reserves	Fund Transfer	Utility Revenue	Reserves Balance	P&I[a] Costs	Net Fund Balance
PREP	22	2	0	24	0	24
1	24	2	1	27	7	20
2	20	2	1	23	7	16
3	16	2	1	19	7	12
4	12	3	1	16	7	9
5	9	3	1	13	7	6
6	6	3	1	10	7	3
7	3	3	1	7	7	0

P&I = principal and interest; PREP = preparatory [year]

[a]Calculated at 10% interest rate for 7 years with debt service payments spread over 8 fiscal years.

Currently in Poland, there are no mechanisms similar to the municipal bond markets of Western Europe or the United States for local governments to use for borrowing. Commercial credit, when available, costs from 35 to 40% per year without long-term credit or rate guarantees. Since the zloty is freely exchangeable within Poland, the annual inflation rate will significantly affect the cost of commercial credit. The viability of creating a municipal bond market by amending existing Polish law needs to be examined.

4.2.4 Cost Recovery/User Fees

The time when a new sewer system is organized is a unique opportunity to establish an appropriate rate structure. There are no existing users with prior pricing experience and the utility has maximum freedom from consumer pressures to set a constructive rate schedule.

Conversely, prior to beginning operations, the utility is most vulnerable to fiscal pressures as a new service provider. It will be exposed to the maximum level of capital construction costs with the minimum number of customers. Thus, policy alternatives should be adopted that will maximize short-term income rather than accomplishing long-term objectives.

Rate structures often reflect policy decisions on who should pay and how much; there are many patterns available. Further, sewer rates are often linked to water policies. Five of the most commonly used of these water pricing strategies are discussed below.

- Uniform - the same unit cost is established for all classes of customers, irrespective of the quantity of water used. This flat rate approach appears on the surface to meet the issue of equity but ignores the gmina's concerns for conservation.

- Accelerating - The more each customer uses, the more the unit cost is increased. The greatest impact of this pricing pattern is encouragement of conservation and therefore reduction of required capacity.

- Decelerating - This strategy decreases the price charged per unit as usage increases. It encourages water use and may presume an economy of scale that is true for O&M costs but not true for capital costs, usually the largest expenditures of new systems.

- Categorical - The utility establishes classes of customers for which separate rate structures may be developed. Separate classes may be established for several reasons (e.g., different effluent characteristics, differing service requirements, etc.) Often for reasons of social policy, industry is charged a different rate to "encourage jobs or economic development." The net effect may be to transfer the true costs to another class of customer.

- Fixture/component - This is an alternative to quantity-driven rate structures. It requires metering and uniform charges. Often, a monthly charge is established for each appliance or plumbing fixture at the time it is installed in the service. This approach may be subject to fraud over time, but may also be the only feasible method when water meters are not used.

- Combinations - There are many possible combinations of these approaches and, in fact, many public utilities in the US and in Western Europe combine various elements to accomplish the service objectives.

The gmina's approach to sewer rates is conservative. At the same time, there is community sentiment to have a rate schedule that assists those least able to pay. The gmina is currently leaning toward a schedule based on accelerating rates by classes of customers—i.e., residential, agricultural, industrial, and business users. Such a tariff would maximize flexibility and encourage conservation of wastewater treatment capacity.

Can a typical household in the gmina afford the cost of a nonsubsidized sewer system? In considering the community's ability to pay a higher monthly utility charge, it is important to recognize that about 23% of all households qualify for social welfare assistance. Many of the members of these family units are elderly and receive assistance because of low annual income, even though they may own property. These issues are especially relevant to the development of criteria for setting sewer service fees.

While there is currently much discussion of the need for and possibility of additional legislation to encourage privatization of many state-owned enterprises, the absence of credit, innumerable structural problems, and the specter of massive unemployment, have deterred the process. Moreover, there is still public disagreement on the appropriateness of public utilities being privatized. In the case of Miedźna, there is no interest in considering a privately owned sewer and wastewater system. At the same time, there is general concurrence that the construction could best be handled by private engineering and construction firms but that operation of the proposed utility should be a departmental activity of the gmina government.

4.2.5 Summary of Conclusions

In summary, the following points can be made:

1. The gmina leadership is convinced that a sewer system is needed for the future of the community.

2. The high level of administrative expertise at the gmina offices increases the probability of a successful project and sustainable capital improvement.

3. The project has been technically improved by the technical assistance already requested by the gmina and provided by LEM.

4. The technology levels of the proposed wastewater treatment systems are appropriate for the community.

5. The real issue is the question of funding from sources other than the gmina.

6. With a responsible sewer rate structure, all operations and maintenance costs could be covered after the first several years of start-up.

7. The project would be self-sustaining only if debt service requirements were met with other resources.

8. The actual construction of the project will depend on whether the gmina can secure construction grants or loan guarantees that would significantly reduce debt service payment.

9. The gmina seems poised to commit to the project without having secured the full capital construction costs.

4.3 Recommendations

The Miedźna Wastewater Treatment Project is feasible if capital construction costs can be offset by other resources. As shown in the hypothetical models, it is the debt service schedules of the outright capital costs of zł 100 billion (zł 8.3 million per household) that determine all other aspects of the project. Therefore, it is recommended that the LEM project:

1. Assist the gmina in its efforts to secure alternative funding for the sewer construction project.

2. Help the gmina to more accurately and definitively estimate the projected operational and maintenance costs over the next 8 years and adjust cost estimates for the new Polish value-added tax (VAT).

3. Help the gmina to develop a business plan that includes a capital debt repayment schedule and a capital equipment depreciation schedule.

5 TRAINING AND OUTREACH NEEDS

The general training and outreach needs identified in this chapter are based on the LEM consultant suggestions as revised — and added to — by the Miedźna representatives during the LEM Project Workshop held in Wrocław on 14, 15, and 16 July, 1993. The list of courses presented here will be further refined as a result of the development of a LEM training plan for Poland.

5.1 Training Course for Treatment Plant Operators

This course should be a two-tiered training program. The first tier should be a basic introduction into the practice of treatment plant operations and the background essentials needed to operate successfully; the second tier should build on the introductory course with a more detailed, technical application of processes and systems.

These two courses should be developed within the Polish context but with attention to practical new developments and techniques that could applied in Poland. The courses could be given to all LEM cities at once, or in stages; the courses might also be repeated for other gmina representatives who are interested in the LEM program, particularly those who attended the Wrocław Workshop in July 1993.

5.1.1 Introduction to Treatment Plant Operations

This course should cover introductory information on the topic of municipal wastewater, including collection systems, piping, valves, tanks and pumps, the essentials of wastewater treatment processes and systems, sludge treatment and disposal, mechanical and chemical treatments, lagoon treatment systems, essentials of laboratory sampling and techniques, laws and regulations, and administrative record keeping. It may be necessary to include rudiments of math, chemistry, biology, hydraulics, applied electricity, health, safety, and environmental best management practice. The course should be designed to be specific to Polish practice and to the types of equipment currently being used, especially in the LEM cities.

5.1.2 Advanced Course in Treatment Plant Operations

This course would expand upon the basic course but with much more emphasis on the details of wastewater treatment processes and systems. Examples of topics are screening, grit removal, trickling filters, activated sludge, disinfection, lagoon systems, and similar technologies appropriate

to small, rural communities; sludge treatment and removal; sampling and laboratory operations; laws and regulations; plant housekeeping; and the need for and best methods of keeping records.

5.2 Training in Management and Operations of Water and Wastewater Organizations

This training program should focus on improving management practices and introducing systematic administrative processes within the organization charged with the water/wastewater operations in the gmina. It should review the various options for such management (e.g., independent units, privatized companies, and joint public and private companies). The course should include a general overview of best management practices relating to operations, personnel administration, and problem solving, to name a few. Emphasis should be put on the need and methods for determining rates, budgeting for operations and maintenance, assessing capital needs, keeping effective records, writing reports, billing and collecting fees, setting rates, and understanding the close relationship between water and wastewater functions. All of this training should be designed within the framework of existing Polish law and regulations on water and wastewater treatment and operations.

5.3 Financial Administration of Water/Wastewater Organizations

This may be considered an advanced course growing out of the previously described management course; at the same time it could also be designed, in part, to be introductory and specific to managers, bookkeepers, and other employees assigned to financial functions within the gmina, or within the water/wastewater organization or company serving the gmina. It should cover in some detail the basis for water/wastewater rates; the design of rate structures; the detail of billing, collection, and accounting; and the relationship between operations and maintenance accounting and accounting for capital expenditures. Best accounting practices in compiling a full annual budget and a capital expenditure budget should be integral to this course.

5.4 Planning for Water/Wastewater Management

This course should be considered a continuation of the training on management and financial administration in which the elements of short- and long-range planning for water/wastewater needs are combined. It would deal with such items as planning as a technique to improve management and financial operations; setting priorities; and estimating costs while taking into account likely changes, contingencies, and practical realities. Emphasis should be put on capital budgeting as a focus of practical planning. Such devices as pert charting, planning maps, etc., could be introduced as techniques for illustration.

5.5 Developing and Writing a Project Business Plan

This course would be given to top-ranking municipal officials and their consultants, if appropriate. The course focus would be putting together a "pre-feasibility" study (i.e., a project business plan) for an infrastructure project for which the gmina would like to attract other-source funding (e.g., from the central government, private investors, foreign banks, and foreign development lending institutions). The first part of the course would review the possible sources for outside funding and their requirements along with the "business plan" formats required by these agencies. The second part would then review the data needed; the manner in which it should be presented in the report; and finally, the writing, editing, and publication of the report. The course would also discuss methods for presenting the report in summary form to the various institutions interested in funding this kind of project.

5.6 Management of Infrastructure Projects

One of the most important training courses to be given to all municipalities is one that involves project management. This course should be available to high-level managers and decision makers in the gmina. The course would take a proposed project through the major stages of the project management cycle: preparing a project proposal, completing preliminary studies on design and coverage (with emphasis on appropriate technology as well as operations and management when the project is finished), assessing finances, hiring a design firm, approving the design, preparing detailed project specifications, bidding, awarding the bid, negotiating the contract, administering the contract, inspecting the project, receiving the completed project, and beginning operations. Within each of these steps, best practices would be discussed. A particular project would be employed as a case study for taking participants through the project management procedures. Again, the course would have to be practical and consistent with Polish law.

5.7 Design and Implementation of Public Information Programs on the Environment

The object of this training course would be to assist the gmina in designing and implementing various outreach information programs that are concerned with the environment; a secondary object would be to improve communications among the gmina executives, the gmina council, the nongovernmental organizations in the gmina, and the citizens. The course would first introduce the participants to the basic psychology of public information programs (i.e., who is the audience, what is the message, what is the best way to get the message across, what results do you want to achieve). It would also give background on the various written and visual techniques available and when to use which technique for which audience, message, etc. The course would then choose a particular municipality that has some public information or outreach need, and go through the steps from idea to result. Emphasis should be placed on using available resources and not relying too much on high-tech methods that are costly and impractical to implement.

APPENDIX A

Regulations of Tender (Bid) Competition

Miedźna, February 12th, 1993

To Bidders of the Tender Competition
(everyone according to the list)

Commune Government in Miedźna (Katowice Voivodship) invites your company to participate in the Tender Competition for the design and turnkey construction of wastewater treatment plants in Miedźna.

Enclosed please find:

1. The Tender Competition regulations, with annexes.
2. The basic design data.
3. Topographic maps of Miedźna in the scale of 1:10,000.

The Tender Competition will be held on April 14th, 1993, in the Office of the Gmina Council of Miedźna at 8^{00}a.m.

(The stamp): MAYOR (WÓJT GMINY)
Andrzej Granatyr
(—) [signature illegible]

Regulations of

The Tender Competition for design and turnkey construction
of wastewater treatment plants in **Miedźna**, organized
by the Gmina Council of Miedźna with the cooperation of
the Silesia Ecological Foundation

§1

The purpose of this Tender Competition is the design and construction of wastewater treatment plants in Miedźna, according to basic design data sent to potential bidders who were preselected with the cooperation of the Ecological Expertise and Service Office of the Silesia Ecological Foundation in Katowice.

§2

1. Bidders invited to participate in the Competition should submit their offers according to the specifications in the basic design data, within 1 month from the date of the invitation but no later than and April 7th, 1993.

2. The offer should be submitted in two sealed envelopes to the Secretary's Office of the Mayor (Wójt Gminy).

3. The offer should have the following annexes:

   a/ A list of materials and structures to be supplied by the bidder
   b/ A financial statement from the bidding company (1992 annual balance)
   c/ A receipt verifying that zł 30,000,000 as a security deposit and zł 3,000,000 as a participation fee has been transferred to the Tender Competition of the Gmina Council.

§3

The Tender Competition will consist of an open session and a closed session:

1. At the open session, in the presence of the bidders, the Tender Committee will:

   1.1 Announce a list of submitted offers;
   1.2 Make sure that the two offer packets for each bidder are complete and intact;
   1.3 Open every offer packet one by one and check their conformity to the basic design data;
   1.4 Obtain from bidders additional explanations of any unclear information connected with submitted offers;
   1.5 Enter into the official record declarations as to the basic content and amounts of submitted offers, as announced and confirmed by the signature of an authorized representative of each bidder;
   1.6 Decide whether any offers will be formally excluded from further examination.

2. At the closed session, the Tender Committee will:

   2.1 Analyze offers accepted for the competition, consulting with experts if necessary;
   2.2 Choose the most advantageous offer or offers and decide how to proceed with implementation;
   2.3 Note in the official record the committee's reasons for its choices or conclusions.

§4

1. If the Tender Committee has difficulties in choosing an offer, it will arrange for additional clarification by way of a spoken tender.

2. In this instance, the Tender Committee will let the authors of selected offers know the terms of the supplemental bids and will inform them of the basic components of other offers admitted to the additional evaluation.

3. During the additional evaluation, bidders should submit additional proposals for the official record. After it has analyzed these proposals, the committee will make a final decision.

4. The official record will be signed by members of the Tender Committee and participants of the additional evaluation.

§5

1. The Tender Committee of the Competition may ask selected bidders to elaborate upon specific elements of their offers in as much detail as necessary, particularly those elements that may influence the construction and operation of the wastewater treatment plant and sewerage system, or that may affect the costs.

2. In this case, the final choice of bidder may be postponed for whatever length of time is fixed by the Tender Committee.

§6

The Tender Committee of the Competition may reject any offer at any stage of its examination if:

1. The offer raises any doubts among committee members as to its basic plan or costs,

2. The bidder does not appear ready to design or construct the wastewater treatment plant.

§7

The Tender Competition is considered to be unresolved if:

1. The committee does not examine at least two offers.
2. None of the offers considered satisfies the Gmina Council of Miedźna.

45

§8

The Chairman of the Tender Committee will notify bidders in writing of the results of the evaluation of their offers after the Tender Committee ends its work.

§9

1. A bidder who has been notified that his offer has been chosen must sign a contract for design and construction of the facilities within 14 days after the notification.

2. Beginning with the moment of notification, the commitment between the bidder and the ordering customer comes into being and regulations of the civil code relevant to preliminary contracts apply to this commitment.

§10

The Gmina Council reserves the right to void the Tender Competition during its execution without explanation.

for the Gmina Council of Miedźna

(The stamp) MAYOR (WÓJT GMINY)

[signature illegible]

Andrzej Granatyr

Annex No. 1

to the Regulations of the Tender Competition

1. Amounts subsequent to the Regulations:
   a/ the security deposit amounting to zł 30,000,000 (thirty million zlotys)
   b/ the participation fee of the Tender Competition amounting to Zł 3,000,000 (three million zlotys) - should be transferred to our account: Bank Spółdzielczy in Miedźna no. 927307-1179-133.

2. Receipts for amounts transferred subject to clause 1 of the annex should be shown:
   a/ on the day of the Tender Competition,
   b/ on the day the offer is submitted.

3. The participation fee for the Tender Competition (zł 3,000,000) is nonrefundable.

APPENDIX B

Scope of Work: Miedźna, Poland

APPENDIX B

Scope of Work: Two-Person Advisory Team for Miedźna, Poland

1. Background:

The municipality of Miedźna has a population of about 15,000. The mayor and the gmina council are pushing ahead on a program to solve the wastewater problem in each of the six villages in the gmina. They have had an overall report made by a local consulting firm, EURO-EKOLAS, which gives the plan and the estimated costs. Based on this study, the municipality has asked for bids for the design and turnkey implementation of the program from 10 contractors who were "short-listed" through a municipal selection process. The tender has already been given out and the bids will be opened on April 14, 1993. The immediate need is for the municipality to have a careful study made of each village and to develop recommendations for the municipal officials on what type of wastewater treatment would be most efficient and economical. This study will aid in the assessment of the bids and negotiation of a contract with the successful bidder.

The municipality will also need a financial/management plan on how to finance and manage the resultant system, over what time span it can be implemented, and what practical types of training of personnel will be necessary for planning, management, and implementation. This "business plan," as it is referred to by the municipality, is what (in final form) would be presented to the central government, commercial banks, and/or international lending institutions as a basis for funding beyond that which the municipality itself can undertake through its local budget and through increases in the wastewater fees.

This scope of work is concerned with technical assistance to help sort out the "immediate problems."

2. Scope of Work

The two-person assistance team will, in cooperation with municipal officials, study the wastewater problems in detail for each village and, in reviewing these problems against the background of existing technology, make recommendations to the municipality on the approach to take in each village. This activity should result in a wastewater technical implementation plan for the municipality. The technologies recommended should fit with the capacity of the municipality to both manage and finance the installation based on its overall plan. The team's work will involve gathering data on each village, making field trips to each village, meeting with village and/or municipal officials regarding the wastewater situation in each village, and analyzing the initial planning document of EURO-EKOLAS in relation to existing conditions as well as the bid documents. Other information on Miedźna will be available directly through RTI's NC office.

In doing its field research and analysis, the team should identify particular training that the municipality will need to carry out its overall wastewater plan. The team should also underline potential financial and management issues that arise out its field work and that likely will be a next step in LEM's technical assistance to the municipality. In addition, the team should work with municipal officials to give whatever technical assistance over and above the specific tasks illustrated that they may be called upon to render.

It is also possible that the municipality may ask that the team extend its stay in order to assist in the analysis of the bids once they are received. This, however, should be worked out with municipal officials once the team has begun its work.

3. Proposed Arrival Time, Base of Operation, etc.

The team should arrive in Poland during the second week in March. The two team members should come out together, work as a team, and come directly to Krakow for a day's briefing on the situation in Miedźna; the project manager will accompany the team in its introductory meeting at the municipality. In order to expedite the field work the team will stay in a small hotel in the city of Pszczyna, which is about 10 kilometers from Miedźna center. It is adequate but without frills. The team could spend weekends in Krakow. The municipality will furnish transportation to and from Miedźna or, if that proves inadequate, the team can use the local taxi service. Translation and/or secretarial, fax, copying, and general office backup will be provided through the project manager as necessary and possible.

The final product should be a detailed report presenting the findings and recommendations of the team. These should be given orally to the municipal officials one week prior to departure so that appropriate feedback can be solicited. The final written report should be delivered to the project manager within two weeks after the team departs. It is expected that the final report will be translated into Polish for submission to the municipality.

This initial technical assistance, including the field work, will take from three to four weeks. There may possibly be an extension if the municipality decides it would like to have assistance in assessing the bids and/or if the team can extend. The team shall work under the supervision and guidance of the project manager.

The team is asked to review the material provided on Miedźna; additional material on organization and the population of the villages is under preparation and will be sent soon.

APPENDIX C

Wastewater Project Bid Evaluation Checklist

and

Weighted-Sum Method for Quantitative Evaluation of Bids

APPENDIX C

Wastewater Project Bid Evaluation Checklist

The following checklist was developed to assist Miedźna officials in evaluating the submitted wastewater proposals.

- Review all operation and maintenance records, with a specific interest in the **actual costs** involved.

- Evaluate all mechanisms and equipment; i.e., consider the levels of operation and maintenance (O&M), with respect to expectations within the gmina's available resources.

- Determine the level of equipment spare parts usage associated with the technology.

- Review the written O&M instructions. The more elaborate, the more difficult the technology will be to operate and maintain. Will the instructions be provided in Polish, or will this be an extra service which will have to be purchased?

- Check the design population equivalents. Is the system capable of providing adequate service to the existing levels in the gmina, with an adequate measure of growth?

- Check the system's overall aeration capability. Is there enough to handle expected growth?

- Evaluate the number of component stages required to operate the technology.

- Evaluate the technology used to process and dispose of the sludge generated.

- Evaluate the chemical usage, application methods, costs, and quantities used to operate the process. Are these chemicals available in Poland at reasonable cost and quantities?

- What are the electrical requirements? power consumption rates?

- Evaluate the staffing requirements. Can the gmina afford to operate and maintain the system at proposed levels?

- What is the requirement for on-site maintenance service? What is the requirement for hired services?

- Evaluate equipment replacement availability, transportation costs, and supplier locations. Try to estimate what and where **hidden costs** are most likely to be involved.

- Can equipment be easily replaced with Polish spare parts? Is there a market for these parts? Where?

- What is the equipment and/or service warranty? Does it run from the date of purchase, or the date of installation and start-up?

- What laboratory functions are required to effectively operate the process?

- Evaluate the ease of access to each component regarding O&M functions. Personnel safety should be of paramount importance. Is ventilation adequate?

- What are the land requirements for the system proposed? What is the area required for an environmental protection zone?

- What is the size of the area that will be affected by the facility's odor?

- What extra safety equipment will be required to perform adequate O&M procedures? Consider the daily, weekly, monthly, and yearly requirements.

- What types of valves and gates are required to operate the facility? What is the repair schedule? What type(s) of specialized maintenance is required?

- What types of instrumentation are required to effectively operate the facility? What is the level of sophistication, repair, and replacement? Can these units be purchased locally within Poland?

- What types of pumping are required by the system:

  - Centrifugal (dry pit or wet pit)?
  - Submersible?
  - Rotary positive or rotary lobe?
  - Progressive cavity?
  - Axial flow or torque flow?
  - Direct drive or gear-box drive?
  - Constant speed or variable speed?

  How complex are the O&M requirements for the type of pump required?

- How are screenings removed/disposed? How is malfunctioning equipment removed from service if equipment is below ground level?

- Are there special requirements for construction installation? (for example, specialized cranes, well points for dewatering, etc.)

- What are the plans for construction phasing?

- Evaluate the requirements of emergency power generation.

- What types and grades of oils and lubricants are used? Are these compatible with those available on the Polish market?

- If site visits are made, observe the coloration of the process conditions, and the clarity of the effluent. If the aeration section is blackish instead of a brownish color than the process is at fault. Likewise, if the effluent is murky instead of clear (with no visible solids) then the process is at fault.

Weighted-Sum Method for Quantitative Evaluation of Bids

The following are the proposed technical criteria:

I Compliance with the set specifications (population equivalent, staging, comprehensiveness, etc.)
II Flexibility (possibility of aeration process overload, modularity)
III Technological simplicity (dosage of chemicals, liability to mechanical failure, sensitivity, etc.)
IV Sludge management (frequency of sludge removal, dewatering, utilization)
V Electrical power requirements (kWh/m^3, cost of power, maximum cutoff time)
VI Special construction requirements (cranes, well points, insulation)
VII O&M complexity (day-to-day operation, maintenance, service, safety)
VIII Measurements and monitoring (automatic control and measurements, laboratory, flow)
IX Reliability and professionalism of designers and building contractors (references, financial standing, capacity)

Each of these criteria is given a weighting coefficient on a scale from 0 to 10, based on the gmina's interest.

Each submitted bid proposal is evaluated for each of these criteria on a scale from, say, 0 to 10. The values are multiplied by the weighting factors and the products are added up. The proposals that have the highest scores are selected for further economic analysis.

55

APPENDIX D

Miedźna Contract Issues

APPENDIX D

Miedźna Contract Issues

- Third-party purchases
  - Implementation completed prior to final approval

- Final design report
  - Approval based on review
  - Performance design - purchase
  - Technical support responsibility
  - Performance efficiency

- Technical support service - purchase obligation
  - zł 6.0 million ($375,000) per month

- Start-up and training, O&M manuals - timetables

- Schedule of payments - letter of credit

- Importation, transport schedule, and temporary *force majeure*

- Field personnel and temporary office

- Warranty responsibilities and notices of defect
  - International bills of lading - OWNER
  - Disclaimers
  - Design performance
  - Parts: terms and assigns
  - Start-up sampling and waste disposal

- General settlements, technology ownership, expiration payment

- Missing references in Final Provisions

- Amendments - Attachments - Language

- Reliability of the manufacturer, the service organization, and the general contractor and subcontractors

51

APPENDIX E

Policy Issues Regarding Privatization of the KWK Czeczott Mine

APPENDIX E

Policy Issues Regarding Privatization of the KWK Czeczott Mine

- Will the gmina's administrative, managerial, and financial resources be affected by Czeczott's need to rehabilitate parts of their system pump stations and facilities?

- Does the gmina want to be involved in the development of Czeczott rehabilitation requirements? Can this situation be avoided if the mine is privatized?

- Is there easy access to the Czeczott WWTP for the Wola pump station force main or will design considerations and extra construction costs be required?

- Will the gmina be able to depend on the existing Czeczott WWTP laboratory for accurate and reliable sample testing in its effort to monitor its own WWTP discharges?

- Will Czeczott require the gmina to pay service charges based on its usage of a percentage of the mine's WWTP capacity?

- Can the gmina guarantee to limit effluent to sanitary waste only, as Czeczott has requested, if the section in Wola to be sewered by the gmina decides to build commercial properties in the future?

- Will the extra biological loads from the Wola community create additional process efficiency problems at the mine's WWTP? If so, what are the implications for the wastewater system?

- Can the proposed Wola pump station wetwell be designed to miss the peak flow periods at the Czeczott WWTP?

APPENDIX F

System Design Considerations

APPENDIX F

System Design Considerations

Technical assistance review and evaluation of the gmina's approach to project implementation has identified a few considerations that must be addressed during the design phase:

- All pump station wetwell chambers should contain surge and overflow piping. Piping should be located at proper points of drainage.

- Pumps should be of the submersible type, and mounted well above the floor of the wetwell. This will reduce clogging of the pumps by accumulated sand.

- Pump alternator/controllers should be of simplistic design. On/off floats should be simple mercury-bulb float devices.

- WWTPs, whether lagoon process or otherwise, should contain sedimentation chambers which will prevent collection of unwanted heavier materials within the biological treatment process.

- Diffused aeration devices should be preferred over floating mechanical aeration.

- For post-aeration settling basins, the gmina should consider adequate and convenient methods for removing collected sludge.

- Adequate sludge storage facilities should be provided.

- For the segment of the population not supported by the proposed sewer systems, adequate methods for septic tank collection should be addressed.

- Standard sewer pipe sizes, lengths, diameters, and materials of manufacture will allow purchase in quantity to be more cost effective than if there are several innovative designs requiring specialized piping sections. Common types of piping will be easier and cheaper to maintain in the long run, reducing the need for expensive O&M routines.

- Design and construction of standard pump stations, piping, electrical controls, equipment, and wetwells will reduce overall capital costs.

  For example, six pump stations are needed to serve the gmina community: one station in Wola, two for Góra, one for Gilowice, and one each for Frydek and Grzawa. The stations located in Wola and Góra will be the same capacity because they will serve roughly equivalent populations. The same situation exists for Gilowice and Frydek, which require stations half the size of the ones in Wola and Góra. Grzawa requires a station half the size of the Gilowice and Frydek stations.

61

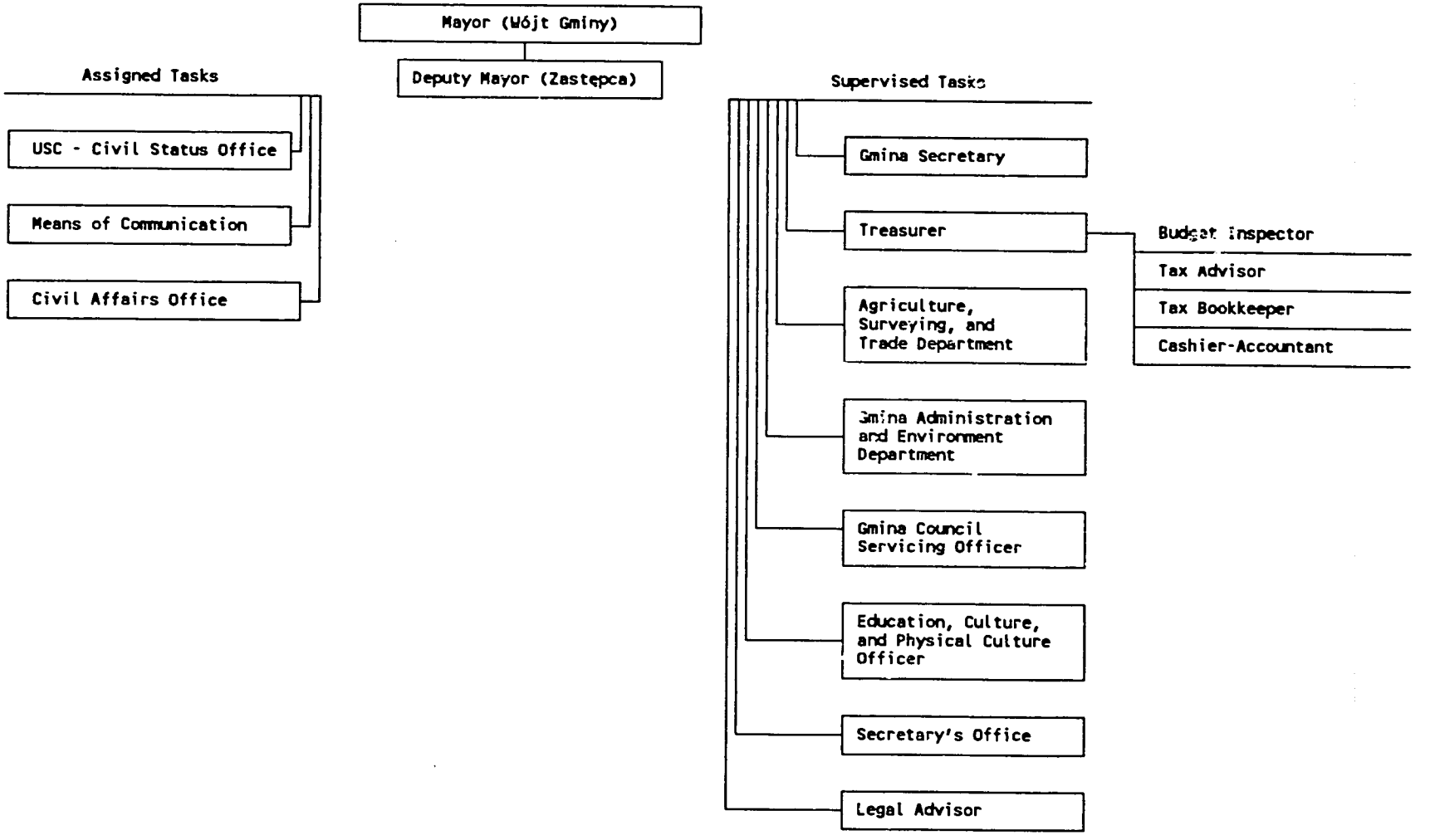
of Wola, Góra, Gilowice, and Frydek. In this manner, design fee costs are limited to one application rather than five separate designs. Construction costs are minimized because a contractor can install multiples of two or four units without significant impact to the overall cost.

Wastewater treatment plants can follow the same concept as described above. Since there is a need for only two WWTPs—one serving Grzawa, Miedźna, and Frydek and the other serving Góra and Gilowice—and since both areas will serve roughly the same numbers, component design is possible.

The Góra-Gilowice communities (with a population of approximately 3,031) are the largest, while the Grzawa-Miedźna-Frydek communities have about 2,656 residents. Assuming a design service life of 15 years, with a corresponding population growth rate of 3% for the same time period, each WWTP could be designed for a population equivalent to 3,200. This type of standard design will reduce overall costs.

APPENDIX G

Miedźna Management and Organizational Structure



(Stamped)
GMINA ADMINISTRATION
43-227 Miedźna
Katowice Voivodship

GMINA COUNCIL (RADA GMINY)

- legislature -

GMINA ADMINISTRATION (ZARZĄD GMINY)

- executive organ for CC -

MAYOR (WÓJT GMINY)

- President of Gmina Administration -

Village Administrator's Office

Village Assembly

- legislature -

Village Council and Administrator

- executive organ -

The Village Administrator's Office has no income of its own, so it applies for funds from the Gmina Council.

List of Subordinate Units:

- Education and Preschool Centers
- Health Service Center
- Welfare Help Center
- Community Center
- Public Library

(Stamped)

GMINA ADMINISTRATION
43-227 Miedźna
Katowice Voivodship

APPENDIX H

Miedźna Community Projects

APPENDIX H

Miedźna Community Projects

- Five primary schools (1948-1989)
- Road building started (after World War II)
- Rural electrification (late 1940s)
- First bus line to Pszczyna (1950s)
- Volunteer fire stations (1950-70s)
- Cultural centers in every village (1950-90s)
- Community telephones for each village (1960s)
- Paving of all roads (1960-70s)
- Regional water line traversing gmina (1968)
- Regional gas line crossing gmina (late 1960s)
- Streetlights (1960s-present)
- Community water distribution lines (1976-1990)
- Local water distribution system built (1976-1990)
- New or expanded preschools in every village (1980s)
- Sports Club (built with community donations on land donated by the mining company)
- Telephone trunk lines with international connections currently being installed into villages[1]

[1]2,000-line capacity replacing 60 phones in all villages and 200 phones in apartment blocks.