

SLOPE PROTECTION FOR MT. PICHINCHA

(EC-0143)

EXECUTIVE SUMMARY

BORROWER: Empresa Municipal de Alcantarillado y Agua Potable de Quito (EMAAP-Q)

GUARANTOR: Republic of Ecuador

EXECUTING AGENCY: The Empresa Municipal de Alcantarillado y Agua Potable de Quito and the Municipal Government of Quito

AMOUNT AND SOURCE:

IDB:	US\$20 million (OC)
Local counterpart:	US\$ 5 million
Total:	US\$25 million

**FINANCIAL
TERMS AND
CONDITIONS:**

Amortization period:	25 years
Disbursement period:	4 years
Interest rate:	Variable (IFF subsidy)
Inspection and supervision:	1.0%
Credit fee:	0.75%

OBJECTIVES: The principal purpose of the project is to control runoff, flooding and mudslides on the eastern slopes of Mt. Pichincha, a volcano which encroaches on part of the city of Quito. In addition, there will be improvements in the technical information on natural events occurring on the slopes and their impact on the city as a whole, as well as in the management of natural resources; "clean areas" will be created in the project area; integrated management will be developed in urban areas of the project; public awareness of appropriate farming practices and the role played by the project in alleviating environmental risks will be enhanced; and community participation in the environmental betterment of the region will be increased.

DESCRIPTION: The project is divided into two subprograms: Subprogram I - Protection Systems, and Subprogram II - Complementary Community Measures. The components of Subprogram I are (i) infrastructure for water regulation and mudslide control; (ii) natural resource management and runoff control; (iii) hydrometeorological and landslip monitoring; and (iv) repair of sewers in the level area. The components of the second subprogram are (i) solid waste management; (ii) community

training and public information campaigns; and (iii) strengthening of municipal management and urban planning.

The proceeds of the financing will be used to set up a Pichincha Slopes Executing Unit. During the project, this Executing Unit will: (i) coordinate operations between the DMQ, EMAAP-Q and the Municipal Street Cleaning Enterprise (EMASEO); (ii) provide technical support for the development of policies and measures for slope management in urban and rural areas, and direct the procurement and contracting processes, request loan disbursements, maintain records, write the reports called for in the contract, and ensure that the goals of the project are achieved.

**ENVIRONMENTAL
CLASSIFICATION:**

The Environment Committee, at its meeting of April 9, 1996, classified this as a Category III operation.

BENEFITS:

Through the measures to be carried out in different sectors, the project will provide the overall benefit of mitigating the risk of floods and landslips on slopes, whose impact is felt throughout the city and not just by people living on the slopes. The specific components will contribute the following benefits:

Water regulation infrastructure. The project will completely avert damage from floods and mudslips with a frequency of recurrence of up to 50 years, and reduce the damage from more infrequent events. The project should avert all flooding in the 50-year flood plain and the flooding from more serious events occurring at greater intervals will be contained in smaller areas and will not be as deep.

Natural resource management and runoff control. The plant cover will be improved on 3,555 hectares, or 58% of the area studied. Information will be disseminated on options for extensive livestock management and slash and burn practices on upland meadows and in secondary forest and plantation areas. The adoption of soil conservation practices will be promoted on 131 hectares planted with single crops, and infiltration pits and ditches on 112 hectares, and live pasture barriers will be established.

Hydrometeorological and landslide monitoring. This component will improve information on meteorology, hydrology, silting, and morphodynamic processes for

increased understanding of stability problems, and will eventually help generate a warning system.

Repair of sewers in the level area. This component will improve hydraulic conditions and safety of the system of main and secondary sewers in the area of direct influence. Emergency repairs and preventive maintenance will be done on 16 interceptors in the main and secondary sewer network.

Solid waste management. Household solid waste collection services will be established in all low-income neighborhoods on the slopes by setting up microenterprises operated by residents of these communities.

Community training and public information campaigns. This component is targeted at the people connected with the project in the areas of natural resource management, soil use control, and waste management.

Strengthening of municipal management and urban planning. This component will support the municipal governments with the development of an urban planning system with policies, mechanisms, and the preparation of investments that take cognizance of environmental realities on the slopes and also the social pressures being felt in the area.

RISKS:

Population growth in the area. To maximize the effects of the project, the size of the population in the area and the present rural land uses must be maintained. Because of the growing demand for low-cost housing in Quito and the current municipal government's practice of granting easements for unzoned construction, there is a risk of uncontrolled population growth on the slopes.

The project has a component for bringing about consistent management of the Pichincha slopes by the municipal government. There will also be an investigation into the mechanisms for illegal purchase and sale of property in the area, and possible mechanisms to discourage this illegal practice will be proposed.

Possible delays in implementation of the resettlement plan. The commencement and execution of the project may be delayed by legal procedures in the country given the prior procedures required for acquisition of land located at the construction site.

Natural events. As in all projects concerned with the control or mitigation of natural processes, whose effects in the present case are aggravated by human activity, there is some risk and uncertainty associated with the random nature of some of the processes and the difficulty of controlling the behavior of local residents.

The area is geomorphologically fragile, especially because of the characteristics of the geological formations, which are prone to (i) avalanches on a catastrophic scale in the rainy season, and (ii) landslips from overhanging escarpments. An attempt will be made to mitigate these eminently natural processes by watershed management measures and small stabilization works, and intense watch will be kept to detect their impending occurrence.

With 100-year rainfalls, there is a high probability of large-scale mudslides, whose effects could exceed those of a 1,000-year flood. Without the project, the area threatened in this way would be 1,130 hectares, which would be reduced to 495 hectares in a situation with the project. This effect would be mitigated by mudflow control structures to be constructed.

There is always the risk of an unusual event undermining the stability of the proposed structures, which could set off a chain reaction with serious consequences. This possibility has been taken into account in the design of the structures, and spillways have been designed to take the excess amounts of water resulting from a 1,000-year flood and their stability in such unusual events has been verified. The monitoring system is designed to detect in advance the presence of conditions causing an event of such magnitude. As an additional safeguard, calculations were based on the assumption that the existing sewers will be functioning at only 60% of capacity.

**THE BANK'S
COUNTRY AND
SECTOR STRATEGY:**

In the Bank's current strategy for the 1994-1997 period, the aim of promoting economic efficiency is supported by the adoption of macroeconomic and sector reforms, stepping up the pace of social progress in the country, and promoting measures and programs for control and preservation of the environment.

POVERTY TARGETING:

Since this operation is directed at improving the environment, the project is not intended to resolve problems of poverty in Ecuador. The proportion of the beneficiary population below the poverty line in

the project area is only 5 points above the poverty index for Ecuador as a whole.

**PROCUREMENT
CEILINGS:**

International competitive bidding will be mandatory for procurement valued at more than US\$250,000 in the case of goods and services. Prequalification by international invitation will be used for works valued at above US\$1 million.

**SPECIAL
CONTRACTUAL
CONDITIONS:**

Conditions precedent to the first disbursement: As conditions precedent to the first disbursement the borrower will present:

1. The agreement signed with the DMQ, which must establish (i) the rights and obligations of the parties for execution of Subprogram II, and (ii) the resources to be put up by the DMQ as the local counterpart for the program (see paragraph 3.1)
2. The agreement signed between the DMQ and EMASEO, which must establish the rights and obligations of the parties for execution of the solid waste management component of Subprogram II (see paragraph 3.11).
3. Evidence that the Executing Unit has been established and is fully staffed, and equipped with the facilities previously agreed upon with the Bank (see paragraph 3.3).
4. Evidence that the Project Coordination Committee has been set up and is functioning (see paragraph 3.2).

Other conditions:

In addition to the usual contractual conditions, the borrower must present:

1. Before commencement of the works, evidence that the resettlement plan previously approved by the Bank has been completed (see paragraph 3.15).
2. Two mid-term evaluations of the program, one after 18 months and the other after 36 months (see paragraph 3.33).
3. Four months prior to the deadline for the second mid-term evaluation of the project, the municipal reform plan must be presented to the Municipal Council of the DMQ. This plan shall include information on the actions, structure,

organization, legislative reforms, and schedule proposed for implementing the municipal reform as a result of the activities provided for in the component for strengthening municipal management and urban planning under subprogram II (supplementary community actions) (see paragraph 3.34).

4. The Bank may recognize as part of the local counterpart contribution the expenditures established in paragraph 3.24 and incurred up to 18 months prior to approval of the loan.

**STANDARD
CONDITIONS:**

The loan contract will contain the Bank's standard clauses on rates, progress reports, bidding and procurement, supervision, maintenance, evaluation and financial statements.

**STANDARD
PROCEDURE:**

In accordance with Section 2(a), Part III, of the Regulations of the Board of Executive Directors, this operation is hereby submitted to the Committee of the Whole for consideration.

I. BACKGROUND

A. Flooding in northwestern Quito

- 1.1 The slopes of Pichincha volcano lie within the limits of Metropolitan Quito, to the west of Avenida Occidental, between that avenue and the summit of the mountain, and between Miraflores creek to the south and El Rancho creek to the north of the city. The area in question covers about 6,142 hectares, of which 1,714 hectares are built up. Geomorphologically the slopes are highly fragile which together with the environmental problems and conflicts that arise cause periodic floods and mudslides in areas east of Avenida Occidental, causing losses of property and human lives, and frequent disruptions of traffic. Fifty-year floods affect an area of about 585 hectares, and 100-year floods about 1,130 hectares. The population affected by floods and mudslides lives in the flat area of the city. All these areas are in established neighborhoods.

1. Physical risk

- 1.2 Floods, mudslides and erosion are caused by a combination of natural phenomena and the activities of residents in the area. On the one hand, the slopes of Mt. Pichincha are steep and cut by many creeks (32 creeks over a distance of about 14 km), the soil is predominantly of volcanic origin, naturally unstable, and subject to a hydrologic regime that, despite an annual rainfall of less than 1,400 mm, produces heavy downpours at certain times of the year.
- 1.3 These natural phenomena are aggravated by the activities of the residents. The activities of farmers and dwellers in the upper reaches of the catchments and the small roads and water channels built without the proper safeguards have brought about changes in the plant cover. Hydrologic events are aggravated by urban spread in the low-lying areas, often without necessary urban works and without trash collection services, and, lastly, the drainage system in the flat area is very limited in its capacity to absorb water and mud, having been designed to handle low discharges of water.

2. Misuse of soils in suburban areas

- 1.4 According to the classification of potential soil use, about 24.5% of the soils in the area should be used for preservation of the natural vegetation for wildlife, 34% of them is recommended for forest use and the remaining 41.5% for use as forest and pastureland under special management. These recommendations are violated by the uses now made of these soils, as only 22.5% of the area is wooded; 28.5% is covered by alpine vegetation, 12.5% by scrub, and 22.5% is urbanized. The remainder consists of natural and artificial pastureland, crops and undifferentiated vegetation.

- 1.5 These present uses in the stated proportions represent farming activities, especially the growing of single crops, livestock production on cultivated and natural pastureland, areas of coarse grasses and alpine vegetation; eucalyptus plantations and natural secondary-growth pine forests in small areas and along the gullies of creeks; and urban settlements associated with crop-growing, livestock raising and brick-making. The activities associated with illegal settlement are the clear-cutting of forests, removal of plant cover and excavation for the erection of structures and laying of access roads, which significantly enhances the potential for erosion by leaving an easily eroded soil unprotected.
- 1.6 In consequence, the suburban areas and the upper reaches of the river catchments enclose areas of risk from human and geomorphological action, as follows: (i) lands subject to both sheet and furrow erosion, in some case producing gullies, because of mismanagement of soils and surface runoff in areas under single crops and cattle pastures, and (ii) the urban and urban-growth area, comprising 1,714 hectares, which poses perhaps the most critical problem in the area of study, since not only are areas being urbanized that are unsafe for settlement, but other activities are being engaged in that heighten the risks.
- 1.7 Some of the factors that have aggravated the environmental problems are (i) the disappearance of the natural forests, (ii) degradation of the natural alpine vegetation, (iii) diminished protective capacity of the forest plantations, (iv) forest fires and slash and burn practices, (v) the construction of roads without regard for technical specifications, (vi) cultivation of single crops without soil preservation measures, (vii) mismanagement of artificial pastureland, and (viii) mismanagement of water.

3. Problems generated in the urban area

- 1.8 The 1990 census 1/ found on the slopes a total of 59 neighborhoods with about 55,000 inhabitants. Owing to the informal nature of many of these settlements, there is no reliable knowledge of their growth rate, but it is thought to be high. In socioeconomic terms there are settlements of four types:
- a. Old settlements, which are consolidated neighborhoods in which houses are provided with services, and in which civic organizations are present.
 - b. Recently established urban districts and settlements, predominantly of the upper middle class, with all services and little or no organizational cohesion.

1/ In the more remote, lowest-income areas, where migration patterns are fairly dynamic, the figures shown in the census do not necessarily reflect the situation today.

- c. The traditional popular settlements, consisting of farmers and persons engaging in construction. These do not always have legal standing, but they do have water supply, sewerage and trash removal services provided by the municipal enterprises. These settlements were initially granted as urban-rural lots of up to 2,500 m² whose subsequent subdivision greatly increased the population density.
 - d. Settlements now being formed through migration from the countryside and other parts of the city, by settlers who either live as squatters or take up residence in unauthorized dwellings. These communities lack basic services although some are in the process of obtaining some form of service through repeated demands to the municipal government.
- 1.9 This settlement has not only generated the environmental problems typical of these areas, but have also affected the magnitude of the flooding and mudslips, creating problems of slope stability.
- 1.10 In preparing the project, estimates were made of the impact of urban growth on the magnitude of the floods, and it was concluded from the simulations for two river catchment areas that a doubling of the urbanized area would cause the peak discharges to rise from 8% to 10%, with damage increasing in a similar proportion. Moreover, the coverage of trash collection in these areas (63%) and the disposal of refuse in creeks and vacant land (30%) give rise to clogging and breakdowns of the slope stormwater drainage system in addition to bringing health problems in their train.

B. Institutional action

- 1.11 The DMQ is governed by the Municipalities Charter and the Charter of the Metropolitan District. Though the latter charter takes an important step forward in improving the flexibility of regulatory practice and streamlining municipal management, important legal and institutional restrictions continue to weigh on the implementation of policies and generate distortions in the decision-making process.

1. Lack of institutional coordination

- 1.12 As now organized, the Municipal Government of the Quito Metropolitan District (DMQ) provides no clear assignment of responsibilities for integrated management of the Pichincha slopes. Though there are units with functions bearing on slope management, there is no system for consultation or procedures to promote coordinated action for dealing with the specific problems in the area. The responsibilities for urban development planning and environmental management are in the General Directorate for Planning (DGP), but program and project formulation for the execution of those strategies is divided among the different sector operating units and the

municipal enterprises, which have serious problems of coordination among themselves.

2. Ineffective public action

- 1.13 The mechanisms for action and control used by the DMQ for the implementation of its development strategies have been inadequate. According to the Law on the Metropolitan District, enacted in December 1993, the DMQ is solely and exclusively responsible for regulation of land use and occupancy. The law includes a broad mandate to issue and enforce environmental regulations. However, neither the legislation nor its implementing mechanisms have had any effect, and there are no economic instruments for promoting the rational use of resources and increasing the efficiency and coverage of basic services.
- 1.14 Though the Planning Directorate has a technical staff, up-to-date maps and a knowledge of settlement patterns on the slopes, there is no policy or mechanism for improving the operation of the land market and the impact of the different regulations or the mechanisms for applying them. There is no clear strategy for enforcing the construction and soil management codes, and no overall vision of the slope problems in the context of the overall development of the city.

3. Inequitable application of zoning regulations

- 1.15 The municipal government does have zoning ordinances and regulations to control illegal land use, but they have been inequitably applied, exceptions having been granted for the construction of apartment buildings and shopping centers. Police surveillance in areas illegally (without exceptions) occupied has been intensified, which together with the repossession of illegally purchased land has punished only the buyers, and not the sellers of subdivided land, which has in turn had an impact on low-income families.

C. The Bank's strategy in Ecuador

- 1.16 The Bank's present strategy for Ecuador supports the aims of promoting economic efficiency through macroeconomic and sector reforms, expediting social progress in the country, and favoring measures and programs for control and preservation of the environment. The proposed project reflects the objectives of control and preservation of natural resources in the city of Quito.

D. IDB participation in the urban development of Quito

- 1.17 At present the Bank has two projects under way exclusively for the development of Quito: Quito water supply and sewerage, in the amount of US\$136 million (823/OC-EC), and historical downtown Quito, in the amount of US\$41 million (822/OC-EC), both approved in September 1994. In addition, the Social Fund Program (819/OC-EC

and 928/SF-EC) for a total of US\$30 million, is financing a significant amount of small social investments in the metropolitan area of Quito.

E. Design of the project

- 1.18 The drainage works for the Pichincha slopes were originally part of the Quito water supply and sewerage project (823/OC-EC), approved in September 1994. However, in the course of preparing that project it was found that the Pichincha slopes could not be considered in the context of drainage works alone. Accordingly, the two projects were separated and the studies which would take longer were continued.
- 1.19 As previously indicated, the characteristics of the problem call for additional measures that take account of the fragility of the slope environment, its complex, dynamic socioeconomic characteristics, and the challenges facing the municipal government in coordinating its responsibilities in the area.
- 1.20 The project presented in this document includes, in addition to the water regulation and mudflow control infrastructure works, several measures to improve the consistency of municipal action in the area through institutional strengthening, natural resource management programs, and the expansion of solid waste collection services in low-income areas.
- 1.21 Flood control will be provided by building a hydraulic infrastructure designed for a 50-year flood. In addition, measures will be included to solve problems of soil erosion and misuse of land in suburban areas around the city by engaging in extension work and building small civil works. In the urban areas of the project, environmental awareness campaigns will heighten the public understanding of the fragility of the area and make the community more disposed to cooperate toward attaining the objectives of the project.
- 1.22 Since the lack of solid waste collection in some areas could make the proposed drainage system ineffective, dealing with this problem is essential for the project to have an impact. Hence, during preparation of the program and as a result of inquiries in the community and other preparation work, the Municipal government hired a microenterprise that already collects solid waste periodically in low-income neighborhoods where that service had not previously been provided. The project will support the establishment and training of three more microenterprises, which will obtain from a local commercial bank the credit they need for their initial investments, with the backing of the Municipal government. The intent of this component is to have regular collection of solid waste in the area by the conclusion of the project, thereby generating a source of income for the low-income population.

- 1.23 As part of the preparation for the project, the population concerned was consulted on the scope and impact of the project in order to learn their views. To do this three community workshops were held and attended by 45 persons representing barrio/neighborhood organizations, the Quito Metropolitan Municipal Government, the EMAAP-Q, the Directorate for Civil Defense, and IDB consultants and staff members. The principal conclusion of the three workshops was that the problems of slope management are complex, and subject to many externalities. There is evidence of overlapping, duplicative and uncoordinated measures, with the resulting squandering of material, human and monetary resources. Hence, though the solution to the municipal administration problems is a long-term affair, the project will facilitate the study of proposals for working plans of action and legal instruments that allow the adoption of a coherent policy on the regulation and management of the Pichincha slopes.

II. THE PROJECT

A. Purpose

- 2.1 The principal purpose of the project is to control the flooding and mudflows which occur on the eastern slopes of Pichincha volcano, and affect part of the city of Quito.

B. Description of the project

1. Subprogram I - protection systems

- 2.2 This subprogram comprises the construction of a system of drainage and sewerage works to reduce the risk of flooding and landslips on the slopes.

a. Infrastructure for water regulation and mudflow control

- 2.3 The works and activities of this component will provide for regulation of water flow upstream from Avenida Occidental, with a discharge volume that can be evacuated, with an acceptable degree of safety, by the existing sewers. The works have been designed to meet the standard for a 50-year flood.
- 2.4 The subprogram calls specifically for the construction of 31 mud embankments, 13 regulating reservoirs along the stream, 4 regulating reservoirs away from the stream, 21 sewer inlets with minor regulating reservoirs, and 7 diversion works (4 tunnels and 3 channels). In addition, there will be stream bed protection works in the area around the reservoirs where the slopes have to be shaped and stabilized, the vegetation cleared, and the hydraulic structures protected, as well as a program for operation and maintenance of the proposed hydraulic system, which includes periodic cleaning of the reservoirs and withdrawal of the material that builds up after any event of magnitude.
- 2.5 The mud embankments are containment structures built of cyclopean concrete or steel rails embedded in the stream beds to hold back mud, stones and trees that flow down from the upper reaches of the creeks. The heights of the embankments range from 2.5 m to 7 m. Most of them are small, with concrete volumes of less than 1,500 m³, and their retention capacity ranges between 1,000 m³ and 21,000 m³, for a total capacity of about 100,000 m³.
- 2.6 The regulating reservoirs will be built in or outside the stream bed depending on the topography and mechanical properties of the soil in each site. The reservoirs are formed by earth, rolled concrete, and reinforced concrete dams. The combined storage capacity of these reservoirs will be about 600,000 m³. Each

structure will include spillways capable of evacuating a 1,000-year flood. The dam heights range between 4 m and 17 m.

- 2.7 The sewer inlets will be in the form of inflow towers of reinforced concrete to prevent the entry of coarse materials and to regulate the rate of inflow. They will also have inspection wells and several entrance levels protected by removable grills for ease of maintenance.
- 2.8 The tunnels and channels carry the discharges from one interconnected work to another. It is estimated that 1,039 linear meters of tunnel and 785 linear meters of trapezoidal channel will be built.

b. Natural resource management and runoff control

- 2.9 This component comprises several works for runoff control and activities in support of natural resource management by residents on the outskirts of the city.

(i) Minor works

- 2.10 The works of this component will be small civil works for the control of erosion - sheet, furrow, gully, regressive ("remontante") - caused by runoff and poor soil use and soil mismanagement, and structures for the protection of roads and irrigation ditches.
- 2.11 The works include 15,800 m of intersecting irrigation ditches, 22,650 m of gutters, 15,850 m of intercepting ditches, 4,800 m of chutes, 6 intake works, and 121 special works such as gutters, sewers, street crossings, and drains.

(ii) Supporting activities

- 2.12 The supporting activities consist of extension work to encourage farmers, cattlemen and woodcutters in the suburban area to take up practices and execute minor works for soil conservation and plant cover management. These activities are (1) the dissemination of information on alternatives for extensive animal husbandry and slash and burn practices in alpine meadows, secondary forest growth, and plantations in an area estimated at 3,555 hectares, or 58% of the rural area; (2) promotion of soil conservation practices on 131 hectares of land under single crops, and the establishment of infiltration ditches and pasture barriers on 112 hectares; (3) technical assistance to cattlemen to improve their grazing management and rotation practices (742 hectares) to ensure pasture regeneration and avert erosion; (4) technical assistance to woodcutters in establishing forest management plans and improving their forest utilization systems in order to reduce the harmful effects of cutting and transporting the wood they take, and (5) the organization and training of cattlemen and the laborers on small and large landholdings and other persons employed in rural pursuits

in the area considered in the use of fire and its consequences and the need to preserve the alpine meadows.

c. Hydrometeorological and landslip monitoring

- 2.13 This component will set up a hydrometeorological network of 33 weather stations and 6 complementary hydrological stations to obtain basic information on rainfall, discharge volumes and sedimentation in the project area with which to predict and provide early warning on mass movements on the Pichincha slopes, and to draw detailed risk-level maps. It includes the construction of facilities and acquisition of equipment, field measurements of liquids and solids, and studies of soil hydrodynamics and surface erosion in three representative catchments (Rumipamba, Rumiurco and Grande creeks).

d. Repair of sewers

- 2.14 This component includes emergency repairs to, and the preventive maintenance of, 16 interceptors in the principal and secondary sewer drains between Miraflores and Atucucho creeks. These repairs will consist of the improvement of impoundment works, the clearing of bottlenecks, reinforcement of walls, arches and outflow works, and other works in inspection wells.

2. Subprogram II - complementary community actions

- 2.15 This subprogram is designed to enhance the effectiveness of the project works, and has three components: solid waste management, community training and public information on the project activities, and the strengthening of municipal management and urban planning.

a. Solid waste management

- 2.16 This component comprises preinvestment activities and training for the microentrepreneurs who will set up businesses for the collection and disposal of solid wastes on the Pichincha slopes. As part of the entrepreneurial training, technical assistance will be provided to the members of the microenterprise in its first year of operation in the areas of business management, financial management, group dynamics, and solid waste management, including the calibration of routes and training in recycling.
- 2.17 The preinvestment studies consist of a barrio census to determine the population served by the microenterprises and generate a customer population large enough for the microenterprises to turn a profit; a study of the volume and composition of the barrio's solid wastes to arrive at parameters that can serve as a basis for the requirements for the sizing, formation and start-up of a microenterprise and ensure that it is technically and financially feasible,

and community organization work to promote the formation of microenterprises.

b. Community training and public information

- 2.18 This component is targeted at the actors associated with the project (residents of neighborhoods on the slopes in northwestern Quito, the agencies and institutions involved in the process, and public opinion) and will cover three subjects: natural resource management, soil use control, and waste management.
- 2.19 This work will consist of seminars and workshops, recording and circulating videos and other audiovisual materials, preparation of radio programs and materials, and special events such as "mingas" (neighborhood projects), and mural and poster design competitions.
- 2.20 The aim is to reach home owners and tenants through local workshops and mingas. Institutional proprietors will be visited individually in the different neighborhoods and given newsletters, foldouts, booklets, and information meetings in the different areas. Audiovisual and radio broadcast materials will be used for general information and awareness building among the public.

c. Strengthening of municipal management and urban planning

- 2.21 The purpose of this component is to support the municipal government on the development of an urban planning system with policies, mechanisms and the preparation of investments that take into account the environmental realities on the slopes and the social pressures in the area.
- 2.22 For the improvement of urban policy, policies and mechanisms will be studied and worked out (i) to reduce illegal settlement on the slopes, and (ii) to stop illegal subdivision of the land.
- 2.23 Prefeasibility studies will be done for investment projects in areas already urbanized, and the identification of areas of potential risk and plans for the resettlement of the inhabitants. The studies will correspond to the profiles that are part of the Northwest Pichincha Slopes Plan recently drawn up by the Planning Department of the Municipal government.
- 2.24 Lastly, a series of measures will be designed to consolidate the planning, regulation and framing of policies on land management, urban settlement, and urban investment, and the functions of the municipal government in relation to the Pichincha slopes. This plan could serve as model for the city's other geographical areas.

C. Cost and financing

- 2.25 The total cost of the program is estimated at the equivalent of US\$25 million, of which the Bank would finance US\$20 million from

the ordinary capital resources, with financing from the Intermediate Financing Facility, and US\$5 million will be funded locally. The following table shows the investment categories by component and source of financing.

COST AND FINANCING
(US\$ thousands)

	IDB	LOCAL COUNTERPART	TOTAL	%
I. Engineering and administration	1,457	1,427	2,884	11.5
1.1 Supervision	957	6	963	3.9
1.2 Executing unit	500	273	773	3.1
1.3 Additional personnel	0	1,148	1,148	4.6
II. Direct costs	13,782	1,862	15,644	62.6
2.1 Subprogram I — protection systems				
2.1.1 Water regulation infrastructure works	10,479	1,620	12,099	48.4
2.1.2 Sewer repair	585	79	664	2.7
2.1.3 Natural resource management and runoff control	1,166	110	1,276	5.1
2.1.4 Hydrometric and mudslip monitoring	1,239	0	1,239	5.0
2.2 Subprogram II				
2.2.1 Solid waste management	66	53	119	0.5
2.2.2 Training and environmental education	247	0	247	1.0
III. Concurrent costs	500	872	1,372	5.5
3.1 Studies: strengthening of municipal management	500	50	550	2.2
3.2 Lands	0	822	822	3.3
IV. Unallocated	2,539	604	3,143	12.6
4.1 Contingencies	1,354	294	1,648	6.6
4.2 Escalation	1,185	310	1,495	6.0
V. Finance charges	1,722	235	1,957	7.8
5.1 Interest	1,522	0	1,522	6.1
5.2 Credit fee	0	235	235	0.9
5.3 Inspection and supervision	200	0	200	0.8
TOTAL INVESTMENT	20,000	5,000	25,000	100.0

- a. Engineering and administration (US\$2,884,000). This category (11.5% of the total cost) comprises the cost of the Executing Unit, in the EMAAP-Q, and the costs of the firm supervising the works.
- b. Direct costs (US\$15,644,000). This category (62.6% of the total cost) includes the direct costs of the following components:

- (i) The infrastructure for water regulation and mudflow control (US\$12,099,000). Financing will be provided for the construction of civil works and improvements (US\$12,074,000), and studies and complementary designs of mud embankments (US\$25,000).
 - (ii) Sewer repairs (US\$664,000). Works and improvements (US\$585,000) and maintenance of these works during project execution (US\$79,000) will be financed.
 - (iii) Natural resource management and runoff control (US\$1,276,000). Financing for works and improvements (US\$1,064,000), and vehicles (US\$30,000), as well as for outreach activities (US\$182,000).
 - (iv) Hydrometeorological and mudslip monitoring (US\$695,000). Facilities (US\$75,000) and machinery and equipment (US\$620,000) will be financed.
 - (v) Solid waste management (US\$119,000). This amount corresponds to guarantees to be used by the Municipality against credits granted by a commercial bank to microenterprises. Financing will be provided for machinery and equipment (US\$53,000), microentrepreneurial training (US\$48,000), and office equipment for start up of the microenterprises, preinvestment studies (US\$18,000).
 - (vi) Community training and public information (US\$247,000). Community courses and seminars will be financed.
- c. Concurrent costs (US\$1,372,000). This category (5.5% of the total cost) includes:
- (i) Purchase of land on which the works will be done (US\$822,000).
 - (ii) Strengthening of municipal management. The studies and plans of action (US\$500,000) and aerial photography for monitoring of population growth on the slopes (US\$50,000).
- d. Unallocated (US\$3,143,000). This category (12.6% of the total cost) comprises (a) contingencies (US\$1,648,000), and (b) escalation (US\$1,495,000).
- e. Finance charges (US\$1,957,000). This category (US\$7.8% of the total cost) comprises interest on IFF conditions, which will accrue during the project execution period (US\$1,522,000), the credit fee on the loan (US\$235,000), and expenditures for inspection and supervision (US\$200,000).

D. The Bank's financing and the local contribution

- 2.26 The Bank will finance 80% of the total cost of the project and the local contribution will be 20%. Of the local contribution, EMAAP-Q will put up the equivalent of US\$4,500,000 and the DMQ the equivalent of US\$500,000. The feasibility of the local contribution being provided on schedule is described in Chapter V.

III. EXECUTION OF THE PROJECT

A. Arrangement for execution

- 3.1 The executing agency for the project will be the Empresa Municipal de Agua Potable y Alcantarillado de Quito (Quito Municipal Sewerage and Drinking Water Supply Enterprise, or EMAAP-Q), through its executing agency. The Quito Municipal Government (DMQ) will be a subexecuting unit. These agencies will conform to the guidelines of the project coordinating committee. The Protection Systems subprogram will be executed by EMAAP-Q and the Community Actions subprogram by the Office of the Administrator of Quito Municipality. A signed agreement between EMAAP-Q and the DMQ will be a condition precedent to the first disbursement of the loan, and will include, among other aspects, the rights and obligations of both parties for the execution of subprogram II; for example the obligation of reimbursement to the borrower for financing of the subprogram, cost recovery mechanisms, and procedures for the implementation of the resettlement plan agreed upon with the Bank.

1. Project coordinating committee

- 3.2 The functions of this committee will be to supervise attainment of the goals of the project and to act to ensure that the project is executed on schedule. It will have four members: the General Manager of EMAAP-Q (the chairman), the General Administrator of Quito Municipality, the General Manager of the Municipal Street Cleaning Enterprise (EMASEO), and the Chief of the Project executing unit. As a condition precedent to the first disbursement, this committee must have been established and be functioning.

2. Executing unit

- 3.3 The executing unit of the Pichincha Slopes project will be the primary contact with the Bank during execution of the project. Its responsibilities will include coordinating operations among the Municipal government, EMAAP-Q and EMASEO; technical support for the development of policies and measures for management of the slopes in urban and rural areas; directing the procurement and hiring processes; requesting disbursements of the loan; carrying records and writing the reports required by the contract; and ensuring attainment of the project targets. As a condition precedent to the first disbursement, this executing unit must have been created and staffed.

B. Mechanisms for execution of the project

1. Subprogram I - protection systems

- 3.4 The construction of water regulation and mudflow control works will be contracted out to construction enterprises on the basis of international bidding operations. There will be one call for tenders with two groups of works: one group will comprise the works of what is referred to as zone 1 (El Rancho, San Antonio, La Grande, Singuna and Rumiurco creeks, which will have the largest works) and the other group of works in zones 2 to 8, comprising 27 creeks requiring relatively minor works. To supervise the construction of these works and the minor runoff works of the natural resource management component, an engineering firm will be engaged on the basis of an international competition.
- 3.5 The activities for natural resource management and runoff control will involve extension work to be done by a nongovernmental organization (NGO) of recognized experience, to be hired through local competitive bidding. The work to be done will be part of a land-use plan based on five categories of recommended use: (i) areas for wildlife and water bodies conservation work; (ii) areas for the development of natural resource protection (soils, forests and wildlife); (iii) areas for sustainable production activities; (iv) protection-production forest areas for forest production activities; and (v) areas for urban expansion.
- 3.6 Most of the natural resource management work will be for the improvement of simple cropping and forestry practices and techniques, and to instill a more environmentally friendly attitude in the suburban population. Most of the area in which these activities will be carried on are large properties, some of them belonging to the government, for which only technical assistance and monitoring are required to preserve the plant cover and control brush fires.
- 3.7 The small civil works for the control of erosion caused by runoff and misuse and mismanagement of the soil, provided for in the natural resource management component and consisting in structures for the protection of roads and ditches, will be carried out by small local contractors. To coordinate their execution it has been provided that the NGO to be engaged for this component will subcontract these works.
- 3.8 The construction of installations for the hydrometeorological network will be let on contract to local firms chosen through local shopping. The equipment for the network will be purchased in international competitive bidding. The technical assistance for installation of the mudslip monitoring network and for the studies will be provided under the existing agreement between EMAAP-Q, the National Institute of Meteorology and Hydrology (INAMHI) and the French Research Institute for Development and Cooperation (ORSTOM),

which has the experience required to provide this technical experience, in addition to which the advisory work complements the counseling being provided under the existing agreement. The enterprise will carry out the activities of the component with technical assistance under the agreement with ORSTON.

- 3.9 The sewer repair work will be done by local construction companies through local competitive bidding.

2. Subprogram II - community actions

- 3.10 For the solid waste component consultants will be engaged to take a census of the low-income barrios in the project area, which have no trash collection service, and estimates will be made of the waste generated in each of them. EMASEO will work out routes on the basis of this information, and will identify persons in the community whose records as workers and knowledge of the barrio will give them the expertise to operate a microenterprise for the management of solid waste. It is estimated that, in addition to the recently set up microenterprise, now in operation, three others will be needed and will be contracted by EMASEO to collect garbage along preestablished routes. The contract will serve as a guarantee for the loan to be made by an already identified local bank to finance the purchase of the equipment and the initial expenditures for start up of the microenterprise. In addition, a local enterprise will be engaged to train the microentrepreneurs in entrepreneurship and solid waste management and recycling.
- 3.11 The agreement to be signed between the Municipal government and EMASEO will establish the responsibilities of the latter in the solid waste management component. Some of these responsibilities are technical inputs for the training of the microentrepreneurs; determination of the solid waste collection routes; identification of the members of the microenterprise; a commitment to pay the microentrepreneurs promptly for the collection service; setting the price of the services, which will be per ton collected as weighed at the disposal site; inspection of the collection area assigned to each microenterprise with a local member of the federation of barrios; and participation in training courses on solid waste disposal in the community awareness-building work. This agreement must be presented to the Bank as a condition precedent to the first disbursement.
- 3.12 The community training in environmental matters and public information on the project will be carried out by an NGO or consulting firm, which will be contracted for a period of three years and will conduct the seminars and awareness-building campaigns and prepare the required materials. EMASEO, the municipal government and the specialist in urban development from the executing unit will participate actively in the training work.

- 3.13 A consulting firm will be contracted in an international competition to shape policies and plans of action for the institutional strengthening of the municipal government. This firm will also do the prefeasibility studies for investments under the Northwestern Pichincha Slopes Plan. By the end of the contract a plan of organizational and legislative action is expected to be ready for implementation. The plan must be submitted to the Bank and discussed in the monitoring missions.

C. Resettlement of the population displaced by the works

- 3.14 It has been determined that in the entire project area it will be necessary to expropriate 30 properties ranging in area from 63 m² (San Francisco de Rumiurco barrio) and 19,050 m² (Reservorio Quebrada Atucucho). The owners have been identified, with their respective title deeds, for 29 of these properties, and the owners of the remaining 1 property remain to be identified. In addition, homes have been built on 7 of these properties and 30 families that either own or rent will be affected.
- 3.15 The Municipal government and the EMAAP-Q submitted to the Bank the final plan for resettlement and compensation in keeping with the policy on involuntary resettlement, setting forth the guidelines, costs and timetable for execution. Compensation will be paid to the residents concerned for the entire area affected at the market value. Accordingly, at the borrower's request, the expropriation will be carried out in accordance with the resettlement plan and the Bank's policies on resettlement. In this regard, MDQ will sign a letter of agreement with the Bank in which MDQ commits to implementing the resettlement plan according to these guidelines. As a condition precedent to commencement of the water regulating works, the Bank will have to see evidence that the resettlement plan has been fully carried out as previously agreed.
- 3.16 At this writing EMAAP-Q and the Municipal government have identified the families involved and have discussed the terms of the negotiation on the basis of exchanges of their properties for lands of equal value or purchase thereof by EMAAP-Q. The cadastre and appraisal office of the Municipal government has reappraised the properties in order to determine their market value. Land to which the residents could move if they so wish has also been identified. According to the resettlement plan presented to the Bank, the deadline for the relocation of the families affected is July 1997.

D. Status of project preparation

1. Subprogram I - protection systems

- 3.17 EMAAP-Q has the designs, plans and specifications for all the works of the protection system. The bidding documents are ready and the terms of reference for the NGO that will be hired to handle the natural resource management component have been established. In

addition, the specifications of the equipment for the hydrometeorological monitoring network and the associated installations and the terms of reference of the consultancy for this component have been prepared, as are the specifications of the sewers to be repaired.

2. Subprogram II - community actions

- 3.18 Agreement has been reached on the terms of reference for the consultancies and NGOs to be contracted for the different components of this subprogram (solid waste, community training, and the strengthening of municipal management and urban planning).

E. Acquisitions of land

- 3.19 With the help of consultants, EMAAP-Q is negotiating for the purchase of lands on which to resettle the displaced families. EMAAP-Q has submitted to the Bank the resettlement plan with an execution timetable. In keeping with the Bank's policy, before issuing calls for bids on works, EMAAP-Q will have to demonstrate to the Bank that it holds legal title to the lands on which the works are to be constructed. The purchase price of the land is included in the project cost and will be financed out of counterpart funds.

F. Term for execution and investment schedule

- 3.20 The project will be executed in a period of four years. This term was arrived at following a detailed analysis of all of the components of the project, including the bidding periods, in light of the time these processes take in Ecuador.
- 3.21 Following is a summary of the project investment Schedule, with figures in equivalents of thousands of US dollars.

SOURCES OF FUNDS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	TOTAL	%
IDB LOAN	4,800	7,000	6,400	1,800	20,000	80
COUNTERPART	1,200	1,750	1,600	450	5,000	20
TOTAL	6,000	8,750	8,000	2,250	25,000	100
PERCENTAGES	24	35	32	9	100	

G. Procurement of goods and services and bidding timetable

- 3.22 In the purchase of goods and services and the contracting of works, the procedures stipulated in Annex B to the Loan Contract will be followed. International competitive bidding will be obligatory for purchases valued at more than US\$250,000 for goods and services and US\$1 million for construction works. For larger works prequalification by international invitation to bid will be used. The

bidding on amounts below these ceilings will follow the ad hoc precontractual conditions agreed upon by the national government and the Bank. Consulting services will be hired in accordance with the Bank's procedures.

- 3.23 Annex II presents a tentative timetable of the calls for bids and the estimated amounts involved.

H. Recognition of prior expenditures

- 3.24 EMAAP-Q has requested that expenditures incurred in preparing the project before approval of the loan be recognized as part of the local contribution. These expenditures have been incurred for: (i) a consultancy to review the designs for works (US\$20,000); (ii) a consultancy on the repair of sewers (US\$11,000); (iii) a consultancy to redesign three dams (US\$30,000), and (iv) expenditures in connection with the resettlement plan (up to US\$25,000). These expenditures were incurred under contracts that comply with the standards and procedures of the Bank. It is therefore recommended that a clause recognizing up to the equivalent of US\$86,000 in prior expenditures chargeable to the local contribution be written into the prospective loan contract.

I. Operation and maintenance

- 3.25 EMAAP-Q will be in charge of the administration, operation and maintenance of the works and equipment to be installed, which will be part of the systems under its responsibility. It has been determined that the executing agency has the personnel and resources needed to discharge these responsibilities.
- 3.26 The engineering works and reservoirs for the system must be operated and maintained by EMAAP-Q. In addition, these works require cleaning by procedures which, though simple, must be performed periodically after every major hydrologic event. EMAAP-Q will engage a private enterprise to remove and dispose of material deposited in the reservoirs.

J. Environmental impact

- 3.27 At its meeting of December 4, 1994, the Environment Committee classified this as a Category III operation, and the environmental summary was approved at the meeting of April 9, 1996.
- 3.28 The environmental summary concludes that, as a program conceived and designed to solve environmental problems and conflicts on the Pichincha slopes and to protect the city of Quito, its environmental effect is highly beneficial. The principal positive environmental impacts are protection of the infrastructure of the city of Quito, maintenance of the plant cover, control of erosion and reduction of transported sediment, heightening the environmental

awareness among the population, and promoting participation by the dwellers on the slopes in sound solid waste management practices.

- 3.29 The negative environmental impacts will be generated by the activities for construction and operation of the proposed engineering works to regulate discharge volumes and the control of mudflows. Most of these effects are temporary, fairly localized, and largely mitigable. Provision has been made in the engineering designs to diminish these impacts, and the construction and operation contracts will include conditions to minimize harmful effects.
- 3.30 The CMA has recommended the following measures, which have been included in the program:
- a. The provisions on monitoring must include explicit requirements for monitoring the implementation of mitigating measures and the progress of the resettlement, expropriation and compensation process.
 - b. For satisfactory execution of the project, mechanisms will have to be provided for participation by community representatives.

K. Monitoring of the project

- 3.31 During execution of the project, the Country Office in Ecuador, in collaboration with the project team, will be in charge of the Bank's supervision and monitoring.
- 3.32 During the execution period, two evaluations will be made, one 18 months and the other 36 months after the commencement of the project, with the participation of the project staff, the specialist at the Country Office, and the executing unit. These evaluations will be done to identify difficulties both in the construction of infrastructure and in the performance of the microenterprises. In addition, they will determine the progress made in implementing a plan of action that reflects the municipal reform proposals to be generated by the institutional strengthening component.
- 3.33 The mid-term evaluations will monitor implementation of the mitigation measures and progress in the expropriation and resettlement process. They will also evaluate attainment of the physical targets of the activities of the program relative to the annual plans. Attainment of the program's targets and goals will be reviewed, with emphasis on (i) the operation and functioning of the water regulating structures, (ii) the operation of the sewer system, (iii) the setting up of the hydrometeorological monitoring stations, (iv) the efficiency of the refuse collection microenterprises, (v) the degree of community acceptance and participation, (vi) the results of the studies and plans of action of the component for the strengthening of municipal management,

(vii) demographic growth on the slopes, and (viii) fulfillment of the resettlement plan.

- 3.34 Four months prior to the deadline for the second evaluation of the project, the municipal reform plan will be presented to the Municipal Council of the DMQ. This plan will be required to contain information on the actions, structure, organization, legislative reforms, and schedule proposed for implementing the municipal reform as a result of the activities provided for in the component for strengthening municipal management and urban planning under subprogram II.

IV. THE BORROWER AND EXECUTING AGENCY

A. The borrower, executing agency and guarantor

- 4.1 The borrower and executing agency for the project will be EMAAP-Q, with the participation of the DMQ in the development of Subprogram II (complementary community actions). The guarantor for the operation will be the Government of Ecuador.

B. EMAAP-Q - institutional aspects

1. Nature and legal basis

- 4.2 EMAAP-Q is an enterprise of the Municipal Government of the Quito Metropolitan District, and was constituted by Ordinance 3057 of December 8, 1993, published in Official Gazette on December 30, 1993, (No. 346). It came into existence by a merger of the municipal water supply and sewerage enterprises, in which the former water supply enterprise absorbed the fixed assets and long-term liabilities of the former sewerage enterprise and some of its personnel. In practical terms, the former water supply enterprise absorbed the old sewerage enterprise, which ceased to exist as a municipal enterprise.
- 4.3 The aforementioned establishing ordinance assigns to EMAAP-Q the principal purpose of providing drinking water supplies and sewerage services to all barrios and districts in the canton of Quito with a view to preserving the health of the inhabitants, caring for the ecological surroundings and preserving the canton's water sources. To accomplish this purpose EMAAP-Q must take charge of (i) the systems for the production and distribution of drinking water, (ii) the collection of rainwater, and (iii) the removal and treatment of sewage.
- 4.4 EMAAP-Q is an administratively autonomous legal entity with its own equity base. It operates on a commercial basis as a provider of a public service for which it charges a rate or price plus applicable surcharges. Its income consists primarily of (i) the revenue from supplying water and sewer service and the sale of rights to house connections for its services, and (ii) tax revenue. The expenses of the enterprise are incurred in its water supply and sewerage operations. The enterprise also has income and expenditures relating to contributions of capital from the national government and the financing it obtains on the domestic financial market and from international development agencies.
- 4.5 The service area of EMAAP-Q is the canton of Quito, which consists of the urban area of Quito (19 urban parishes) and 33 rural parishes. In 1995, this area had a total population of 1.6 million, of which 78% enjoyed water service and 71% sewerage service.

In the urban area alone these proportions were 83% and 79%, respectively.

2. Organizational structure and personnel

- 4.6 As a result of several institutional studies, a proposal for a basic organization and assignment of functions was drawn up and has already been implemented. The new organization attaches special importance to planning and development, construction of works, human resource development, and customer services.
- 4.7 In 1993 EMAAP-Q had a staff of 1,867 and served 181,894 connections – or 97 connections per employee. This excessively low employee-connection ratio was lowered still further by the absorption of 268 employees from the former sewerage enterprise. A reduction-in-force program, which resulted in the voluntary retirement of 500 employees, was completed with internal funding and contributions from the national government. On December 31, 1995, the enterprise had a staff of 1,612 employees and was serving 220,570 connections, for a ratio of 137 connections per employee. The reduction-in-force was successful but caused financial problems for the enterprise which are reflected in the profit-and-loss statement for 1995.

3. The accounting and financial system

- 4.8 EMAAP-Q has a computerized accounting and financial system that was custom designed by a consulting firm. The system has the capacity to supply the information needed to make and follow up on decisions in both its internal and external units. Hence the accounting and financial system is suited to the nature and functions of EMAAP-Q organized as an enterprise.
- 4.9 In its design this is an interactive, self-documenting, modular and integrated accounting and financial system for many users (with clearly defined user profiles and privileges). Operationally, it has the following features: (i) user-configurable options menu; (ii) on-line information input based on the defined rights; (iii) automatic accounting confirmation; (iv) generation of reports that can be exported to other systems; (v) retrieval of accounting information that can be imported and exported to and from other systems, and (vi) procedures for query, search and issuance of reports in compressed form.
- 4.10 The enterprise also has a structured chart of accounts and an accounting manual that sets forth the general characteristics of the code and chart of accounts and defines the basic financial statements and their characteristics.
- 4.11 Despite its flexibility, the quality of the accounting and financial information provided by the accounting system and the speed with which it is delivered have been disappointing.

Financial statements are not always issued monthly, and annual statements are delayed. In addition, information on operating expenditures, the development of management indicators, and internalization of the concept of a financial manager in the management offices cannot be provided in a timely manner at different levels of the enterprise.

- 4.12 One factor that hampers optimum operation of the financial accounting system is that it is wholly dependent on the auxiliary systems from which it draws its information (i.e., invoicing, staff, suppliers, inventory, fixed assets). Some of these systems experience operating problems while others fail to meet minimum requirements. The fixed asset reporting system, for instance, is one critical component that adds an element of doubt as to the reliability of the information contained in the financial accounting reports.
- 4.13 Loan 823/OC-EC, approved by the Bank in 1994, provides for consultancies to reorganize the financial and accounting area and appraise the fixed assets of the merged enterprise. Selection of the consultants to appraise the fixed assets is in the final stage. The consultants for the financial and accounting area have been engaged, and the training for the inventory personnel is in progress and is expected to be extended to the rest of the support services personnel. These measures are expected to substantially solve the aforementioned problems in the accounting and financial area.

4. Internal and external auditing

- 4.14 The enterprise has an adequate internal auditing system. There are qualified professional staff and manuals that spell out the methods and procedures for preliminary and special audits of the entity and its investment projects.
- 4.15 The financial statements of EMAAP-Q are certified by the Office of the Comptroller General of the Nation. Though it does excellent work, this entity leans toward audits of the public sector, and at certain management levels priority is not given to systems suited to the nature of an entity organized as an enterprise.

5. Rates

- 4.16 Ordinance 3057 creating the new unified enterprise empowers EMAAP-Q to set the water rates with a view to making the enterprise financially self-sufficient, by focusing on controlling long-term marginal costs and generating enough revenue to cover all of its expenses, including those of operations, maintenance, administration, depreciation, amortization and debt service, and to contribute to the financing of its expansion programs. These rate targets are consistent and compatible with the rate policies of the IDB.

- 4.17 As late as December 31, 1995, however, EMAAP-Q was still making rate adjustments according to the polynomial formula approved in Ordinance 2285 of 1983. This formula sets a direct price per cubic meter of water consumed based on the increase in the costs of labor, electric power, fuels, chemicals and fixed-asset depreciation.
- 4.18 A consultancy has drawn up a proposal to rationalize the rate-setting system of EMAAP-Q with a strategy of adjustments such that the rate will tend toward the long-term marginal cost and cover the operating costs, debt service, and provide a reasonable percentage for the financing of expansion. The plan of action proposed by the consultant to implement the changes proposed is scheduled to be launched in 1996, when the information systems needed for its implementation will be in place.
- 4.19 Regarding the sewer rate, Ordinance 3008 of May 12, 1993, sets a specific rate for sewer service based on water consumption, which was to rise to a maximum of 38.6% of the water rate in 1995. Although EMAAP-Q has been applying this rate, customer resistance to paying it has impaired the enterprise's collection efficiency.
- 4.20 At present, the revenue from water service and the tax revenues it receives are sufficient to cover operating costs, fixed asset depreciation (though these are understated), amortization, debt service, and part of its expansion costs.
- 4.21 The rates charged will be high enough to recover all the investment and maintenance costs of the components of the protection system to be built on the slopes. These rates are considered an appropriate way to recover those costs, as this project is part of an extensive investment program of EMAAP-Q, which is being financed by the IDB through loan 823/OC-EC, now in execution, and will benefit the entire city. The rates agreed upon between the IDB and EMAAP-Q for loan 823/OC-EC took into account the estimates of investment and maintenance costs of the slope protection program, and were verified by financial analysis.

C. Financial analysis

1. Profit-and-loss statements

- 4.22 The profit-and-loss statements in current sucres for the period 1992 to 1995 have been converted to constant sucres of 1995 and expressed in US dollars. These statements show positive results in each of the years considered except 1995, in which there is a deficit of US\$2,747,000. This is attributable to the negative effect of expenditures totaling US\$10,037,000 for the retirement of 500 employees. This was a one-time expenditure. Without it, 1995 would have been a banner year, with the enterprise earning a profit of US\$7,290,000. This outlay for the reduction-in-force will bring payroll costs down substantially in the years ahead.

- 4.23 Operating income has generally been less than operating expenditure, the former needing to be supplemented by tax revenues to make the profit-and-loss statements positive. Since 1993, however, operating expenses have been rising faster than operating income (without counting outlays for the reduction in force in 1995), signaling an improvement in productivity. Thus, whereas in 1993 total operating expenditures of US\$29,088,000 came to 118% of the operating income, in 1995 total operating expenditures (apart from the expenditure for the reduction in force) totaled US\$32,084,000, or 91% of operating income of US\$35,141; hence, in 1995 operating expenditures were less than operating income for the first time.
- 4.24 The profit-and-loss statements show that operating revenues plus tax revenue were sufficient to cover all operating and maintenance expenditures, amortization of deferred charges, depreciation of fixed assets, and all financial charges, which attests to the financial solvency of the enterprise.
- 4.25 Tax revenue was important for the enterprise, constituting about 20% of operating income for each of the years considered. Without this additional income, the enterprise would have been in a precarious state. The amount of the tax revenue was set by or based on national laws covering the national sanitation sector, and for the time being it is not likely to be rescind.
- 4.26 The following table summarizes the behavior of the leading operating indicators of EMAAP-Q.

ITEM	1993	1994	1995
Average no. of house connections	181,894.00	196,831.00	220,570.00
Water sales (thousands of m ³)	92,710.00	98,175.00	104,866.00
Total billings (US\$ thousands)	19,627.00	19,677.00	20,493.00
Average income per m ³ (US\$)	0.21	0.20	0.20

- 4.27 In the period 1993-1995, the number of connections increased 21% and average revenue per m³ held at around US\$0.20. This means that rate adjustments were sufficient to sustain the average price in real terms. Water sales increased 13% and sales per connection declined from 509 m³ to 475 m³. Moreover, technical and nontechnical losses were reduced from 43% of production in 1993 to 39% in 1995. In 1996, as part of the sanitation program financed with loan 823/OC-EC, macrometers and micrometers will be installed to monitor and reduce losses further.

2. Statements of sources and application of funds

- 4.28 The accounts for the period from 1992 to 1995 needed for the statements of sources and applications of funds in current sucres were converted to constant sucres of 1995 and stated in US dollars.

- 4.29 The internal sources of funds (including the results of the enterprise plus the operating expenditures that involved no actual disbursements, such as depreciation, amortization of deferred charges, charges for bad debts and miscellaneous allowances and reserves) show that in each of the years considered internal cash generation was sufficient to cover service on the debt and part of the additions to fixed assets.
- 4.30 In addition, funds from internal sources increased 24% on average from 1992 to 1994, from US\$10,340,000 to US\$16,076,000. From 1994 to 1995 these funds declined 43% from US\$16,076,000 to US\$9,095,000, owing to the US\$10,037,000 in expenditures for the reduction in force. Without these expenditures funds from internal sources would have risen 19% from 1994 to 1995.
- 4.31 The enterprise's funds from external sources declined appreciably from the equivalent of US\$7,282,000 in 1992 to the equivalent of US\$5,021,000 in 1995. The main reason for this drop was a reduction in capital contributions from the national government. In 1992 these contributions totaled US\$7,282,000, but only US\$1,552,000 in 1995. In the next four years the national government is expected to provide only capital to the enterprise and to fulfill its commitments with respect to local counterpart contributions under loan 823/OC-EC and the loan from the Andean Development Corporation (ADC) for the Papallacta optimization project. To meet its investment needs the enterprise must rely on its own sources of financing and on domestic and foreign loans for funds.
- 4.32 Funds were applied mainly for additions to its fixed assets under its expansion program, which averaged 70% of the total. The amount of funding applied to increase working capital declined from 1992 to 1995. The enterprise's new policy is to reduce its working capital through better inventory management and more active efforts to recover accounts receivable, as a means of generating additional resources to finance expansion.

3. General balance sheets

- 4.33 The balance sheets of EMAAP-Q in current sucres were converted to constant sucres as of December 31, 1995, and stated in US dollars at the exchange rate in effect on that date. However, the value of fixed assets shown on the enterprise's financial statements are understated because they are reported at cost and not restated for inflation. It was not until 1992 that the restatement of assets began. Because of this, for purposes of analysis the annual additions to fixed assets in the period 1982 to 1992 were converted to US dollars at the average exchange rate for the year in which the addition was made to arrive at a more representative value of the fixed assets. Since 1992, the fixed assets were increased by the annual additions and reduced by the respective charges for depreciation.

- 4.34 Loan 823/OC-EC necessitated a technical revaluation of the consolidated fixed assets of the company based on the terms of reference drawn up by a consulting firm. As of December 31, 1995, EMAAP-Q was in the final stages of awarding a contract for this study.
- 4.35 The balance sheets indicate that the enterprise's fixed assets are its largest asset item, amounting in 1995 to the equivalent of US\$286,623,000 or 89% of the total. Meanwhile, the current assets totaled US\$29,063,000 or 9.1%, consisting of accounts receivable (equivalent to US\$11,743,000, or 3.7% of the total), and inventories (US\$11,428,000, or 3.6% of the total).
- 4.36 In 1995, 90% of accounts receivable for water and sewer services were collected, which is an acceptable level. It should be noted that this proportion was down from 1993, when 96% of accounts receivable were collected. This decline stemmed from the resistance of customers to pay the sewer rate, which was not charged in 1993. As of December 31, 1995, the balance due on accounts receivable on charges for house connections came to 33% of billings. This is an acceptable proportion because the customer is given up to one year in which to pay this charge.
- 4.37 It is important to note that the current ratio was 5.2:1 as of December 31, 1995, and the enterprise's policy is to reduce this ratio through improved inventory management and by cleaning up its portfolio of bad debts. In this way it expects to generate additional resources for investment.
- 4.38 The enterprise's long-term liabilities as of December 31, 1995, came to US\$50,338,000, the leading creditor being the IDB with a balance of US\$43,075,000. The other creditor is the Banco del Estado (BDE), with a balance of US\$6,985,000. The debt equity ratio is low, with long-term liabilities amounting to 19% of capital.

4. Conclusion

- 4.39 The review of the financial statements of EMAAP-Q shows that the enterprise is in stable condition and is able to meet all of its financial obligations. Long-term debt is moderate and internal cash generation during the period considered was always sufficient to finance investments in fixed assets and to meet debt service requirements. The company's sound financial condition derives from the fact that it has been able to adjust its rates in real terms.

V. FEASIBILITY OF THE PROJECT

A. Financial feasibility

1. Local counterpart contribution and service on the debt

- 5.1 Financial projections have been made of the statements of profit and loss, sources and applications of funds, and balance sheets to assess the capacity of EMAAP-Q to fulfill its financial obligations under the project here considered, its operations, and the debts contracted and to be contracted by it. Those statements include the present operation and all operations envisaged for the period from 1996 to 2005.
- 5.2 The projections for the profit-and-loss statement were based on the assumption that the average revenue per m³ of water would rise from US\$0.20 in 1995 to US\$0.25 in 2000 and thereafter (i.e., the average water rate would increase on average by US\$0.01 a year over five years and then hold steady). This is a moderate increase. The enterprise is legally empowered to impose this increase and has been raising its rates since 1991.
- 5.3 Meanwhile, the sewerage rate held at 38.6% of the water rate throughout the period. The revenue from connections was calculated on the basis of the connection of new customers to the water and sewerage systems. Tax revenue was estimated conservatively in light of its growth over the last five years.
- 5.4 The projections for profit and loss show that the enterprise would have sufficient revenue from operations and tax allocations to cover its annual costs, including operations, maintenance, of fixed asset depreciation, amortization, and finance charges.
- 5.5 It is important to note that personnel costs are estimated to be 20% lower starting in 1996 because of the 1995 reduction in force.
- 5.6 The project should be generating incremental recurrent costs of US\$673,000 in year five. These costs would be attributable to: (i) the executing unit (US\$103,000); (ii) natural resource management (US\$11,000); (iii) runoff control (US\$24,000); (iv) water regulation and mudflow control (US\$260,000); (v) sewer repairs and closing off of creeks (US\$15,000); (vi) hydrometeorological and landslip monitoring (US\$86,000); and (vii) solid waste management (US\$174,000).
- 5.7 The projections for the statement of sources and applications of funds show that the enterprise will be in a position to make the requisite local counterpart contribution, service the debt from its present operations, and meet its other financial commitments as well. It will have resources of its own to finance the financial

obligations contracted with the Bank, the government, and the Andean Development Corporation. In addition, during the period from 1996 to 2005 the enterprise will generate US\$75,501,000 in operating revenue to finance additional investments.

- 5.8 A review of the financial statements of EMAAP-Q for 1992 to 1995 shows that the enterprise is in sound condition and able to meet all its financial obligations. The long-term debt is moderate and internal cash generation over that period was always sufficient to finance its investments in fixed assets and meet the service on its debt. This stable financial situation derives from the fact that the enterprise has succeeded in adjusting its rates in real terms.
- 5.9 It is not envisaged that the DMQ will encounter any difficulty in contributing the sum of US\$531,300 over the four years of the project because its total revenue over the last four years came to US\$260 million, its investment budget to US\$102 million, and it had a financial surplus of US\$5 million over the same period.

B. Technical feasibility

- 5.10 The proposed works and activities can be executed by the Quito Municipal Government and EMAAP-Q. The works involve normal engineering techniques, and there are experienced domestic and foreign enterprises to carry them out successfully. The community support work is going forward in the area with the participation of NGOs, the Municipal government and its enterprises; they will be executed with the participation of the local groups and NGOs of recognized technical capacity and experience.
- 5.11 The protection systems subprogram is regarded as technically feasible on the following grounds:
- 5.12 The works in the water regulation and mudflow control component are based on technologies widely tested and validated by engineering. The designs, plans and specifications for the works were prepared by a consortium of domestic consulting firms under the supervision of the technical staff of EMAAP-Q. Final adjustments will be needed in some designs, as agreed in the analysis mission. ^{2/} These adjustments should involve no difficulty. It is been recommended that a consulting team be assembled to prepare the final bidding documents and designs.
- 5.13 The works for the system will make it possible to control surface runoff from heavy rainfall of short duration with a frequency of

^{2/} The adjustments consist of reviewing the stability designs and structures of the spillways of dams 6.4 (Rumiurco creek) and 25.3 (Rumipamba creek), on the latter to increase its regulating capacity by 25,000 m³, and redesigning the new location of embankment 11.6 (Habas Corral creek).

50 years. Transported solid material deposited in the reservoirs will be cleaned out periodically. The proposed system will make use of the evacuation capacity of the sewers that traverse the city.

- 5.14 The component for management of natural resources and runoff control will help to maintain plant cover and check increased erosion. The proposed extension practices and small civil works can be easily executed and their effectiveness has been demonstrated in similar programs in Ecuador and across the region.
- 5.15 EMAAP-Q and the Ecuadorian institutions are amply experienced in the construction and operation of meteorological and hydrologic stations. The equipment is of known technical specifications and technical assistance will be forthcoming from ORSTON, the French cooperation agency, which is working closely with EMAAP-Q under an agreement for the performance of studies of the entire metropolitan area of Quito.
- 5.16 The costs of the projects are based on the volume of labor and work derived from final designs and unit costs in the domestic market and from local and international quotations. In addition, the budgets include reserves for contingencies and escalation.
- 5.17 Consulting firms experienced in supervision will advise on proper control of the works. Equipment will be purchased and the works executed under contracts awarded in international competitive bidding. Enough bidding kits will be sent out to afford sufficiently broad local and international participation.

C. Economic feasibility

- 5.18 For purposes of economic analysis, the components of Subprogram I were grouped as follows: (i) the water regulation and mudflow control infrastructure, which is combined with the components of natural resource management and runoff control, and hydrometeorological monitoring, because of the obvious complementarities among them, and (ii) sewer repair. The components of Subprogram II are by nature difficult to evaluate from the economic standpoint, though amply justified for other reasons.

1. Water regulation and mudflow control infrastructure

- 5.19 The project as designed will completely avert the damage from floods and mudslides with a recurrence of up to 50 years and reduce the damage from more infrequent events (i.e., with a recurrence of more than 50 years). The economic studies quantified the benefits in the following areas: (i) damage to homes and businesses, (ii) damage from changes in urban traffic patterns, (iii) damage to sewers and the costs of cleaning the regulating works built under the project, (iv) damage at Mariscal Sucre Airport, and (v) the costs of emergencies.

- 5.20 Loss of income was not considered in the analysis because floods are of relatively short duration and much economic activity is easily rescheduled. Moreover, though human lives have been lost in the past and the project could theoretically have a favorable impact in this regard, the available information is insufficient as a basis for associating the loss of human life with the magnitude of hydrologic events. It has to be borne in mind that not including these potential benefits constitutes a factor for additional safety in the evaluation.

2. Damage to homes and businesses

- 5.21 To estimate the benefits from the expected reduction in losses of homes and business premises, the following information had to be obtained: (i) flood volumes at sewer inlets in the city drainage system for the 5-, 10-, 50-, 100- and 500-year flood situations without the project, (ii) volumes at intake points of sewers for the same recurrence intervals allowing for regulation by the project works, (iii) areas and depths of flooding (water alone or water and mud) produced by different overflow volumes in drains in a situation both with and without the project, (iv) damage curves versus flooding depth for homes and businesses. The information for points (i) to (iii) was obtained from hydrologic and hydraulic studies, and for damage to homes and business premises a survey was conducted of 177 homes and 73 businesses in areas subject to flooding.
- 5.22 This information was finally summarized in two curves expressing the value of damages for different probabilities of occurrence (i.e., frequency of recurrence of the hydrologic event) in situations with and without the project. The difference between the areas under these two curves is the expected value of the damage averted by the project.
- 5.23 The project area was divided into four regions north to south for both the hydrologic studies and the economic analysis, as follows: Region I, between Parayacu and Lea creeks, Region II between El Colegio and San Vicente creeks, Region III between La Concepción and Rumipamba creeks, and Region IV between Pambachupa and Miraflores creeks.
- 5.24 The results indicate that in a situation without the project the flooded areas range from 35 hectares for a 5-year flood to 585 hectares for a 50-year flood to 1,130 hectares for a 100-year flood. In a situation with the project, a 50-year flood should produce no flooding at all, and for a 100-year event the flooded area should be reduced to about 490 hectares, with a resulting reduction in flooding depth.

3. Damage from changes in traffic patterns

- 5.25 To quantify this factor, alternative vehicle traffic routes were identified for different areas of flooding in situations with and without the project, and vehicle counts were taken and travel distances and times measured along Avenida Occidental through the four main intersections of Avenida Universitaria, Avenida Mariana de Jesús, Avenida Edmundo Carvajal and Calle Fernández Salvador.
- 5.26 The estimates indicated that the increases in vehicle operation costs are very small, and the final calculations were based solely on the opportunity cost of travel time, valued at one half of the estimated revenue.

4. Costs of cleaning reservoirs and damage to sewers

- 5.27 To estimate the costs of cleaning reservoirs and streets, estimates were made of the volumes and granulometric characteristics of the sediment in the creeks in situations with and without the project, the percentages retained in the reservoirs with the project and the proportions that would be deposited in streets and homes. In the section of damages to homes and businesses, the costs of cleaning up were taken into account. The volumes deposited in reservoirs and streets with and without the project and the estimated unit costs of cleaning up were used to calculate the cleaning costs with and without the project.
- 5.28 The damage to sewers was estimated by analyzing the existing information on kinds of damage, frequency of occurrence and cost of repairs over the last five years. During that period, 60 events causing damage occurred that cost EMAAP-Q S/.4,605 million (about US\$1,880,000). ^{3/} It was estimated that damage to urban infrastructures may be 1.3 times the value of the repairs done by EMAAP-Q. In consultation with the enterprise's technical maintenance staff, damages were estimated for other recurrence intervals and the impact of regulatory works.

5. Damage to the airport

- 5.29 The damage to the airport includes damage to structures and to cargo. Damage to structures was estimated by the same procedure as for damage to homes, applying the same unit repair costs to the items to be affected by 100-year and 500-year events.
- 5.30 Since floods can occur at any time of day, the estimates of damage to freight are conservative, and it is assumed that a 100-year event will affect only one third, and a 500-year event two thirds of the daily shipment of flowers. Flower exports are on the order of 2,175 cases a day with an average value of US\$60/case.

^{3/} At the exchange rate of US\$1 = S/.2,450.

6. Emergency expenditures

- 5.31 These are expenditures for the personnel and equipment to deal with emergencies during events that produce flooding. To estimate these costs the Quito fire department was consulted, and the costs of personnel (remunerations/day) and equipment (operation and rental) were estimated on the basis of the magnitude of the events estimated in the hydrologic studies and past experience. The expenditures were estimated for 100- and 500-year floods.

7. Results

- 5.32 The net benefits at efficiency prices were calculated on the basis of accounting price ratios (APR) estimated by CONADE and Banco del Estado for conversion of costs and benefits. The following table summarizes the expected values of the annual benefits and damage averted in each region. It can be seen that most of the benefits come from the averted damage to homes and businesses.

EXPECTED ANNUAL BENEFITS-COSTS
MILLIONS OF SUCRES

ITEM	REGION 1	REGION 2	REGION 3	REGION 4
Residential-Commercial	8,182	8,397	3,679	1,448
Traffic	38.5	53.8	18.6	1.5
Street cleaning	12	12	8	6
Cleaning of works	-42	-56	-30	-28
Sewers	20	124	35	28
Emergencies	4	4	2	0.4
Airport	0	19	0	0
Total	8,214	8,553	3,712	1,457
Cost of works ^{4/}	21,093	8,460	7,096	4,856

- 5.33 These results were used to calculate the present value of the net benefits discounted at 12% and the internal rate of return, and several sensitivity analyses were carried out, as shown in the following table:

^{4/} In present value discounted at the rate of 12% p.a.

CASE	NPV \$/ MILLIONS	IRR%
Base case Region 1	36,747	41
Region 2	45,338	80
Region 3	17,132	47
Region 4	5,431	32
Aggregate project	104,726	51
APR = 1		34, 68, 38, 23
30% reduction in benefits		32, 64, 38, 24
Delay in construction		36, 63, 41, 29
30% increase in costs		33, 58, 33, 22
20% reduction flooding		35, 69, 36, 22
20% reduction in flooding depth		36, 73, 37, 22

5.34 These results suggest that economically this component is highly attractive. The sensitivity exercises indicate that the results stand up fairly well to changes in the assumptions used for the analysis, and that the IRRs for the works in the four regions remain above 12%, even assuming a 20% reduction in flooded areas and flood depths, a 30% increase in costs, or a 1-year delay in execution of program works. The results of the economic analysis at market prices (i.e., an APR of 1) indicate that the works in all four regions are economically attractive even disregarding the existing distortions in the economy.

8. Sewer repair

5.35 To evaluate the cost of repairing sewers, it was assumed that this would be additional to the investments in flow regulation and natural resource management. The benefits from the repairs were estimated by a procedure similar to the one described for estimating the impact of the regulation project on the costs of sewer repair. The results of the analysis are as follows:

REGION	IRR (%)	COST (\$/ MILL)	NPV (\$/ MILL)
I	0	2,227.3	-942.3
II	31	914.8	977.3
III	6	2,399.2	-707.5
IV	31	518.4	384

5.36 These results indicate that repairs are attractive only in regions II and IV. This is largely accounted for by the existing statistics on damage over the last five years, which indicate that 75% of the emergencies have arisen in those regions.

9. Distributional impact

- 5.37 To determine whether this project may be regarded as targeted to poverty reduction, an estimate was made of income in the areas of the flood zone (downstream from Avenida Occidental) that would benefit from the project. The poverty level in Ecuador, as determined by the Bank for 1994, is a monthly per capita income of S/.80,997, and the poverty index is 32.12%. ^{5/} Based on information from the Quito Planning Directorate, it was estimated that the average income in the beneficiary areas was S/.245,000 in 1994. Updating the information in the 1990 census, it was established that in Quito about 37% of the population lives below the Bank's poverty line, and the median per capita income is about S/.102,000 a month. The figures clearly show that this project does not meet the requirement that 50% of the beneficiaries have incomes below the poverty level.

^{5/} For a project to be considered as targeted to alleviating poverty, the percentage of beneficiaries that are poor must be more than 20 percentage points above the country's poverty index, or account for at least 50% of the total beneficiaries. Poor beneficiaries are those earning incomes below the poverty line determined by the Bank for each country.

ECUADOR
SLOPE PROTECTION FOR MT. PICHINCHA
(EC-0143)

LOGICAL FRAMEWORK

ARRATIVE SUMMARY	INDICATORS	VERIFICATION	ASSUMPTIONS
Damage to property and personal risk to northern Quito.	Extension of flood areas; repair of Avenida Occidental, flood damage to housing.	Simulations with hydrologic data obtained by the project and reports from the executing unit.	The event level does not exceed the level.
Water levels (water/mud) at sewerage mudslips and floods	Size, depth and frequency of floods (recurrence interval of precipitation that provokes the event).	EMAAP-Q reports, progress reports of CEC, mid-term evaluation and monitoring reports.	The event level does not exceed the level.
S			
Construction of water regulating and mudflow works.	At end of third year of project execution, 31 mud embankments, 13 regulating reservoirs, 21 sewer inlets with minor regulating reservoirs, 7 diversion works.	Annual reports by the executing agency, reports by the executing unit, on-site inspections by CEC, mid-term evaluation and monitoring reports.	Counterpart funds available.
Sewerage works.	At end of second year, emergency repairs and preventive maintenance on 16 interceptors in the main and secondary sewer system.	Annual reports by the executing agency, reports by the executing unit, on-site inspections by CEC, mid-term evaluation and monitoring reports.	
Construction and maintenance of works for erosion and runoff	At end of third year, 15,800 m of irrigation ditches-intersecting channels, 22,650 m of roadside gutters, 15,850 m of intercepting ditches, 4,800 m of discharge chutes, 6 inlet works, and 121 special works.	Annual reports by the executing agency, reports by the executing unit, on-site inspections by CEC, mid-term evaluation and monitoring reports.	
Soil conservation and resource management program.	Adoption of soil conservation and natural resource management practices.	Annual and final reports from the NGO, reports by the executing unit, mid-term evaluation and monitoring reports. Photographs of area to show soil use and plant cover.	Adequate demand for extension services from part of private owners; extension services to change present soil use practices.
Hydrological and mudslip monitoring.	Installation and operation of 6 hydrologic stations, 25 rain measurement stations, and eight automatic synoptic stations. At end of first year of execution of the project, delivery of studies of soil hydrodynamics and runoff plots in three representative catchment areas.	Final report from NGO, reports from executing unit, mid-term evaluation and monitoring reports.	

DESCRIPTIVE SUMMARY	INDICATORS	VERIFICATION	ASSUMPTIONS
Completion of solid waste collection in low-income communities without project area.	At end of fourth year of the project, collection of all residential solid waste in low-income neighborhoods on slopes.	Tonnages of monthly collection. Financial reports of microenterprises, mid-term evaluation and monitoring reports.	Microenterprises are operating properly.
Increased community awareness of hazards on slopes and the role of community in mitigating them.	Eight public campaigns, 6 seminars, 10 press campaigns, 10 meetings of Barrios Federation, 8 meetings with officials from DMQ during execution of the project.	Monitoring reports of the executing unit, participation by the Barrios Federation, mid-term evaluation and monitoring reports.	Close coordination with the component strengthening of municipal management.
Approval of plans of action under government policy.	<ul style="list-style-type: none"> Three studies of urban policy and structural organization of the municipal government, including proposed changes in regulations. Legislative mechanisms will be presented to municipal and community leaders at end of third year of project execution. Municipal ordinances. Investment plan. Population growth on slopes stabilizes. 	<p>Reports of the executing unit, including inputs of planning office, mid-term evaluation and monitoring reports.</p> <p>Periodic data of weight of waste collected. Aerial photography showing new settlements.</p>	<p>Political willingness to implement recommendations contained in policy studies through means of ratified ordinances.</p>
Completion of the executing unit.	<ul style="list-style-type: none"> US\$500,000 three technical specialists for four years. US\$273,000 support personnel, offices, machinery, for four years. 	CEC progress reports.	
First disbursement.			
Completion and contracting of the executing unit.			
Completion of water regulating and control works.	<ul style="list-style-type: none"> US\$12,099,000 water regulating works. US\$12,074,000 construction of civil works and improvements. US\$25,000 studies and complementary designs of mud embankments. US\$822,000 purchases of land. 	CEC progress reports, EMAAP-Q reports. Accounting records of the executing unit.	
Second disbursement.			
Approval of final resettlement and action plan.			
Approval of final designs for			
Third disbursement.			
Completion of agreement signed between EMAAP-Q.			

DESCRIPTIVE SUMMARY	INDICATORS	VERIFICATION	ASSUMPTIONS
Before first disbursement			
Call for tenders for the two lots of works.			
Engineering firms are contracted for the infrastructure works.			
1 year of project execution.			
Construction is completed.			
Services.	<ul style="list-style-type: none"> US\$585,000 works and improvements. US\$79,000 maintenance. 		
After the first disbursement			
Team hired.		CEC progress reports, EMAAP-Q reports. Accounting records of executing unit.	
Construction and maintenance of works for erosion control.	<ul style="list-style-type: none"> US\$1,064,000 works and improvements. 	CEC progress reports, EMAAP-Q reports. Accounting records of executing unit.	
After the first disbursement.			
Construction.			
Source management program.	<ul style="list-style-type: none"> US\$182,000 extension program. US\$30,000 vehicles. 	CEC progress reports, EMAAP-Q reports. Accounting records of executing unit.	
After the first disbursement.			
Construction.			
Hydrological and mudslip	<ul style="list-style-type: none"> US\$620,000 machinery, equipment. US\$75,000 works. 	Accounting records of executing unit.	
After first disbursement.			
Procurement of equipment			
After first disbursement.			
Representative catchment areas			
Implementation of system for solid waste in low-income communities and service in project area.	<ul style="list-style-type: none"> US\$48,000 machinery, equipment and training US\$53,000 office operations and maintenance. US\$18,000 preinvestment studies. 	Accounting records of executing unit.	

ARRATIVE SUMMARY	INDICATORS	VERIFICATION	ASSUMPTIONS
First disbursement.			
of agreement signed between MASEO.			
of community's understanding of hazards on slopes and the role of them in mitigating them.	US\$247,000 training and instruction campaigns.	CEC reports, executing unit reports, feedback from meetings of Barrios Federation. Accounting records of executing unit.	
After first disbursement.			
ected.			
for urban planning studies being conducted at municipal level.	US\$500,000 three studies and plans of action.	CEC reports. Executing unit reports. Accounting records of executing unit.	
After first disbursement.			
ed.			
1 year of project execution.			
reforms already discussed with community to be presented to Municipal			

BIDDING SCHEDULE
TENTATIVE PROCUREMENT PLAN

Principal procurement	Financing Bank %	Method	Prequali- fication	Amount (US\$000s)	Publication date (half of year)
A. Items					
1. Hydrometeorological equipment	100.0	ICB	NO	620.0	96/II
B. Consulting services					
1. Supervision of works (consulting firms)	99.4	ICP	YES	963.0	96/II
2. Training in solid waste management	100.0	LCP	NO	48.3	96/II
3. Community training (NGOs)	100.0	LCP	NO	246.7	96/II
4. Strengthening in municipal management	90.9	ICP	YES	550.0	96/II
5. Natural resource management	42.3	LCP	NO	100.0	96/II
C. Works and improvements					
1. Hydraulic works					
a. Zone 1	86.3	ICB	YES	8,769.0	96/II
b. Zone 2 to 8	86.3	ICB	YES	6,297.0	96/II
2. Sewer repairs (minor works and contracts)	88.1	LB	NO	664.0	96/II
3. Installation of hydrometeorological monitoring	100.0	LB	NO	75.0	96/II

ICP — International calls for proposals
ICB — International competitive bidding
LB — Local bidding
LCP — Local call for proposals

**SUBPROGRAM II: SOLID WASTE MANAGEMENT BY
MICROENTERPRISES**

I. BACKGROUND

- 1.1 Recently the Municipal Government, through EMASEO, supported the formation and operation in the northern part of the project area of the first microenterprise (ME), which is now functioning in the Comité del Pueblo II barrio and adjacent neighborhoods. This first ME has nine partners, seven of whom are women. It is legally established as an association in accordance with articles 435-439 of the Law on Companies.
- 1.2 The technology needed to set up this pilot ME was transferred to EMASEO through the GTZ, the German technical cooperation agency, and had been successfully tested in other countries of Latin America (Bolivia, Peru, Colombia and Costa Rica). In addition, EMASEO did preinvestment work, including feasibility studies for the establishment of MEs for refuse collection, barrio censuses, analysis of the composition of refuse, the mapping of collection routes, and promotion for the establishment of the ME (barrio meetings, identification of interested microentrepreneurs, etc.) as described in the following section.

**II. TECHNICAL STUDIES AND PROMOTION FOR THE STARTUP OF A
MICROENTERPRISE FOR SOLID WASTE MANAGEMENT ON THE PICHINCHA SLOPES**

- 2.1 A survey of the barrio population was taken through EMASEO in conjunction with the Barrio Committee and a secondary school in the district on the basis of a barrio census promoted by the Municipal Government. This survey verified that the population in the area of influence of the first microenterprise was sufficient (at least 20,000) to enable the ME to operate on a scale that would make the economic rate of return acceptable. Similarly, EMASEO, in conjunction with the Barrio Committee, made a study of the volume and composition of solid waste in the barrio. This research produced basic parameters such as production per capita, volumetric weight, quantification of recyclable materials, time-and-motion studies to arrive at design yields, etc. These parameters were used to trace the collection routes and prepare the bidding documents for the selection of the ME to be contracted, to ensure that it would be technically and financially feasible.

- 2.2 During the four months before the ME was put into operation, EMASEO performed tasks toward setting it up in the Comité del Pueblo II barrio, or neighborhood, such as identification of barrio organizations, familiarizing the barrio residents with the subject of refuse collection by an ME, holding community meetings, and identifying and selecting microentrepreneurs, as well as providing initial support for the organization of the ME.
- 2.3 In its first year of operation, an ME needs advisory services in the entrepreneurial and social areas and also in refuse management (calibration of routes, training in recycling, etc.). In the case of the pilot ME, the Swiss Fund is financing the technical assistance needed to provide entrepreneurial and social advisory services during that first year of operation. EMASEO, too, is providing operational guidance during the first year of service.

III. COVERAGE OF REFUSE COLLECTION SERVICES ON PICHINCHA SLOPES

- 3.1 Three additional microenterprises will be required to provide proper coverage in the project area. Through EMASEO, the Municipal Government has undertaken to promote the formation of these other microenterprises. During the analysis mission it was verified that EMASEO has the capacity to do the initial preinvestment work: a survey of the area to be served by each microenterprise, determination of the volume and composition of the refuse, and promotion and establishment of the microenterprises. It would basically be a question of performing the tasks already performed satisfactorily during establishment of the pilot ME. Hence no difficulties are expected to arise in the performance of these tasks in 1996.
- 3.2 These activities of the MEs will be articulated with the other two components of Subprogram II. The "community training and public information campaign" called for under one of the other components will be essential in order to secure the collaboration of the population of the area with the refuse collection by the MEs, for example, by placing their refuse in the street on the days and at the scheduled time, including assisting in the recycling by presorting their refuse in the home. Similarly, the information to be provided by the urban studies will facilitate the design of appropriate solid waste management operations by the MEs.
- 3.3 Following is an account of the operating practices of the MEs. An ME will start by collecting the solid waste in its assigned areas in accordance with the operating plan agreed upon with EMASEO. The trash will be conveyed by the ME to the municipal dump, located in Sábiza. EMASEO will tally the tons of trash delivered and pay the

ME monthly at an agreed upon price per ton. Before the monthly payment is made, a "surveillance committee" made up of one representative each of the ME, EMASEO and the Barrio Committee) will determine the quality of the work done by the ME in a given area. The model service contract provides the mechanisms needed to ensure satisfactory performance by the MEs (e.g., rewards and penalties).

IV. COST AND FINANCING OF THE MICROENTERPRISES

A. Preinvestment

- 4.1 As explained in section II, the preinvestment costs of studies of the volume and composition of refuse would be the responsibility of EMASEO, and resources for the purpose will be included in the financing of the present project. Those costs come to US\$5,950 per ME, for a total of US\$17,850, as itemized in the table that follows.

B. Working and investment capital

- 4.2 The working capital needed for the commencement of operations will consist of an advance that EMASEO will make to the ME for one month of work and in savings of the microentrepreneurs themselves. With support from EMASEO the ME has succeeded in obtaining a loan from FILANBANCO to finance the investments. The loan was made at market interest (about 55% at present) and is to be amortized in monthly installments over a 2-year period.
- 4.3 The ME opened a current account with a bank, to which EMASEO makes payments to the ME for refuse collection services. Hence, the bank will deduct the installments owed directly at source.
- 4.4 The bank has a signed service contract between EMASEO and the ME as a guarantee. As provided in a framework agreement, this contract has a duration of three months and is subject to renewal over a period of three years. The same working arrangement will be used to finance the other three MEs, the analysis mission having found that Filanbanco was interested in replicating it.

C. Technical assistance in getting started

- 4.5 The administrative accompaniment (entrepreneurial and social advisory services) for these three new MEs will be financed by the Bank with resources provided in this operation (US\$14,810 per ME). The terms of reference of this assistance are described in section F of this Annex.

- 4.6 The technical counseling (operational advisory services) will be provided by EMASEO with resources provided under this operation (US\$1,300 per ME). As noted above, the investment costs of the other three MEs will be financed by Filanbanco as it did for the pilot ME. Hence, resources will have to be budgeted for this subcomponent in the Pichincha Slopes project.
- 4.7 The table that follows itemizes the costs and financing for the launching of a typical refuse collection microenterprise, based on the information obtained and verified from different sources (EMASEO, equipment suppliers, financial institutions, international specialists in solid waste management by MEs, etc.). It can be seen that the typical costs of just the preinvestment, investment and advisory services for establishment, start up and initially follow up on each ME comes to US\$120,000 for all three of them. This amount rises to US\$340,040, however, if the projected recurring and nonrecurring costs of operations four years out are included.

**INITIAL COST AND FINANCING OF A SOLID WASTE
COLLECTION MICROENTERPRISE
(US\$)**

COST CATEGORY SOURCE OF FINANCING	MICRO- ENTERPRISE	FILANBANCO COMMERCIAL BANK	IDB (EC-0143)	TOTAL
I. PREINVESTMENT			5,950	5,950
1.1 Study of collection volume and analysis of composition			1,900	1,900
1.2 Feasibility study (barrio census, calculation of costs, etc.)			2,400	2,400
1.3 Promotion for formation of microenterprise (barrio meetings, identification of microentrepreneurs)			1,650	1,650
II. LAUNCHING OF MICROENTERPRISE	790	17,150		17,940
2.1 Investments:				
2.1.1 Truck		15,600		15,600
2.1.2 Pushcarts		770		770
2.1.3 Furniture and fixtures	580			580
2.2 Start up expenses				
2.2.1 Establishment of microenterprise	210			210
2.2.2 Vehicle insurance		780		780
III. MONITORING OF MICROENTERPRISE			16,110	16,110
3.1 Financial and accounting advisory services (first 12 months)			6,000	6,000
3.2 Organizational and social advisory service (first 12 months)			6,000	6,000
3.3 Technical assistance (route calibrations, training in recycling, etc.)			1,300	1,300
3.4 Contingencies			2,810	2,810
TOTALS	790	17,150	22,060	40,000

D. Profitability of refuse collection MEs

- 4.8 The price to be paid to the MEs engaged by EMASEO will be US\$18/ton, which is in line with the prices obtained by refuse collection MEs in other countries of the region. According to EMASEO, the cost of collecting refuse is US\$28/ton, which makes it advantageous to make use of MEs, especially in areas of difficult access, as in the area of influence of the project (barrios at high elevations on steep slopes, streets in poor condition, etc.) and, in turn, releases scarce mechanical equipment for service in areas of high population density. Moreover, the studies of the profitability of investment for the operation of a typical ME to collect refuse bear out that the stated price is satisfactory and will yield an acceptable return. As an illustration, the following table shows the results of a financial evaluation of the investments of an ME.

**CALCULATION OF THE PROFITABILITY OF A SOLID
WASTE COLLECTION MICROENTERPRISE
(US\$)**

	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Total gross sales		45,360	47,174	49,061	49,061	49,061
I. Total gross value		45,360	47,174	49,061		
Investment cost						1
- Initial investment	17,913					(3,894)
- Replacement of carts				769		769
- Operating costs (incl. est. taxes)		31,291	33,738	37,629	41,629	36,304
II. Total cost	17,913		33,738	38,398	41,629	43,179
III. Net cash flow (I-II)	(17,913)	14,069	13,436	10,663	7,432	5,882
Discount factor	1,00	0,89	0,80	0,71	0,64	0,57
IV. Real net present value	(17,913)	12,562	10,711	7,590	4,723	3,338
DISCOUNT RATE	12%					
NET PRESENT VALUE	21,010					
INTERNAL RATE OF RETURN	27%					

E. Recycling

- 4.9 The recycling would not begin immediately with the refuse collection, but is expected to be started gradually in the course of the first year of operation of the collection system here described. This division of functions emerges from international experience, which indicates the strategic usefulness of this

precaution based on the possibility of jeopardizing the launching and consolidation of the ME in the performance of proper refuse collection service. However, once the service has been developed well, the ME could consider the development of an additional line of work and engage in recycling. The study of the composition of the refuse in the pilot area has shown that there is not a high proportion of recyclable material in the area. Organic solid waste is a major component (65%). To make it worthwhile to compost the material and sell the humus, there has to be a market, which has not yet developed. The Municipal Government could generate in future a demand for it for its public parks and gardens.

F. Terms of reference for preinvestment activities and technical assistance

1. Preinvestment

4.10 Before the MEs are formed, EMASEO will carry out the following operations to provide a foundation for the establishment and operation of the MEs:

- a. A barrio census in conjunction with the barrio committees, secondary and other schools in the area, including a survey of the population to be served by the MEs. This study must verify the presence of not less than 20,000 inhabitants per ME to enable it to operate on a scale at which the economic rate of return is acceptable.
- b. A study of the volume and composition of solid waste in the area to be served. It must determine such basic parameters as production per capita, volumetric weight, quantification of recyclable materials, a time-and-motion study to determine design yields, etc.
- c. With the information generated by the studies described in a) and b), the collection routes will be traced and the requirements formulated that the MEs must meet to be contracted, in order to ensure that they are technically and financially feasible.
- d. Municipality receives on periodic basis data on solid waste collected by microenterprises.

4.11 In addition, EMASEO will be responsible for the tasks to be carried out for establishment of the MEs, on which it will spend four months and at least 15 hours a month per ME:

- a. familiarization of the community with the project for setting up a microenterprise to collect household refuse by hand;
- b. identification of barrio organizations;

- c. community meetings ("video forums") to publicize the project for the collection of refuse and the establishment of a microenterprise, convened for those interested in participating actively in it so that they may present folders containing their personal backgrounds and documents;
 - d. Selection of candidates (responsibility, references, physical and psychological examination, etc.), and
 - e. weekly meetings to support the microenterprise in its internal organization, legal establishment, group dynamics exercises, etc.
2. Initial operation of the MEs
- 4.12 The advisory services to be provided during the initial operation of the microenterprises will continue for 12 months for at least 20 hours a month to each ME, and will include:
- a. training in budget preparation, basic bookkeeping, time sheets;
 - b. counseling in contract negotiation;
 - c. training in the management of profits and generation of funds for replacement of equipment, and
 - d. monitoring the financial performance of the ME.
- 4.13 In addition, the social counseling will run concurrently with the preceding advisory services for the same period of time and the same apportionment of hours, and will consist in:
- a. the organization of group dynamics events and exercises;
 - b. workshops on motivation, belonging, and other needs detected in conjunction with the ME, and
 - c. mediation in personal conflicts that arise between microentrepreneurs.
- 4.14 During this stage EMASEO will be responsible for providing operational advisory services to the MEs for the same initial 12 months with a minimum of four hours a month being devoted to each ME, in such matters as:
- a. calibration of the collection routes and monitoring of their development;
 - b. technical advisory services in the solid waste management, and
 - c. training in recycling operations.

PROPOSED RESOLUTION

ECUADOR. LOAN ____/OC-EC TO THE EMPRESA MUNICIPAL DE AGUA POTABLE
Y ALCANTARILLADO DE QUITO

(Laderas del Pichincha Protection Program)

The Board of Executive Directors

RESOLVES:

That the President of the Bank, or such representative as he shall designate, is authorized, in the name and on behalf of the Bank, to enter into such contract or contracts as may be necessary with the Empresa Municipal de Agua Potable y Alcantarillado de Quito, as Borrower, and the República del Ecuador, as Guarantor, for the purpose of granting the former a financing to cooperate in the execution of the Laderas del Pichincha Protection Program. Such financing will be for the amount of up to US\$20,000,000, or its equivalent in other currencies, except that of Ecuador, which are part of the Ordinary Capital resources of the Bank, and will be subject to the "Special Contractual Conditions" and the "Terms and Financial Conditions" of the Executive Summary of the Loan Proposal.

PROPOSED RESOLUTION

ECUADOR. LOAN No. ____/OC-EC.
(Laderas del Pichincha Protection Program)

The Board of Executive Directors

RESOLVES:

That the President of the Bank, or such representative as he shall designate, is authorized, in the name and on behalf of the Bank as administrator of the Intermediate Financing Facility Account, hereinafter referred to as the "Account", to enter into such contract or contracts as may be necessary with the Empresa Municipal de Agua Potable y Alcantarillado de Quito, as Borrower, and the Republica del Ecuador, as Guarantor, and to adopt other pertinent measures to use the resources of the Account to pay a portion of the interest due by the Borrower on outstanding balances of the loan authorized by Resolution DE- /96, in accordance with the provisions set forth in Document FN-263-2, as amended, approved by the Board of Executive Directors on December 21, 1983.