bd. Recycling

There are two possible systems for separation of materials for recycling and reuse:

- Mechanic separation: In this process, the waste is segregated through mechanical equipment which utilize the different physical properties of the materials.
- Source separation: In this process, the different materials are separated at the generation sources, being collected, transported and treated separately.

In Asuncion, it is considered that the following quantities of materials could be recovered:

- Paper and cardboard: between 3,400 and 10,100 ton/year
- Plastic: between 1,400 and 3,300 ton/year
- Glass: around 6,500 ton/year
- Ferrous metals: around 2,250 ton/year
- Aluminum: around 250 ton/year

Given the financial situation of Asuncion, only those products whose recovery is profitable should be considered.

be. Composting

Production of compost from organic materials could be considered. However a compost plant would need an initial investment of at least 1,600 million Gs, the final disposal site would have to remain in use to dispose residues, the final product would have high transportation costs and at the end, the compost produced would probably not have a market. For all these reasons, it seems practical to forget the idea of a compost plant.

bf. Feasibility of a project of generation source glass recycling

Totally closed containers of 2 to 3 m^3 capacity with openings large enough for one bottle at a time to be disposed would be placed near households, supermarkets, hotels, restaurants, etc. Collection would be done through a vehicle with a hydraulic arm which would transport the glass to the storage stations where it would be separated to be later transported to the factory. The total cost of the process would be around 66,716,330 Gs/year. The plant would have to process more than 1,627 ton/year to be profitable. This number is much smaller than the estimated amount of glass which could be recycled, so there shouldn't be any

technical or economic difficulties. Also, the decrease in the collection volume would produce savings to the Collection and Disposal Department in the first year of around 33 million Gs.

bg. Feasibility of a mechanic recycling station

The structure of the station is very simple; the collection vehicles dump the waste onto 5 selection conveyor belts with a capacity of 5 ton/hour. At each belt there would be 5 workers salvaging the different reusable materials and placing them in 1 m^3 containers with wheels. The station should work in two 8 hour shifts, which would give it a capacity of 400 ton/day. The estimated total cost of this station would be of 410 million Gs. Considering the estimated values of recovered materials and their selling prices, the station could have a revenue of around 1,794 million Gs. Therefore, despite the simplicity of the calculations and the possible variation in prices it is clear that this station is feasible, even if glass is not included, which would be absorbed by the station previously described.

It is important to note that since 90% of the waste would be rejected from the belts, at the end, 15 to 20 m^3 containers should be placed to be transported to the final disposal site. Therefore this recycling plant should be planned as a transfer station to avoid increasing the collection service. It should also be taken into consideration that a plant of this type produces odors, so it should not be located in highly populated areas.

bh. Social problems of recycling

Many people are involved in the current recycling system. There are the scavengers, intermediaries, transporters and buyers, so it is very difficult to determine the number of people involved. The current process, however structured and organized, is very primitive and inefficient since most of the products are damaged from being exposed too long, miss handled and so forth. However, it is clear that the construction of a recycling station would adversely affect them, so they should be involved in the station. The easiest way to involve them is to hire them as workers for the plant, since they have experience in the subject and they are not afraid to work with waste.

Another important matter is the legal formulation of the subject. The four possible ways to create the station are described below:

- Municipal service
- Municipal corporation
- Concession to a private company

- Labor cooperation

bi. Pilot project to recover used paper from office buildings

A system to recover used paper from office buildings should be implemented through the installation of special containers next to common waste baskets in the offices buildings. The project should be first implemented in the Municipality building(s) and then gradually implemented in other offices.

bj. Environmental education

There are two possible solutions to the lack of environmental education of the population of Asuncion;

bja. Information and participation campaigns during the selective collection campaigns of glass, aluminum and paper.

The contents of the propaganda should be of two kinds:

- On the advantages of recycling
- Concrete instructions on dates, systems, ways to use the containers, etc.

bjb. Education in schools

bk. Types of management of the municipal services

The advantages and disadvantages of the following types of management of the municipal services are described as follows:

- Direct Management
- Municipal Corporation
- Privatization
- Mixed Enterprise

bl. Creation of a municipal corporation

A Municipal Corporation works like any private company, difference being that it belongs to the Municipality and, even though it can obtain benefits, its ultimate goal is not profit but rather providing a municipal service. The Municipal Corporation should have municipal autonomy, enough resources to achieve the expected objectives and administrative, financial and patrimonial autonomy. It should be instituted as a public company subordinated to the Executive Council of

the Municipality, with a management board and be responsible for all cleaning, collection, transportation and disposal of all urban solid waste. It is also very important that a fund for improvement and replacement of its equipment is created.

F.4.3 Technical Study on the Present Situation of the Urban Cleaning Services of the Country

a. Outline of the report

The "Technical Study on the Present Situation of the National Urban Cleaning Services" prepared by the National Service of Environmental Sanitation (SENASA) and the Ministry of Health and Social Welfare (MSPBS), in cooperation with technicians from the Municipality of Asuncion and under the assistance of the Panamerican Health Organization attempts to analyze the present situation of SWM in all the urban areas of Paraguay and to establish a set of objectives for the future.

The Study describes the present problems created by urban solid waste, which it blames rapid economic growth, high concentration of population in urban areas, the use of perishable materials and the increasingly general use of disposable containers and packages. These elements cause illegal dump sites, foul odors, wrong and mishandling and uncontrolled disposal of urban solid waste and diseases due to bacterial infection. Another issue is the lack of attention these aspect have received in the past in Paraguay, mainly due to the urgent need of other factors such as water supply and sewage networks which shifted the notice and resources of the health institutions in Paraguay.

b. Objectives

The Study lays down some general objectives to be achieved on the Urban SWM sector, which are described below.

- Acquire information to promote the strengthening of institutional development of the public cleaning services both in the municipalities of the metropolitan area and other areas of the country.
- To establish public cleaning services in those municipalities of more than 4,000 inhabitants that lack them and present feasible conditions.
- To establish communication and cooperation systems between the governmental, inter-municipal, municipal and even private organizations and entities related to SWM.

- Solve the Urban Solid Waste collection and disposal problems in Paraguay.
- Reduce the rates of illness and death from waste handling related diseases.
- Aesthetic improvement of the cities to contribute towards public well being and to attract local and international tourism.
- Protect the environment and prevent the deterioration of natural resources.
- Organize and train the human resources of the executing bodies (municipalities) as well as the consultants (SENASA, OPACI, IDM, etc.) at the professional, technical, assistant and worker levels.
- Promote public participation and school education to improve SWM.
- Establish a legal framework required to implement the services and participation of the different organization and entities from the sector.

c. Situation of the urban solid waste sector

For the purpose of this Study on Urban Solid Waste in Paraguay, the urban centers are defined as those with more than 4,000 inhabitants. Some of the general estimates about the present SWM are:

- Urban solid waste contains approximately 75% organic matter.
- Waste generation per day per person is at around 1 kg in Asuncion and 0.7 kg in smaller cities.
- In 1991 around 1,388 tons of urban waste was produced.
- The density of loose urban solid waste is 333 kg/m^3.
- All street sweeping is manual.
- Collection coverage is around 60% in Asuncion.
- The index of population per collection vehicle of 8,400 is very low.
- In cities with more than 10,000 inhabitants, the index of personnel employed in public cleaning services to serve population is 1,082.
- The percentage of professionals and technicians is less than 1%.
- The waste collection cost in Asuncion is around US$ 10/ton.

d. Conclusions and recommendations

The problems to overcome are:

- Lack of plans and programs on the practical performance of urban cleaning;
- The human resources not trained for their functions;
- Deficit in financial self-sufficiency;
- Technology requiring some adjustments to obtain maximum efficiency;
- Low community participation; and

- Even though the problem is not as large as in other American countries, there are some problems with scavengers in large cities.

Concerning the aspirations of the communities, the needs are to:

- Solve the present financial deficit to be able to provide better services;
- Achieve the primary and ultimate objective of preserving the city clean;
- Create services in all the municipalities of more than 4,000 inhabitants;
- Increase the coverage area of the municipalities that have a cleaning service in operation;
- Drive to the maximum health levels, preserving the environment free of polluting agents; and
- Contribute to the landscape, improving the aesthetic aspects of the cities.

The municipalities do not adopt appropriate and low cost technologies and methods in the development of their cleaning programs. They improvise immediate actions to attend situations of emergency based on traditional projects, which today are out of phase with the sanitary and aesthetic necessities. The main aspects to be improved concerning solid waste management are described below:

- Concerning residential and commercial storage the population does not follow the criteria established for that purpose, using cardboard or wooden boxes, drums, wash bins and others. The municipalities have to adopt measures to stop collecting waste discharged in containers that do not follow the technical requirements established by the regulations.
- Concerning collection and transportation, the routes and collection areas need to be planned better to use the available resources more efficiently.
- Final disposal is the most deficient area of solid waste management in the country; most of the cities have open dumps without any control and there are no specific projects.

Another important aspect to be improved is the lack of a financial-economic policy of the SWM sector, which goes hand in hand with the limited institutional development and the absence of capable personnel for its management. The internal generation of cash is very low, the percentage of users paying is small, and the ordinances establishing the fees are outdated and do not even follow the inflation rate.

Public participation in urban cleaning tasks reflects their attitude of giving all the responsibility to the municipality. It is the responsibility of the municipalities to start special education programs through the media to achieve public cooperation in cleaning campaigns, avoid the creation of illegal dumping sites and to obtain

public tolerance concerning possible deficiencies of the service, to receive information when facing problems with the service, increase the payment of fees and so they understand the necessary increases in the works.

The SWM personnel should have suitable uniforms and clothing for the different seasons.

Concerning recycling, the activities of the scavengers inside of the cities and in the final disposal sites create scattering of waste and aesthetic as well as operational problems of the collection service.

It is necessary to install a truck scale in the city of Asuncion to obtain information to improve the service in such areas as:

- Evaluation, redesign and adjustment of the collection routes;
- Planning of the operation to follow in the sanitary landfill;
- Definition of requirements of covering materials for the sanitary landfill;
- Information to the Workshop Division to readjust the maintenance of the equipment;
- Information to obtain cost per ton collected and disposed to facilitate the tariff differential analysis and the eventual valuation of contracted services; and
- Possibility to use the information obtained through the scale for investigations in the waste recovery field.

The truck scale shall have a capacity of 30 tons, dimensions of 34" x 10" over a concrete base, with a mechanical indicator and printer. The personnel that will operate it shall be trained and an inspection building shall be built next to it.

F.5 Evaluation of Present MSWM

F.5.1 Technical System

The evaluations of the present municipal solid waste management in terms of the technical system are presented in Tables F.5.1a, F.5.1b and F.5.1c.
As mentioned in the Tables, the major issues and problems identified on the present MSWM as well as the preliminary recommendations for the formulation of a draft master plan are described below.

i. The priority for the improvement of the present system is given to:

- plan and acquisition of the future landfill for the highly urbanized municipalities;
- strengthening collection capabilities and the commencement of sanitary landfill operation for the urbanized municipalities; and
- establishment of collection services and the commencement of sanitary landfill operation for the less urbanized municipalities.

ii. Concerning storage and discharge of wastes, citizens do not utilize the standard types of containers, using various other kinds (cardboard boxes, wooden boxes, drums, etc.) which make collection services inefficient, difficult, dangerous and insanitary. In order to improve this situation, the municipalities should take the following measures:

- establishment of proper storage and discharge standard ;
- instruction and enforcement of the standard established to the citizen;
- promotion of the waste stand installation; and
- introduction of public container collection system in the core (commercial) area.

iii. In order to solve littering by the citizens, the municipalities should install public containers in the core area in addition to the enforcement of anti-littering regulations.

iv. For efficient collection, the HUM (Asuncion and F.Mora) should introduce a container collection system for the institutional, non-infectious hospital, market and street sweeping wastes.

v. Considering frequent breakdowns of collection vehicles, replacements of the present fleet shall be carefully examined with the consideration of their financial capabilities.

vi. The present manual sweeping system is suitable under the condition of high unemployment ratio, so it should be extended or implemented where this service is not provided.

vii. The market for compost product from municipal solid waste is very limited. It seems unnecessary to introduce a processing facility except for the treatment of hazardous wastes.

viii. The present recycling system mainly established by the private sector functions well. The introduction of a recycling facility shall be carefully examined in order to avoid the conflict with the present private sector.

ix. Planning and control systems for the vehicles and equipment operation and maintenance shall be implemented, where the municipalities do not rely on the private sector.

x. In order to prevent deterioration of the surrounding environment, appropriate measures such as the execution of final covers, establishment of monitoring, etc. should be established when the present landfill will be closed.

xi. The present open and controlled tipping landfill operation should be terminated and the sanitary landfill operation introduced.

Table F.5.1a Evaluation of Present Technical System in Highly Urbanized Municipalities

Name / Items	Asuncion	Fernando de la Mora
1. Discharge & Storage	Present curb collection system is suitable. In order to avoid animal scavenging, the installation rate of the waste stand (porta basurero) should be increased.	Present curb collection system is suitable. In order to avoid animal scavenging, the installation rate of the waste stand (porta basurero)should be increased.
2. Collection & Haulage - Type of Management - Evaluation	Municipality and partly contract. Collection service shall cover the whole jurisdiction. Collection efficiency shall be examined by a truckscale. Collection capability shall be improved by replacement and increase in the number of vehicles.	Concession The municipality should be involved in control and management of the service.
3. Street Sweeping - Type of Management - Evaluation	Municipality Present system is suitable. Further improvement shall be achieved through public cooperation.	Municipality Considering limited budget, street sweeping service shall be expanded.
4. Intermediate Treatment	In case the acquisition of a future landfill is difficult, the introduction of a waste volume reduction facility shall be examined. Market of compost from waste is very limited.	In case the acquisition of a future landfill is difficult, the introduction of a waste volume reduction facility shall be examined. Market of compost from waste is very limited.
5. Recycling	Present system mainly established by private sector functions well. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector functions well. The governments shall promote their activities and shall not impede them.
6. Final Disposal - Type of Management - Evaluation	Municipality Level of the sanitary landfill shall be improved. Landfill equipment shall be replaced regularly. A future landfill site shall be planned and secured.	Asuncion Municipality There are no municipally owned landfills. The landfill in Asuncion is being used. The municipality should be involved in management of the landfill.
7. Equipment operation & Maintenance - Type of Management - Evaluation	Municipality	
8. Illegal Dumping		

Table F.5.1b Evaluation of Present Technical System in Urbanized Municipalities

Items / Name	Mariano R. Alonso	Luque	Capiata	San Lorenzo	Lambare	Villa Elisa
1. Discharge & Storage	Present curb collection system is appropriate. The installation rate of the waste stand should be increased.	Present curb collection system is appropriate. The installation rate of the waste stand should be increased.	Present curb collection system is appropriate. The installation rate of the waste stand should be increased.	Present curb collection system is appropriate. The installation rate of the waste stand should be increased.	Present curb collection system is appropriate. The installation rate of the waste stand should be increased.	Present curb collection system is appropriate. The installation rate of the waste stand should be increased.
2. Collection & Haulage - Type of Management - Evaluation	Municipality Collection capability is very limited by the number of vehicles. It should be improved.	Concession The municipality should be involved in control and management of the service.	Municipality Collection capability is very limited by the number of vehicles. It should be improved.	Municipality Collection capability is limited and it should be improved.	Contract Collection service shall cover the whole jurisdiction.	Concession The municipality should be involved in control and management of the service.
3. Street Sweeping - Type of Management - Evaluation	No service Sweeping service for main roads shall be commenced.	Municipality Considering limited budget, sweeping service roads shall be expanded.	No service Sweeping service for main roads shall be commenced.	No service Sweeping service for main roads shall be commenced.	Contract Considering limited budget, improvement may be achieved through public cooperation.	No service Sweeping service for main roads shall be commenced.
4. Intermediate Treatment	Considering limited available finance, there is no need for the introduction of processing facilities for municipal waste. Priority shall be given to the improvement of collection service and final disposal.	Considering limited available finance, there is no need for the introduction of processing facilities for municipal waste. Priority shall be given to the improvement of collection service and final disposal.	Considering limited available finance, there is no need for the introduction of processing facilities for municipal waste. Priority shall be given to the improvement of collection service and final disposal.	Considering limited available finance, there is no need for the introduction of processing facilities for municipal waste. Priority shall be given to the improvement of collection service and final disposal.	Considering limited available finance, there is no need for the introduction of processing facilities for municipal waste. Priority shall be given to the improvement of collection service and final disposal.	Considering limited available finance, there is no need for the introduction of processing facilities for municipal waste. Priority shall be given to the improvement of collection service and final disposal.
5. Recycling	Present system mainly established by private sector is well functioned. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector is well functioned. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector is well functioned. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector is well functioned. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector is well functioned. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector is well functioned. The governments shall promote their activities and shall not impede them.
6. Final Disposal - Type of management - Evaluation	Municipality Open dumping shall be changed to the sanitary landfill. The municipality should control and manage the landfill. A long-term use landfill shall be planned and secured.	Private Municipality should be more involved in the plan and management of the landfill. A long-term use landfill shall be planned and secured.	Municipality Open dumping shall be changed to the sanitary landfill. The municipality should control and manage the landfill. A long-term use landfill shall be planned and secured.	Municipality Open dumping shall be changed to the sanitary landfill. The municipality should control and manage the landfill. A long-term use landfill shall be planned and secured.	Municipality Open dumping shall be changed to the sanitary landfill. The municipality should control and manage the landfill. A long-term use landfill shall be planned and secured.	Municipality Open dumping shall be changed to the sanitary landfill. The municipality should control and manage the landfill. A long-term use landfill shall be planned and secured.
7. Equipment Operation & Maintenance - Type of Management - Evaluation						
8. Illegal Dumping						

Table F.5.1c Evaluation of Present Technical System in Less Urbanized Municipalities

Items \ Name	Nemby	J. A. Saldivar	Ita	Aregua	Limpio	Villa Hayes	Benjamin Aceval
1. Discharge & Storage	Present curb collection system is suitable. The installation rate of the waste stands should be increased.	Curb collection system with waste stands should be established.	Present curb collection system is suitable. The installation rate of the waste stands should be increased.	Curb collection system with waste stands should be established.	Present curb collection system is suitable. The installation rate of the waste stands should be increased.	Present curb collection system is suitable. The installation rate of the waste stands should be increased.	Curb collection system with waste stands should be established.
2. Collection & Haulage - Type of Management - Evaluation	Concession The municipality should be involved in control and management of the service.	No service Collection service shall be established.	Municipality Collection capability is very limited by the number of vehicles. It should be improved.	No service Collection service shall be established.	Concession The municipality should be involved in control and management of the service.	Concession The municipality should be involved in control and management of the service.	No service Collection service shall be established.
3. Street Sweeping - Type of Management - Evaluation	No service If the finance for the service is available, the service shall be commenced.	No service If the finance for the service is available, the service shall be commenced.	No service If the finance for the service is available, the service shall be commenced.	Municipality Priority of the cleansing service shall be given to the commencement of collection service.	No service If the finance for the service is available, the service shall be commenced.	No service If the finance for the service is available, the service shall be commenced.	No service If the finance for the service is available, the service shall be commenced.
4. Intermediate Treatment	In any case, there is no need for the introduction of processing facilities for municipal waste.	In any case, there is no need for the introduction of processing facilities for municipal waste.	In any case, there is no need for the introduction of processing facilities for municipal waste.	In any case, there is no need for the introduction of processing facilities for municipal waste.	In any case, there is no need for the introduction of processing facilities for municipal waste.	In any case, there is no need for the introduction of processing facilities for municipal waste.	In any case, there is no need for the introduction of processing facilities for municipal waste.
5. Recycling	Present system mainly established by private sector functions well. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector functions well. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector functions well. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector functions well. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector functions well. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector functions well. The governments shall promote their activities and shall not impede them.	Present system mainly established by private sector functions well. The governments shall promote their activities and shall not impede them.
6. Final Disposal - Type of Management - Evaluation	Municipality Open dumping shall be changed to the sanitary landfill. The municipality shall control and manage the landfill. A long-term use landfill shall be planned and secured.	No service In order to prepare the commencement of collection service, the municipality shall plan and secure a long-term use landfill.	Municipality Open dumping shall be changed to the sanitary landfill. The municipality shall control and manage the landfill. A long-term use landfill shall be planned and secured.	No service In order to prepare the commencement of collection service, the municipality shall plan and secure a long-term use landfill.	No service Open dumping shall be changed to the sanitary landfill. The municipality should be involved in management of the landfill.	No service Open dumping shall be changed to the sanitary landfill. The municipality should be involved in management of the landfill.	No service In order to prepare the commencement of collection service, the municipality shall plan and secure a long-term use landfill.
7. Equipment Operation & Maintenance - Type of Management - Evaluation							
8. Illegal Dumping							

F.5.2 Institutional System

F.5.2.1 Findings

There are no institutional systems, designed as such, not even a well defined institutional responsibility on MSWM covering neither the group of municipalities that form the Asuncion Metropolitan Area, nor each of the municipalities considered alone.

What exists is makeshift management systems in each of the cities, independent and different one from each other, some more organized than others, with sometimes no system at all.

None of these systems have ever been subjected to a study, design or planning, growing and conforming itself haphazardly, according to the will of the incumbent mayors or to the initiative of private small enterprises or individuals.

Technical and managerial capacities of the municipalities are often very weak or non-existent, although there is a great will to improve this situation.

There is almost no operational cooperation among the municipalities, concerning SWM, except the use of the Cateura landfill by private operators in charge of collecting the wastes from Fernando de la Mora and Luque municipalities.

Sharing of disposal sites, equipment and vehicles is also non-existent, as is operational procedures and technical knowledge.

Private sector participation, on average, is more substantial than in most Latin American cities, sometimes the private MSWM provider works on his own or as a concessionaire, not only as a municipality contractor. These contractors are not only Paraguayans but often Argentineans, (except those working alone) and have a weak managerial capacity and limited financial resources, not having any Associations or any other kind of partnership among them. It is easy to find that the private market share is more the result of the public sector incompetence in coping with their duties, rather than of their greater efficiency.

The situation above described has led to a very uneven system, each city dealing with their solid waste in it's particular and inconsistent way. Characteristics of these systems vary but as a whole we can find service rationing, some cities with a very low or non-existent collection and street sweeping coverage, specially in the low

income areas, and many operational inefficiencies, leaving a large portion of uncollected refuse in the streets and in open areas while those actually collected are dumped without any care, generating high environmental costs.

Finally the informal sector operations should be mentioned, of course a non-governmental and unregulated enterprise but an important sector, mainly on the recovery and recycling operations in the Metropolitan Asuncion area.

F.5.2.2 Improvement Measures

The Institutional System of Asunción and other municipalities needs to be modeled, planned and implemented, since at present there are none.

This way, many improvement measures are needed, most important ones being the following:

a. Setting up a regional entity, encompassing all the municipalities of the study area so to deal with common problems and solutions regarding solid waste management, or to adapt an existing one, like AMUAM, to this objective.

The main common problems are concerned with:

- Disposal of solid waste
- Fleet maintenance
- Procurement capacity
- Public participation campaigns
- Environmental education programs
- Weak tax collection capacity

This regional authority should plan it's work taking into account the municipalities grouped in the same way as proposed in the Study, i.e., Highly Urbanized cities, Urbanized cities and Less urbanized cities.

b. Enact regional legislation concerning SWM, to be applied by the municipalities of the study area, such as:

- Ordinances concerning littering of public spaces and vacant lots
- Ordinances concerning industrial waste and the environment
- Standards and regulations on solid waste disposal
- Ordinances on public participation in the collection activity

- Ordinances regulating the tax system
- Standards and regulations to guide private contractors

c. Provision of a training program, so to form officials, managers and skilled laborers of different levels in the solid waste management institutions, in the following areas:

- Planning, design, management and control of street cleaning, waste collection, transportation and disposal operations.
- Public administration and budgeting
- Public relations and environmental education
- Management of the taxing system
- Management and supervision of service contracts
- Operation and performance control
- Communal participation and behavior

These areas should concentrate on training courses especially on the job training, supported by good quality audio-visual programs and brochures.

ANNEX G

LOCALIZATION OF INTER-MUNICIPAL FINAL DISPOSAL SITE

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G.1 Objectives of the Works

G.1.1 Inter-Municipal Final Disposal

a. Basic Principle "Independent Disposal"

Article 18 C of the municipal organic law (1294/87) stipulates that the municipality is solely responsible for its municipal solid waste management. On the other hand, the inter-municipal cooperation method is taken in some cases as a solution for municipal solid waste management. Focusing on the present situation of the Study Area, the following difficulties could be pointed out on inter-municipal cooperation.

- **Political and Administrative Aspects**

. The municipalities in the Study Area are completely independent, having various political backgrounds and various administration policies.

- **Financial Aspects**

. The inter-municipal final disposal site leads to a large rise in solid waste management cost due to increase of haulage distance as collection and haulage cost occupy more than 90 % of the solid waste management total cost at present.

. To use a disposal site in a different municipality, the discharger municipality must pay more compensation in order to get acceptances from the citizens in the municipality where the disposal site is constructed, than using disposal sites within its municipality.

. To improve the sanitary level of final disposal operation too rapidly leads to large increase in solid waste management cost.

Therefore inter-municipal cooperation is considered to be a difficult and impractical measure for the municipalities in the Study Area. The best solution is that collection, haulage and disposal operations are executed by the discharger municipality within its jurisdiction area.

b. Necessity of Inter-municipal Disposal

The survey for the last three months concluded that all municipalities except Asuncion and Fernando de la Mora would be able to keep the final disposal sites within their jurisdiction area. It is nearly impossible to acquire the final disposal sites except the Cateura landfill site within the jurisdiction areas of Asuncion and Fernando de la Mora because most areas of those cities have been highly urbanized. Therefore, the new inter-municipal disposal site has to be urgently planned outside of those municipalities.

c. Requirements to succeed in Inter-municipal Disposal Operation

Primarily, the municipality and its citizens are required to have enough financial capability to bear higher solid waste management cost because inter-municipal cooperation leads to cost increase.

The core municipality, which has enough experience, organizations and control capabilities, is required to participate in the running of the inter-municipal disposal site because it is constructed and operated by the various municipalities which have various political and administrative policies.

It is, therefore, judged that inter-municipal disposal sites can not be operated without the participation of the Municipality of Asuncion, because only Asuncion is operating a large scale landfill site and receiving wastes from the other municipality, Fernando de la Mora. Only the Municipality of Asuncion has capability of planning, operation and supervision required for the inter-municipal disposal site.

G.1.2 Objectives of the Works

a. Location of the Final Disposal Site

It is desired that 15 municipalities in the Study Area have their own final disposal sites, as described before. Localization of future final disposal sites should be carried out for 15 municipalities however the scope of this study does not cover this work. Therefore, the localization work of this study concentrate on only the final disposal site participated by Asuncion, Fernando de la Mora and the municipality where the final disposal site will be constructed.

b. Objective Constituent Municipalities of Inter-municipal Final Disposal Site

Asuncion and Fernando de la Mora will lose a final disposal site which is essential for solid waste management after the Cateura landfill is closed. The new final disposal site for both municipalities have to be a inter-municipal final disposal site which will be located outside their jurisdiction areas. To maintain a basic level of solid waste management, the new final disposal site for both municipalities has to be planned urgently. Therefore, the objective municipalities of this study shall be Asuncion, Fernando de la Mora and the municipality where the final disposal site will be constructed.

c. Other 12 Municipalities

Independent final disposal is considered to be desirable in terms of financial and administrative aspects. The 3 months survey in the study area concluded 12 municipalities still have possibilities to continue independent final disposal. However, anti-waste dumping demonstrations, which Luque is now facing may spread to other municipalities. 12 municipalities may require the inter-municipal final disposal as a solution when they encounter such problems. In that case, it is a practical idea that these municipalities participate in the inter-municipal disposal site run by Asuncion, Fernando de la Mora and the municipality housing the landfill.

d. Conclusion

Therefore, the objective municipalities for localized inter-municipal final disposal site shall be Asuncion, Fernando de la Mora and the municipality where the final disposal site will be located.

G.2 Site Selection Method

G.2.1 Flow Diagram of Site Selection

The study flow diagram of the final disposal site is shown in Figure G.2.1a.

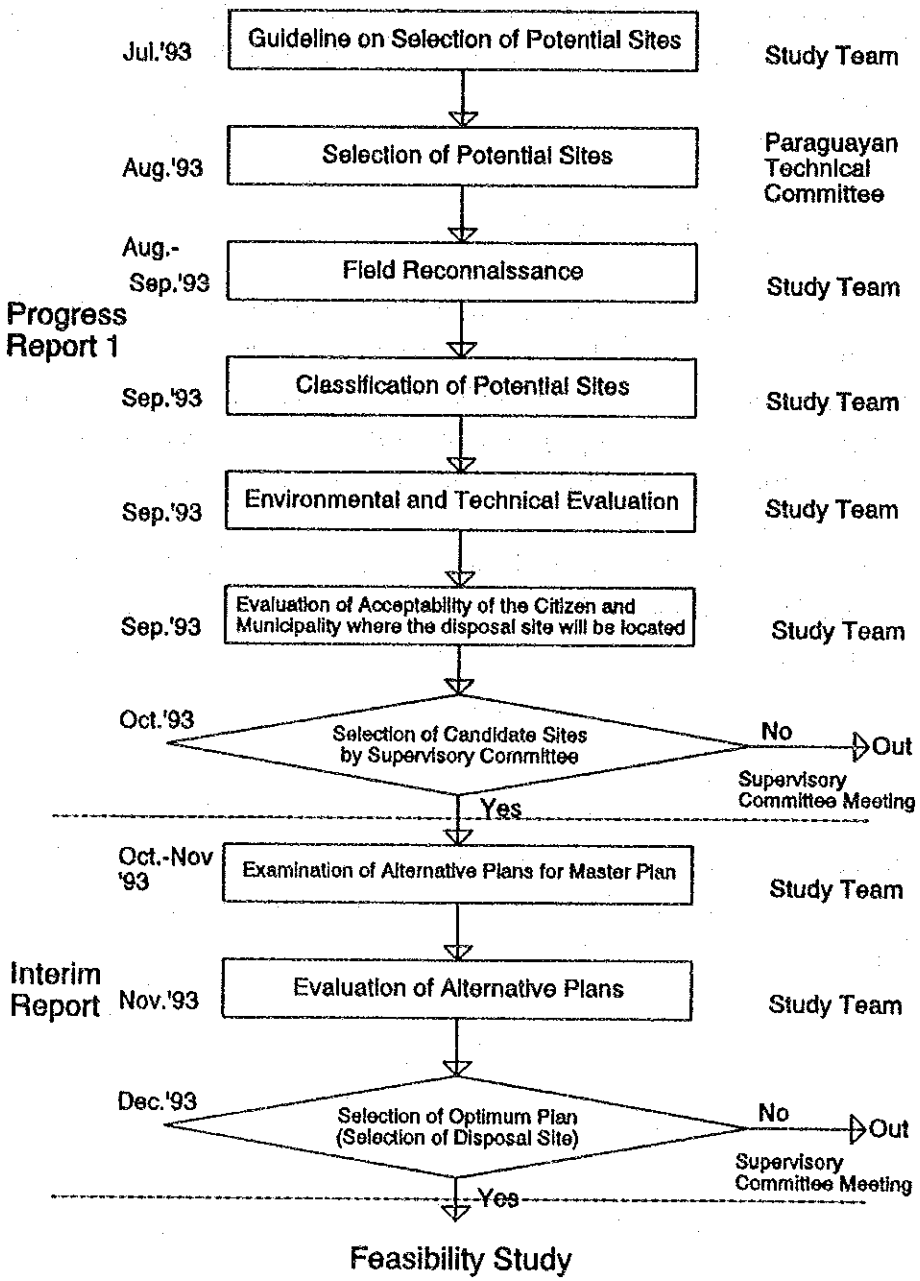


Figure G.2.1a Work Flow Diagram on Localization of Inter-municipal Disposal Site

G.2.2 Site Selection Method

a. Guideline on Selection of Potential Sites

After understanding the situation and characteristics concerning MSWM through the preliminary survey, the Study Team proposed a guideline to find potential sites as inter-municipal disposal sites to the Paraguayan Technical Committee.

b. Selection of Potential Sites

The Paraguayan Technical Committee presented the Study Team potential sites selected on the basis of the guideline.

c. Field Reconnaissance

Field reconnaissance was executed on all potential sites informed by the Paraguayan Technical Committee in order to collect data for further evaluation.

d. Classification of Potential Sites

Evaluation of potential sites quantitatively and objectively is difficult because the values of evaluation items depends on the person conducting the evaluation. Final site selection, therefore, is usually made by political and administrative decision. The role of the Study Team was to provide the concerned parties with tools to make a decision. In order to prepare the policy making tools, many surveys and analyses were conducted. In this study potential sites were classified by their different characteristics to ease making and understanding the tools.

e. Environmental and Technical Evaluation

Environmental and technical evaluations were conducted to all potential sites. Environmental evaluations were divided into three categories, social impact, environmental pollution and impact on nature. Evaluation items are listed up and the allotments of points are decided. These evaluations were carried out without adding any weight to a specific item.

f. Evaluation of Citizen and Municipality Acceptance where the Disposal Site will be located

To get acceptance from neighbors of the site and the municipality in which the site is located is the minimum requirement for the proposed site because to acquire the land and to carry out operation of facilities is almost impossible without their agreement. For instance in Luque, disposal sites were forced to be closed due to protests by the neighbors twice in 1992 and 1993. The Municipality of Luque is seriously suffering from solid waste management problems. Therefore, only the items concerning social acceptance were evaluated to confirm it with the Paraguayan Supervisory Committee.

g. Selection of Candidate Sites by the Supervisory Committee in the Meeting of Progress Report (1)

The selection of the final disposal site influences the total cost of solid waste management, because the location of the final disposal site is related to not only the haulage distance of wastes but also the haulage system such as with or without transfer stations. Moreover, collection and haulage costs occupy a large portion of the total cost. Thereby, it is quite important to estimate overall solid waste management cost, including collection and haulage costs, depending on the potential sites. However it is not practical to estimate cost for all potential sites. Therefore, it was proposed that the cost evaluation was carried out in Japan for the candidate sites selected in the Meeting of the Progress Report (1) and the results were included in the Interim Report.

h. Examination of Alternative Plans for the Master Plan

The examination of alternative plans for the master plan was divided into two, one is for Asuncion and Fernando de la Mora and the other for the rest of the 13 municipalities in the Study Area.

ha. For Asuncion, Fernando de la Mora and the Municipality in AMUAM where the Inter-municipal Disposal Site will be located

The objective municipalities are to be Asuncion, Fernando de la Mora and the municipality in AMUAM where the inter-municipal disposal site will be located. Based on the projection of the target year 2006 and the above-said objective municipalities, the following alternative plans will be examined.

Alternative No.1: Independent Disposal Plan

Intermediate treatment and Final disposal in Cateura
(Objective municipalities are Asuncion and Fernando de la Mora)

Alternative No.2: Inter-municipal Disposal Plan

In this plan all wastes are disposed of in the inter-municipal disposal site without intermediate treatment. Transfer stations may be included depending on the haulage distance. This plan is examined for all candidate disposal sites selected. Therefore, three alternative plans of this kind may be examined.

The optimum system will be selected from an economic and financial aspect.

hb. For the Other 12 Municipalities

The following alternative plans are examined as the technical system in 2006 for the other 12 municipalities.

Alternative No.1: Independent Disposal Plan

Every municipality dispose of their wastes in the final disposal sites located within their own municipal areas.

Alternative No.2: Inter-municipal Disposal Plan

Wastes are transported to the inter-municipal disposal site for disposal.

i. Evaluation of Alternative Plans

The technical system alternatives in 2006 prepared as described above were evaluated using the following items.

- Technical points of view
- Economic and financial points of view
- Environmental points of view
- Social points of view

j. Selection of Optimum Plan (ie. Selection of Disposal Site)

The evaluation results on the alternative plans were included in the Interim Report submitted in December 1993. In the Meeting of the Interim Report, the supervisory committee made a final decision on the selection of the optimum alternative plan as the main system for the solid waste Master Plan. The objective project for the feasibility study, in other words the first priority project, is decided and the geological survey and topographical survey will be executed for the site selected in the 2nd phase of the study in 1994.

G.3 Selection of Potential Sites

G.3.1 Guideline on Selection of Potential Sites

a. Guideline on Selection of Potential Sites

The following selection guideline for the inter-municipal disposal sites was presented to the Paraguayan side.

- Possibility of land acquisition
- Possibility of obtaining neighborhood consensus
- Compatibility with regional development plan
- Economic feasibility
- Environmental acceptability

Table G.3.1a Worksheet with Guidelines for Potential Site Selection

Item	Remarks
1 Possibility of Land Acquisition	
1a Land use restriction	
1b Land ownership	
1c Necessity of compensation	
1d Other considerations	
2 Possibility of Getting Neighborhood Consensus	
2a Necessity of neighborhood consensus	
2b Necessity for site to be unseen	
2c Necessity for isolation from noise, dust and odor	
2d Other conditions	
3 Compatibility with Regional Development Plans	
3a Compatibility with development plans	
3b Conformity with the City Master plan and Land use plan	
3c Direction of urbanization towards sites	
3d Other considerations	
4 Economic Feasibility	
4a Location of site (distance from main waste generation area	
4b Area of site (ha)	
4c Life expectancy (years)	
4d Availability of covering soil	
4e Availability of public services	
4f Present conditions of site	
4g Technical consideration	
4h Benefits of site upon completion	
5 Environmental Acceptability	
5a Risk of drinking water pollution	
5b Risk of surface water pollution	
5c Risk of flooding	
5d Risk of ground water pollution	
5e Distance from other public facilities	
5f Distance from densely populated areas	
5g Hazards from dust, noises and odor	
5h Land use of adjacent area	
5i Slope stability	
5j Inshore or river fishery	
5k Terrestrial vegetation and wildlife	
5l Impact on Natural landscape	
5m Historic places or structures	
5n Religious places or structures	

G.3.2 Selection of Potential Sites by the Paraguayan Supervisory Committee

The Paraguayan Technical Committee presented to the Study Team the following 13 potential sites selected on the basis of the guideline after August 15th in 1993.

		Site No.
1.	Benjamin Aceval No.1	A–1
2.	Benjamin Aceval No.2	A–2
3.	Villa Hayes No.1	A–3
4.	Villa Hayes No.2	A–4
5.	Villa Hayes No.3	A–5
6.	Compania Salado, Limpio	B–1
7.	Luque No.1	B–2
8.	Luque No.2	B–3
9.	Emboscada	C–1
10.	Itagua	C–2
11.	Ypane	C–3
12.	Villeta No.1	C–4
13.	Villeta No.2	C–5

All the sites informed, as the potential sites, are private lands except Villa Hayes No.2 (A–4).

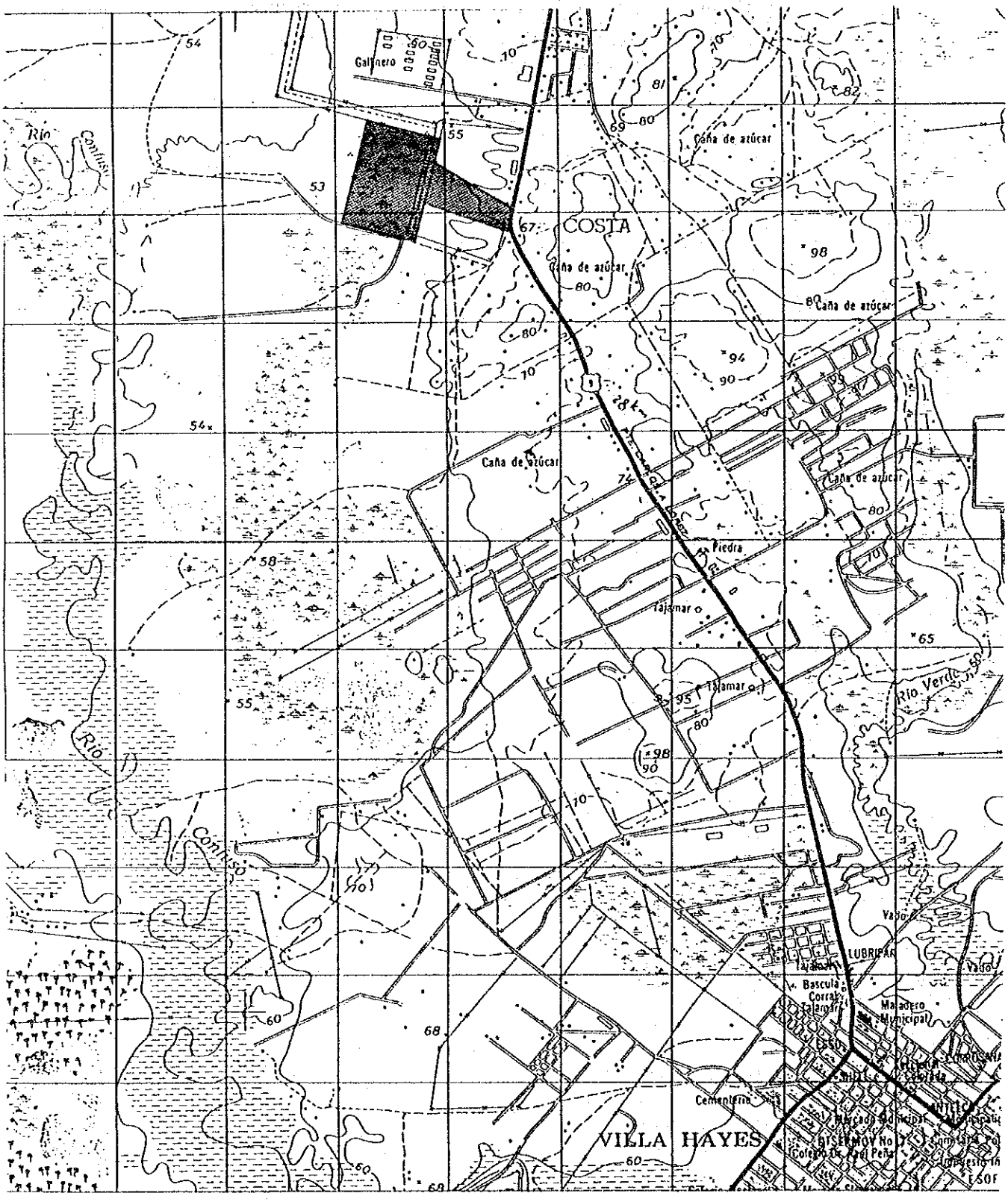
In Paraguay, it is very difficult to obtain reliable data concerning land because the land registration system has many problems. The survey and evaluation of the potential sites were carried out based on the data given by counterparts and the data collected by field reconnaissances. The data given by the counterparts seems unreliable enough because standard land confirmation works in Paraguay such as area survey were not conducted. The reliability of the data concerning the land such as area, location, ownership, etc. and also the evaluation result brought based on these date are, therefore, not guaranteed by the Study Team.

G.3.3 Field Reconnaissance

The field reconnaissance was carried out by the Study Team in order to obtain enough data for evaluation of 13 potential sites. The location of each potential site and the general information are presented in this section.

Site No.A-1

Location: North side of the 41 km milestone of the Route No.9, Benjamin Aceval



Year of Evaluation: September, 1993

Ownership: Private (Marcial Artecona)

Total Area: 89 ha

Type of Terrain: Flat land

Present Land Use: Pasture

Availability of Coverage Materials:

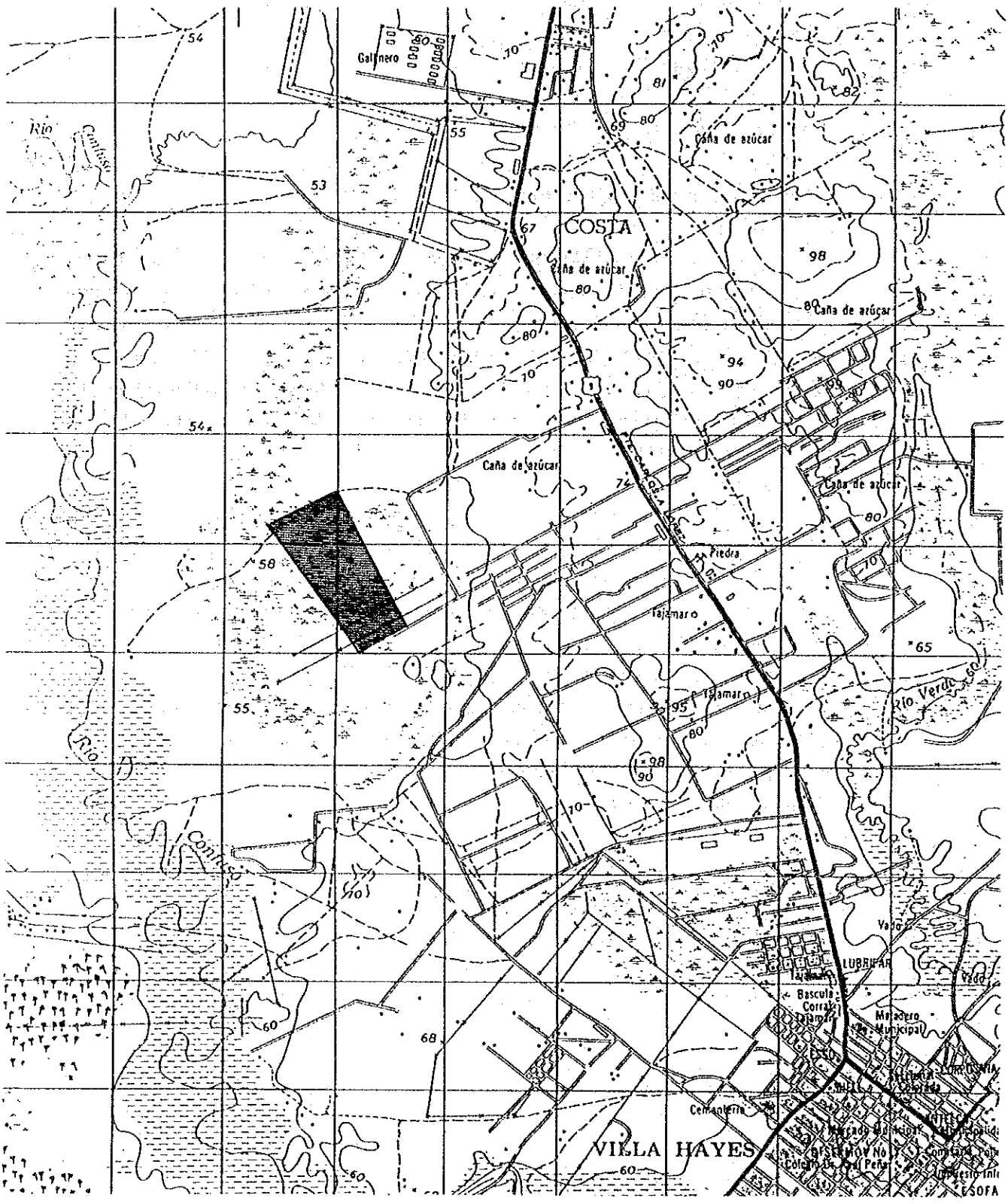
It is too difficult to find suitable coverage soil near this site, because the Chaco area is very flat and there are no mountains near this site. However, there are two possibilities in obtaining coverage material instead of soil for this site. One way is to utilize ash and slag discharged from the iron factory "ACEPAR" located in Villa Hayes, 9.8 km from this site, and the other is to utilize overburden of the quarry "Minera Ypacarai" located in Villa Hayes, 15 km from this site.

Accessibility:

The construction of a new access road to the landfill site is not required, because this land is located along the route No.9 road. The distance from the center of Asuncion is 38.9 km and the road from Asuncion to the site is asphalt paved. The road consists of 4 lanes for 15.0 km from Asuncion until Mariano R. Alonso and 2 lanes for 23.9 km from Mariano R. Alonso until the site. There are no sharp horizontal and vertical alignments. This road is very suitable for a large trailer to travel in terms of width and alignment throughout its route. The present volume of traffic is very low after Mariano R Alonso and it is forecasted that the traffic volume will not increase.

Site No.A-2

Location: 2.5 km north of the 38 km milestone of the Route No.9, Benjamin Aceval



Year of Evaluation: September, 1993

Ownership: Private (Pastor Alfonso)

Total Area: 85.2 ha

Type of Terrain: Flat and marsh land

Present Land Use: Pasture

Availability of Coverage Materials:

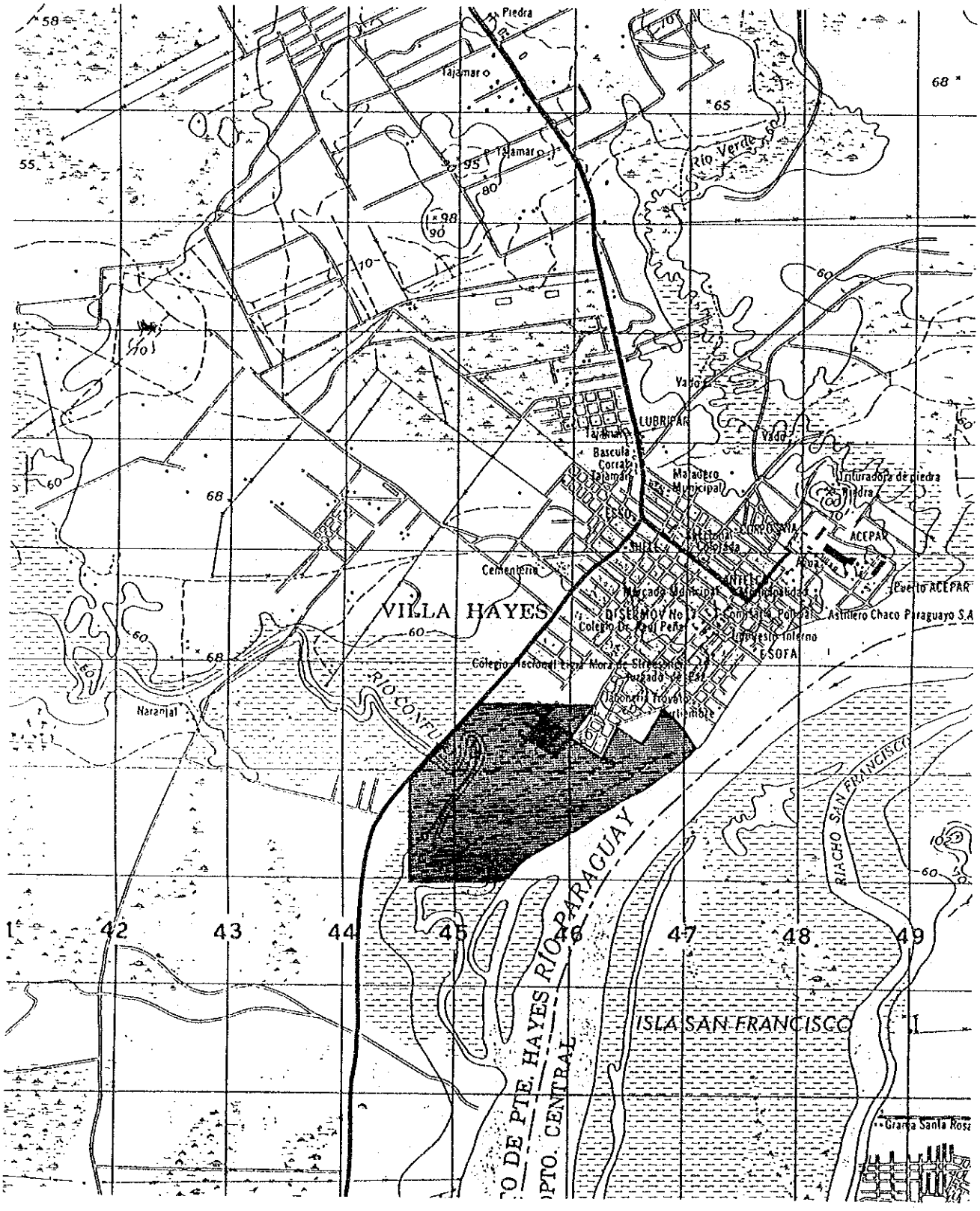
It is too difficult to obtain suitable coverage soil near this site, because the Chaco area is very flat and there are no mountains near this site. However, there are two possibilities in obtaining coverage material instead of soil for this site. One way is to utilize ash and slag discharged from the iron factory "ACEPAR" located in Villa Hayes, 9.3 km from this site, and the other is to utilize overburden of the quarry "Minera Ypacarai" located in Villa Hayes, 14.5 km from this site.

Accessibility:

The construction of a new access road to the landfill site is not required, because this land is located along the route No.9 road. The distance from the center of Asuncion is 38.4 km and the road from Asuncion to the site is asphalt paved. The road consists of 4 lanes for 15.0 km from Asuncion until Mariano R. Alonso and 2 lanes for 23.4 km from Mariano R. Alonso until the site. The road alignments do not include any sharp horizontal and vertical curves. This road is very suitable for a large trailer to travel in terms of width and alignment throughout its route. The present volume of traffic is very low after Mariano R Alonso and it is forecasted that the traffic volume will not increase.

Site No.A-3

Location: Along the most downstream area of Confuso River, Villa Hayes



Year of Evaluation: September, 1993

Ownership: Private

Total Area: 216 ha

Type of Terrain: Almost flat and some parts are inundated area.

Present Land Use: Mixed with coconut field, pasture and bush

Availability of Coverage Materials:

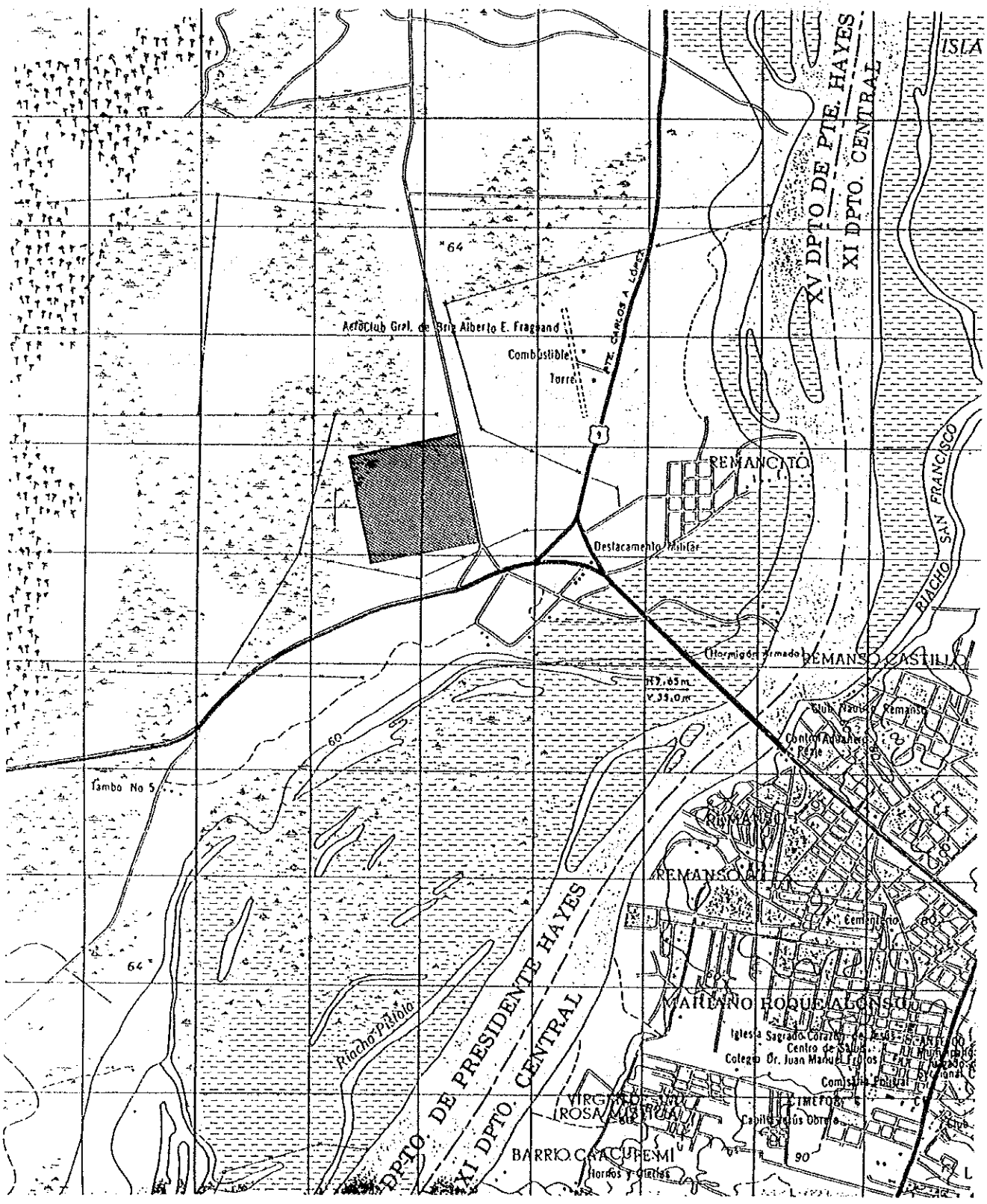
It is too difficult to obtain suitable coverage soil near this site, because the Chaco area is very flat and there are no mountains near this site. However, there are two possibilities in obtaining coverage material instead of soil for this site. One way is to utilize ash and slag discharged from the iron factory "ACEPAR" located in Villa Hayes, 3.5 km from this site, and another is to utilize overburden of the quarry "Minera Ypacarai" located in Villa Hayes, 4.7 km from this site, and the other is to utilize sand obtained from Paraguay River.

Accessibility:

The construction of a new access road to the landfill site is not required, because this land is located along the route No.9 road. The distance from the center of Asuncion is 28.0 km and the road from the Asuncion to the site has been paved with asphalt. The road consists of 4 lanes for 15.0 km from Asuncion until Mariano R. Alonso and 2 lanes for 13.0 km from Mariano R. Alonso until the site. The road alignments do not include any sharp horizontal and vertical curves. This road is very suitable for a large trailer to travel in terms of width and alignment throughout its route. The present traffic volume is very low after Mariano R Alonso and it is forecasted that the traffic volume will not increase.

Site No.A-4

Location: 1 km western side from the intersection after the Remanso Castillo Bridge, Villa Hayes



Year of Evaluation: September, 1993

Ownership: National land

Total Area: 100 ha

Type of Terrain: Flat land

Present Land Use: Pasture

Availability of Coverage Materials:

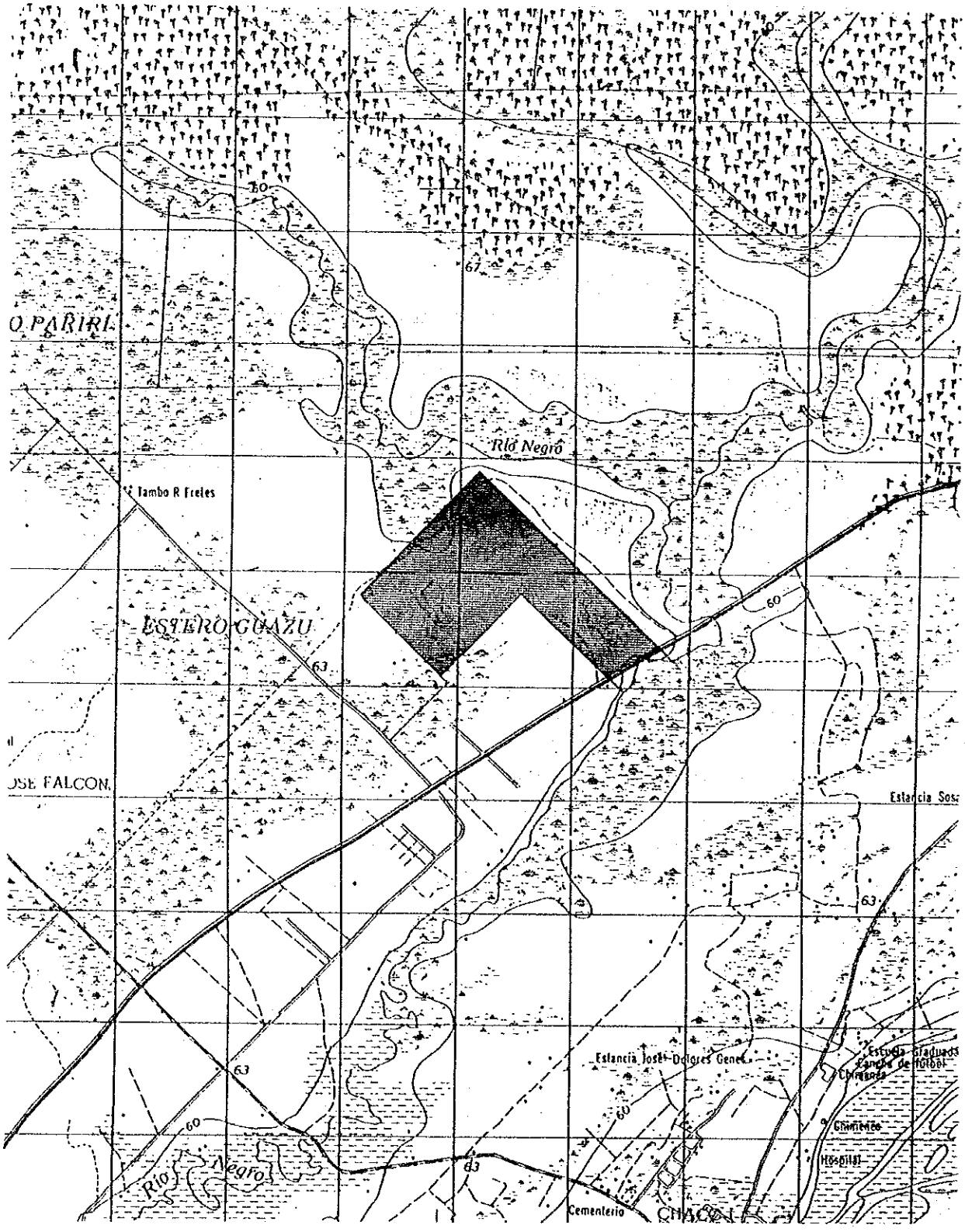
It is too difficult to obtain suitable coverage soil near this site, because the Chaco area is very flat and there are no mountains near this site. However, there are three possibilities in obtaining coverage material instead of soil for this site. One way is to utilize ash and slag discharged from the iron factory "ACEPAR" located in Villa Hayes, 12 km from this site, and another is to utilize overburden of the quarry "Minera Ypacarai" located in Villa Hayes, 6.5 km from this site, and the other is to utilize sand obtained from Paraguay River.

Accessibility:

The construction of a new access road to the landfill site is not required, because this land is located along the route No.9 road. The distance from the center of Asuncion is 20.4 km and the road from the Asuncion to the site has been paved with asphalt. The road consists of 4 lanes for 15.0 km from Asuncion until Mariano R. Alonso and 2 lanes for 5.4 km from Mariano R. Alonso until the site. The road alignments do not include any sharp horizontal and vertical curves. This road is very suitable for a large trailer to travel in terms of width and alignment throughout its route. The present traffic volume is very low after Mariano R Alonso and it is forecasted that the traffic volume will not increase.

Site No.A–5

Location: 1.2 km western side of the Rio Negro, Villa Hayes



Year of Evaluation: September, 1993

Ownership: Private land

Total Area: 214 ha

Type of Terrain: Flat land

Present Land Use: Pasture

Availability of Coverage Materials:

It is too difficult to obtain suitable coverage soil near this site, because the Chaco area is very flat and there are no mountains near this site. However, there are three possibilities in obtaining coverage material instead of soil for this site. One way is to utilize ash and slag discharged from the iron factory "ACEPAR" located in Villa Hayes, 24 km from this site, and another is to utilize overburden of the quarry "Minera Ypacarai" located in Villa Hayes, 18.5 km from this site, and the other is to utilize sand obtained from Paraguay River.

Accessibility:

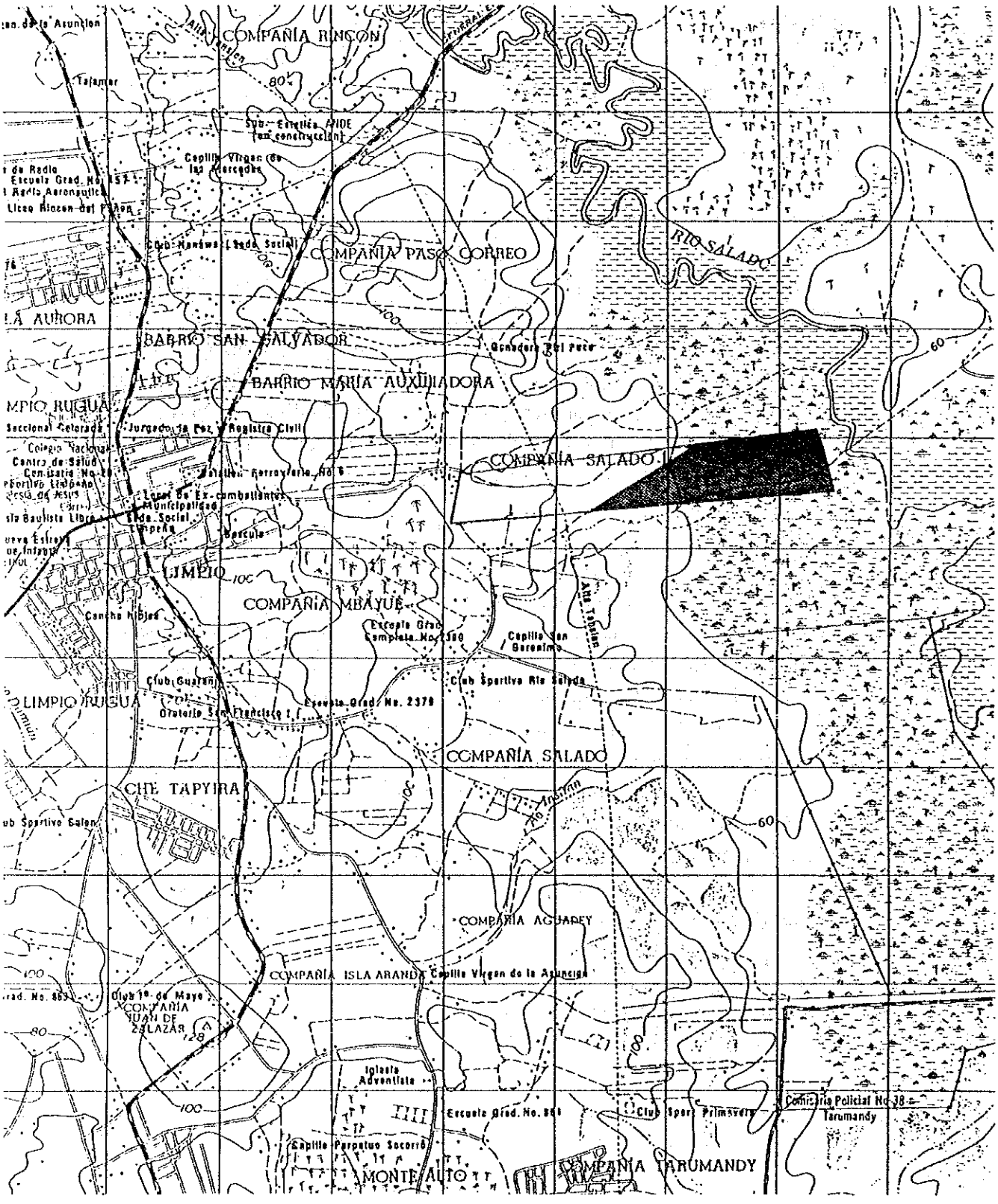
The construction of new access road to the landfill site is not required, because this land is located along the route No.12 road. The distance from the center of Asuncion is 31.2 km and the road from the Asuncion to the site has been paved with asphalt. The road consists of 4 lanes for 15.0 km from Asuncion until Mariano R. Alonso and 2 lanes for 16.2 km from Mariano R. Alonso until the site. The road alignments do not include any sharp horizontal and vertical curves. This road is very suitable for a large trailer to travel in terms of width and alignment throughout its route. The present traffic volume is very low after Mariano R Alonso and it is forecast that the traffic volume will not increase.

Inundation

There are large areas in Chaco, which are flooded, however the latest inundation occurred here in only 1983.

Site No.B-1

Location: Compania Salad, Limpio



Year of Evaluation: September, 1993

Ownership: Private (Dionicio Aranda Sanchez and others)

Total Area: 90 ha

Type of Terrain: This area is almost flat but has a very gentle slope until the River Salado. The surroundings are hilly and many places are used as borrow pits.

Present Land Use: Pasture

Availability of Coverage Materials:

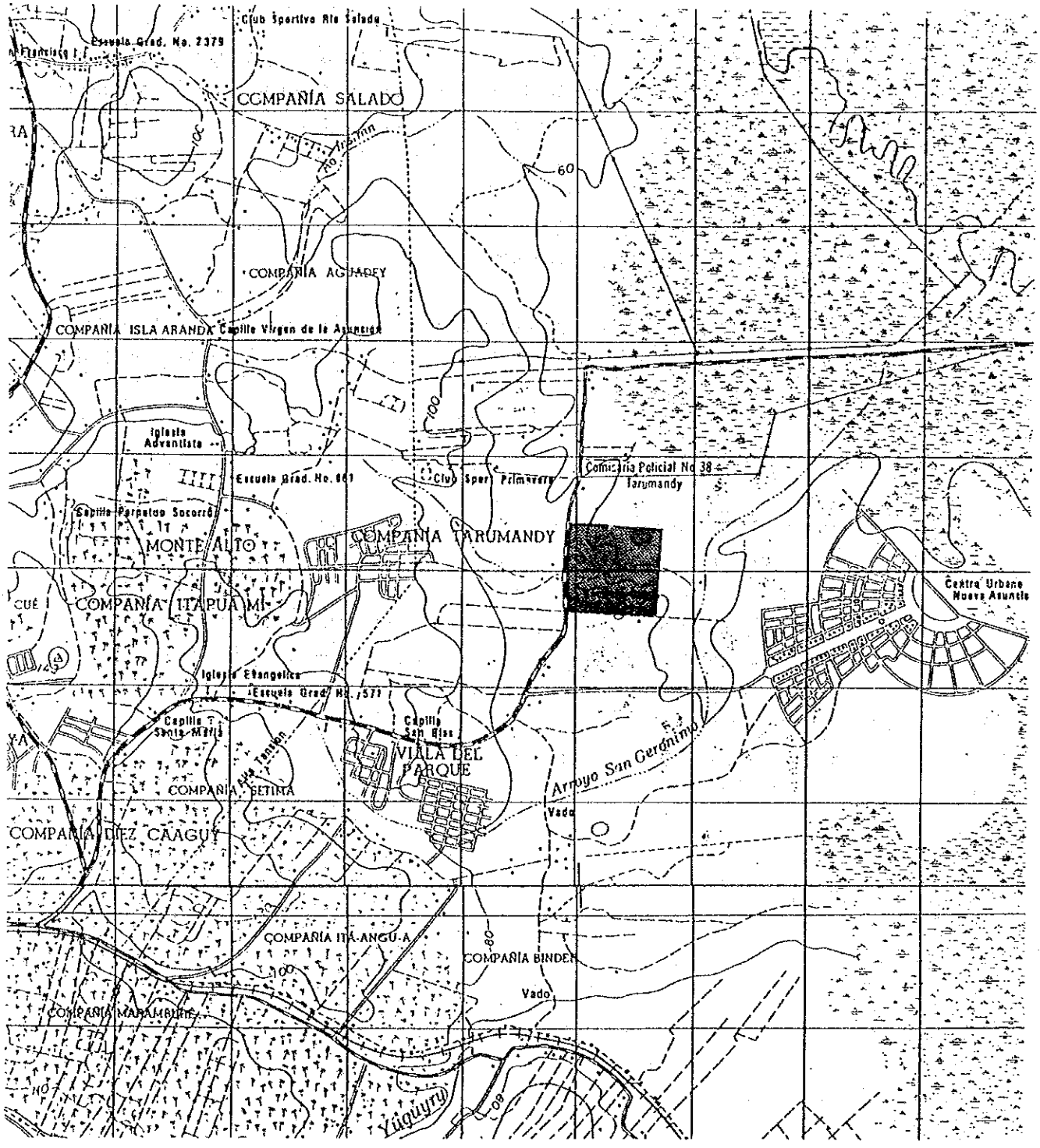
Although coverage soil seems unavailable within this site, it is expected to be obtained quite easily near this site. There are many borrow pits supplying soil for road repairing around this site.

Accessibility:

Improvement of the existing road for 3.3 km is required from the urban area of Limpio until the site. The distance from the center of Asuncion until the site is 25.0 km. The road consists of 4 lanes for 15.0 km from Asuncion until Mariano R. Alonso and 2 lanes for 6.7 km from Mariano R. Alonso until Limpio and 1 lane from Limpio to the site. The existing road from Limpio until the site is not paved, and its width is narrow, and it has many curves. There are many houses along the present road from the urban area of Limpio until this site. Even though the road is improved, it will not be suitable for a trailer.

Site No.B-2

Location: Compania Tarumandy, Luque



Year of Evaluation: September, 1993

Ownership: Private

Total Area: 60 ha

Type of Terrain: Almost flat

Present Land Use: Pasture

Availability of Coverage Materials:

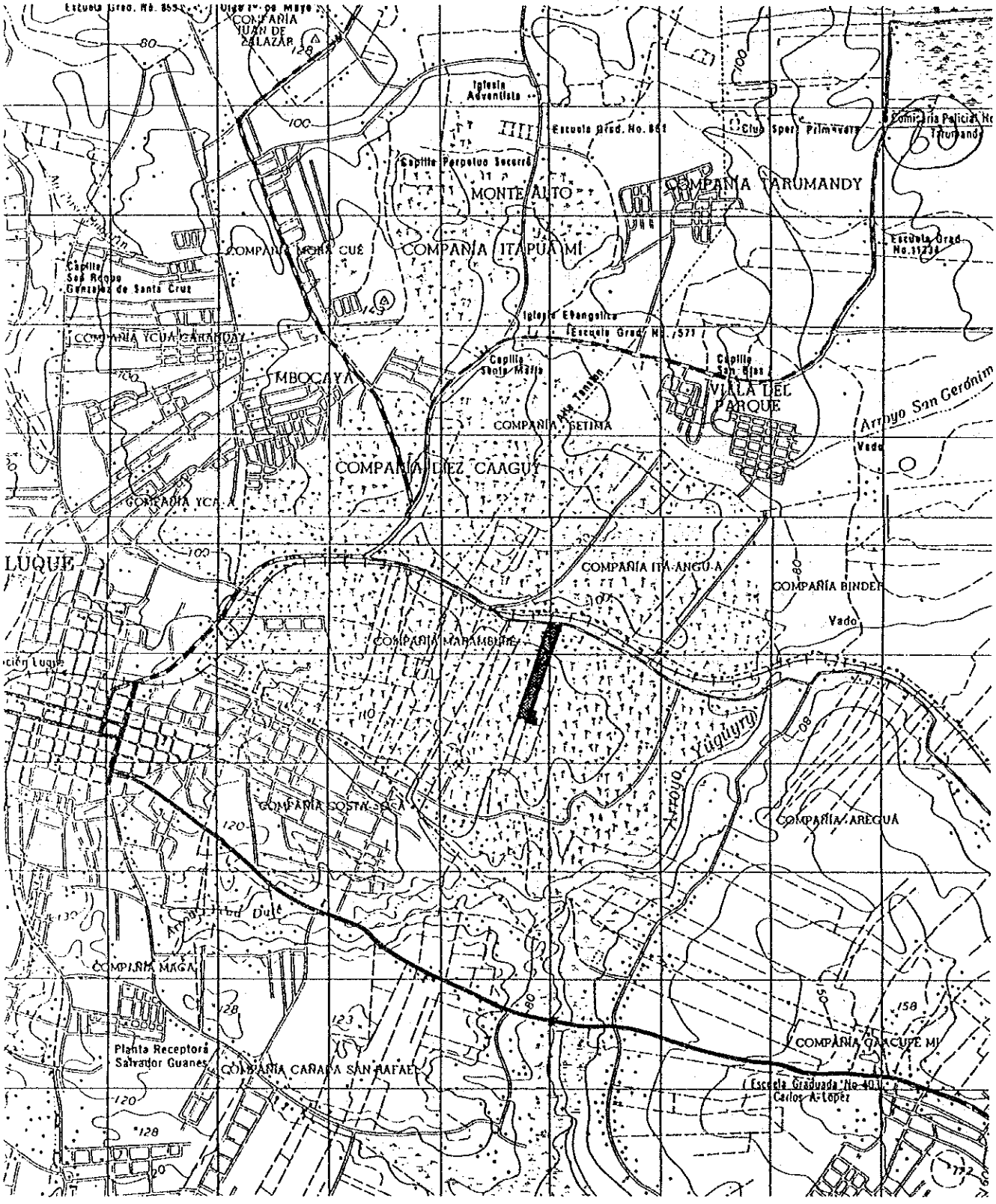
Suitable coverage soil can be probably obtained from the hill to the north of this site.

Accessibility:

The existing road for 10.8 km from the main paved road to the landfill site has to be improved. The distance from the center of Asuncion is 26.3 km. The present 2 lane road is asphalt paved for 15.5 km from Asuncion until the urban area of Luque, and from the urban area of Luque until this site it is not paved and very narrow. The road alignments of the improved haulage route will have several sharp horizontal and vertical curves. This road is thereby expected unsuitable for a large trailer and also do not allow compactor trucks etc., to travel at high velocity. The traffic volume is increasing rapidly until the urban area of Luque, because the population is increasing quickly in Luque due to the location being convenient to commute to Asuncion. It is, therefore, expected that the traffic volume of the access road will increase after being paved.

Site No.B-3

Location: Compania Marambure, Luque



Year of Evaluation: September, 1993

Ownership: Private (Genaro Sanabria)

Total Area: 10 ha

Type of Terrain: This area is hilly and faces a shallow valley to the east. There is a large hole in the ground, which is approximately more than 10 m in depth and 1 ha in area, on the southeast side within this site as this site was used as a borrow pit. The other area within this site has been excavated, on average 3 m deep.

Present Land Use: Waste land

Availability of Coverage Materials:

This site was used as a borrow pit for earthwork on the international airport project. Suitable coverage soil can still be obtained at this site but ripping work may be required to excavate the ground because the overburden in some areas have already been removed and hard ground is exposed.

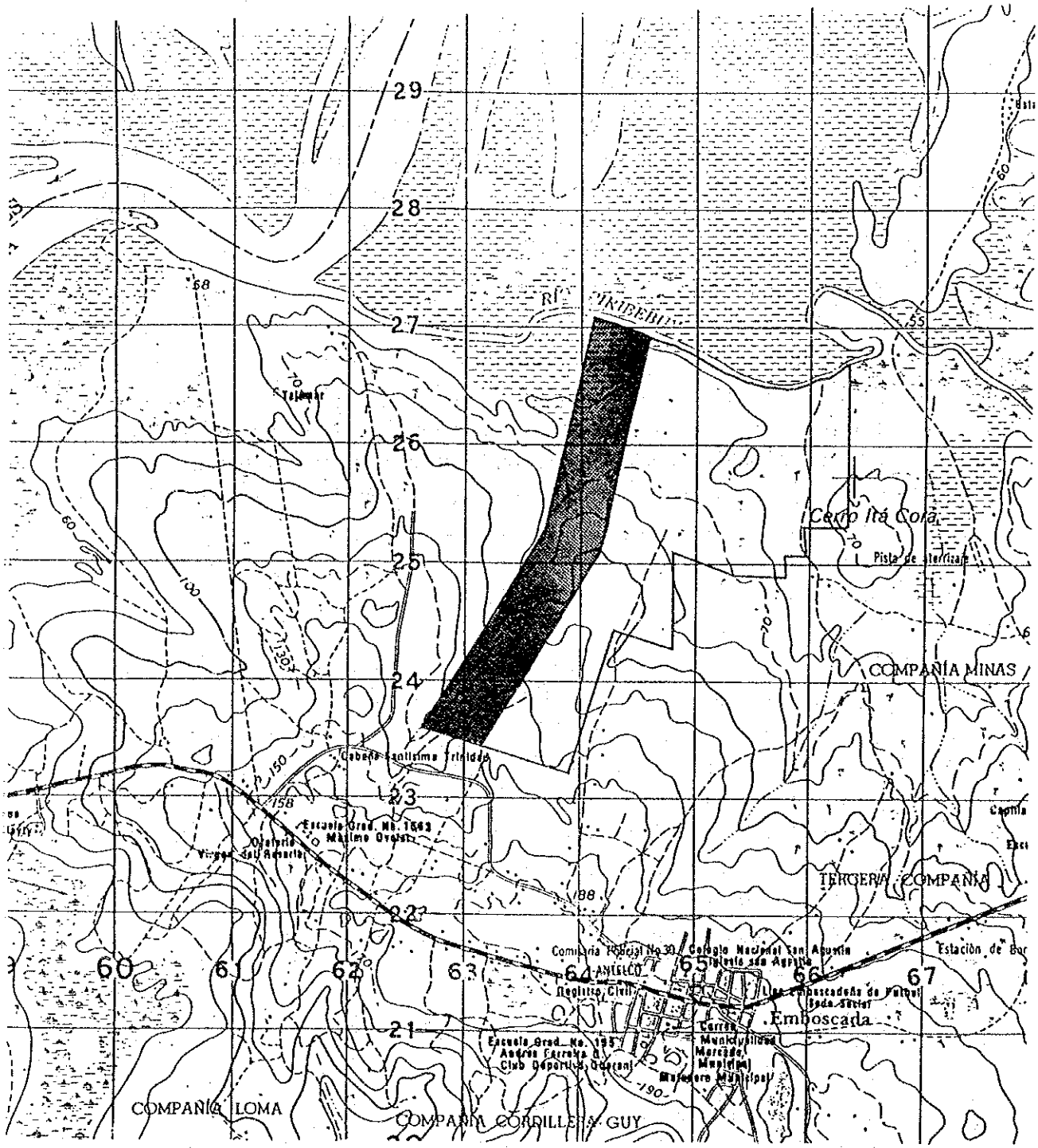
Accessibility:

The existing road for 4.5 km from the main paved road to the landfill site has to be improved. The distance from the center of Asuncion is 20.0 km. The present road with 2 lanes is asphalt paved for 15.5 km from Asuncion until the urban area of Luque, and from the urban area of Luque until this site some parts have been paved with stone and some parts have not been paved. There are many houses along the present road from the urban area of Luque until this site and the road is very narrow. The improved access road is expected unsuitable for a large trailer and also do not allow compactor trucks etc., to travel at high velocity. However, it is too difficult to construct a new access route because the population is quite dense along the route.

This site was partially used for a landfill site by the Municipality of Luque in early 1993, and it was forced to be closed for landfill site due to the protests from the residents along the haulage route. In order to use this site for a final disposal site, countermeasures to protect residence from traffic problem are required.

Site No.C-1

Location: Emboscada



Year of Evaluation: September, 1993

Ownership: Private (Ramon Bogarin)

Total Area: 180 ha

Type of Terrain: One side of this area is facing Rio Piribebuy and the other side is facing Arroyu Guazu Pire and Arroyo Naku. Half of this site is a gentle slope and the other half is flat and some area is marshlands.

Present Land Use: Waste land

Availability of Coverage Materials:

Since some of this site is a slope the soil may be obtained within the site. However, it is expected that excavation work of soil will encounter difficulties from rocks and boulders.

Accessibility:

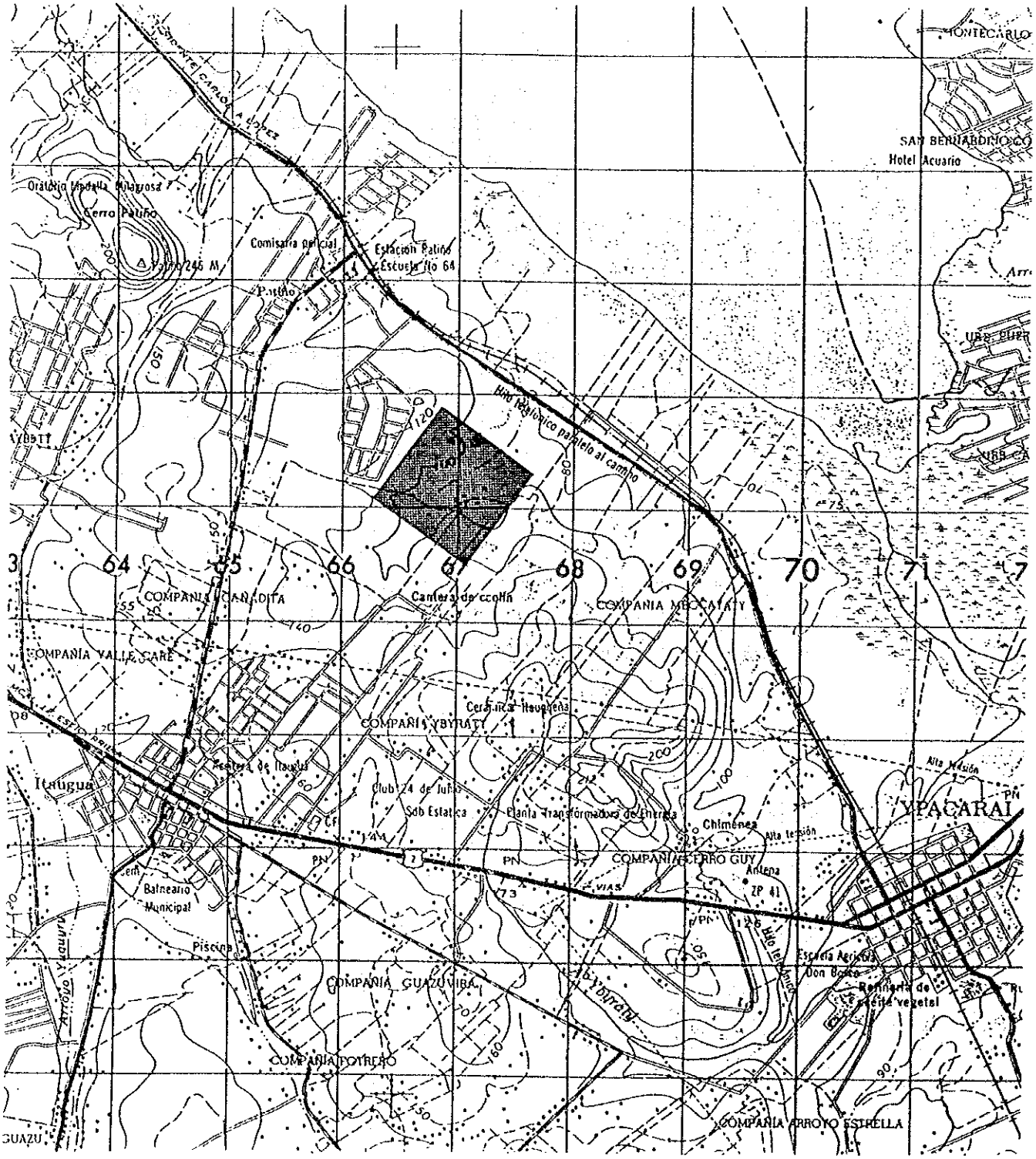
The condition of the existing road to this site is very bad. The existing road is 4 lanes asphalt paved for 15.0 km from Asuncion until Mariano R. Alonso, 2 lanes asphalt paved for 6.7 km from Mariano R. Alonso till Limpio, and unpaved narrow road for 4.0 km from Limpio until near the site. Therefore, the road construction cost is expected to be very high.

Others:

There are many boulders and rocks exposed at this site and also around it. This area, Emboscada, is supplying rocks to Asuncion. The rocks may give many problems on road construction and landfill construction and operation.

Site No.C-2

Location: Compania Mbocayaty, Itagua



Year of Evaluation: September, 1993

Ownership: Private (Ceramica Itagua)

Total Area: 1.5 ha

Type of Terrain: This site has many undulations. This site was utilized for borrow pit for material of brick and therefore there are 5 large holes excavated for bricks. Rain water in all the holes proves that the bottom layer of the ground is impermeable.

Present Land Use: Borrow Pit

Availability of Coverage Materials:

The remaining overburden within this site is not allowed to use as coverage soil, because the landowner still wants to use it for brick material.

Accessibility:

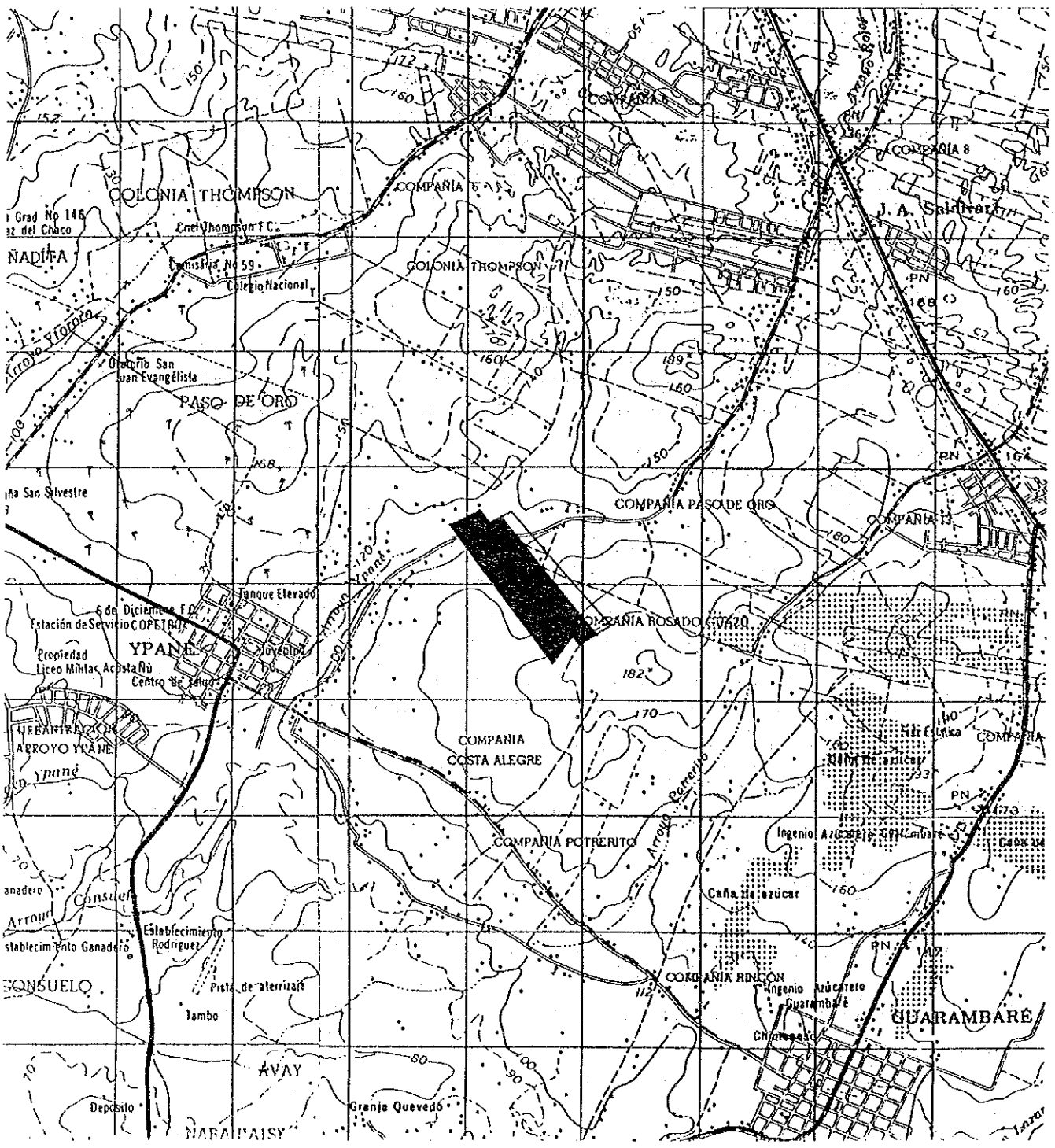
The existing road for 1.5 km from the paved road to the landfill site has to be improved. The distance from the center of Asuncion until this site is 33.0 km. The most of this haulage route is route No.2 road which is the most important and has one of the heaviest traffic in Paraguay. Traffic jams often occur especially during the summer due to many vacationers to Lake Ypacarai. Considering access of trailers, to pass the urban area of San Lorenzo will be the biggest problem. The solution is to install a transfer station after the urban area of San Lorenzo or to construct a bypass road for San Lorenzo urban area. The traffic volume of Route No.2 is forecast to increase due to the importance of this road.

Others:

The landowner seems to want the municipality to fill in the large holes with waste. The landowner permitted the use of 1.5 ha holes for waste dumping at the confirmation time, even though he offered the use of all 100 ha initially.

Site No.C-3

Location: Compania Rosado Guazo, Ypane



Year of Evaluation: September, 1993

Ownership: Private (Miguel Valzken)

Total Area: 55.4 ha

Type of Terrain: Very gentle hillside

Present Land Use: Coconut field and bush

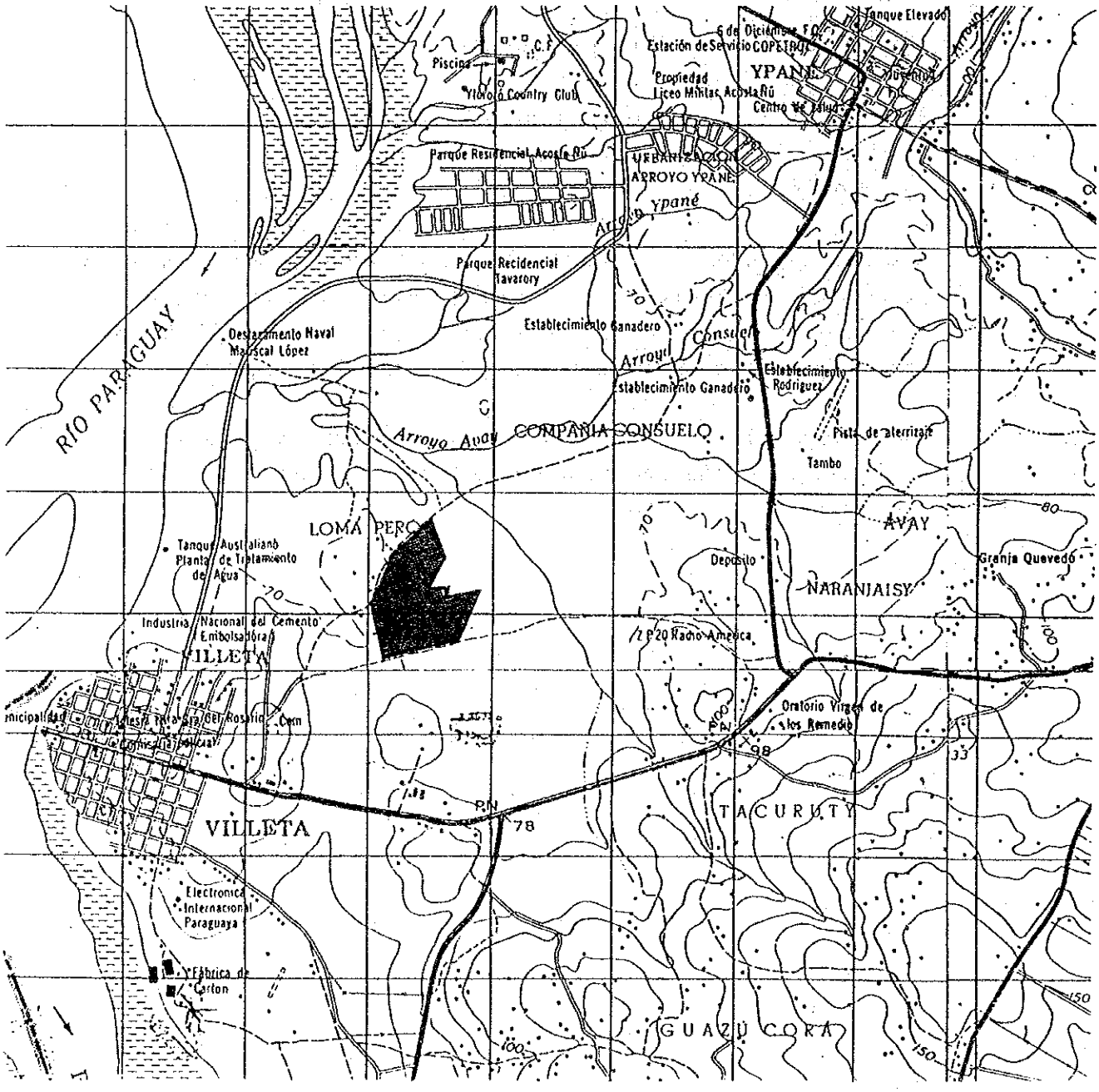
Accessibility:

The existing road for 2.8 km from the main paved road to the landfill site has to be improved. The distance from the center of Asuncion is 24.8 km. The present road has 2 lanes asphalt paved road for 22.0 km from Asuncion until the urban area of Ypane, and from the urban area of Ypane to this site is unpaved.

This haulage route is not suitable for a large trailer but may be possible for a semi-trailer because there are sharp horizontal curves in the urban areas of Nemby and Ypane.

Site No.C-4

Location: Loma Pero, Villeta



Year of Evaluation: September, 1993

Ownership: Private (Felix A Tani)

Total Area: 58.2 ha

Type of Terrain: Gentle slope to the stream

Present Land Use: Pasture

Availability of Coverage Materials:

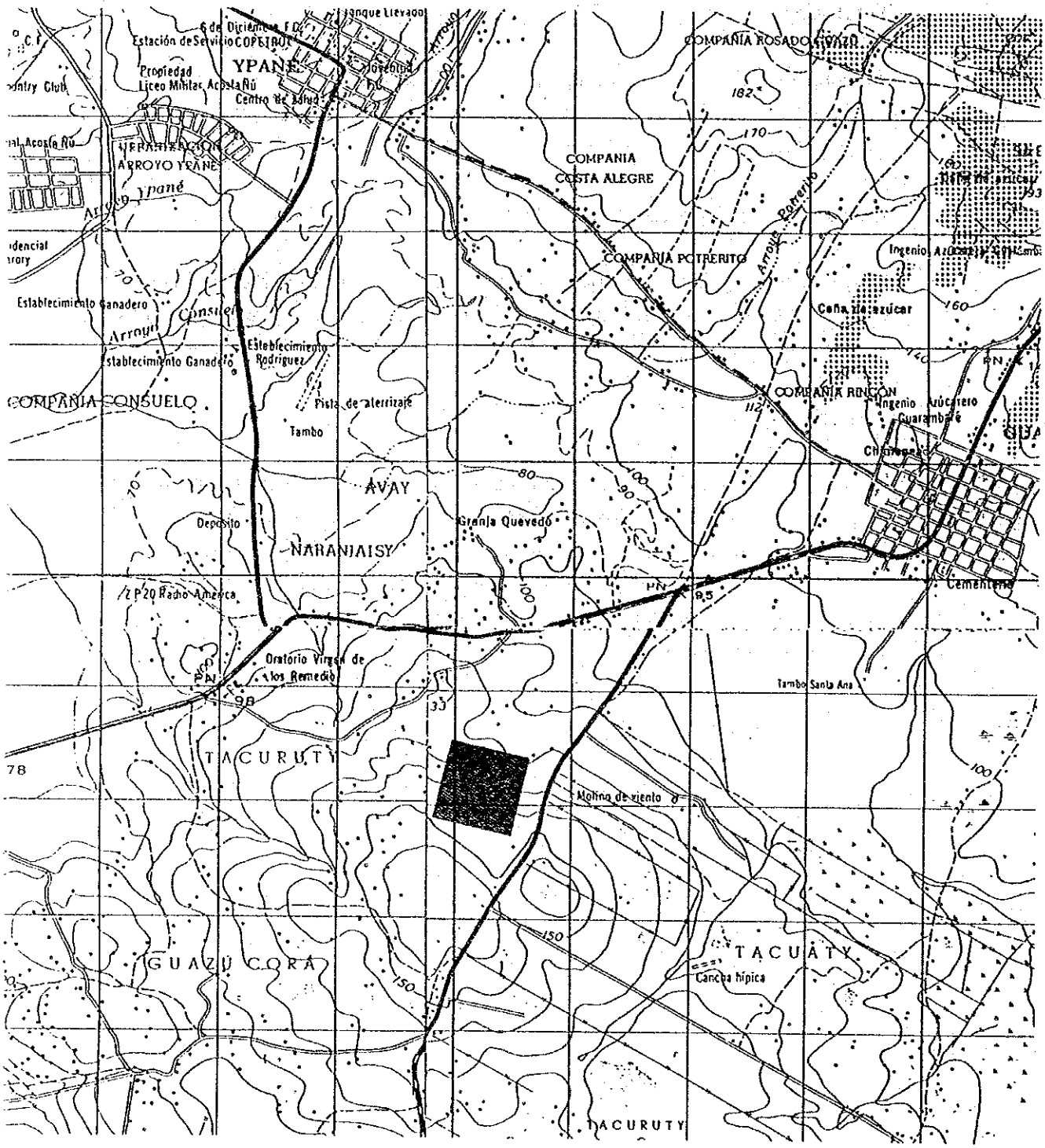
There are no mountains to obtain soil near this site. The overburden within this site is expected to be utilized but may not be enough. Another way is to get sand from Paraguay River 2.5 km away from this site.

Accessibility:

A new access road for 1.8 km from the paved road to the landfill site has to be constructed. The distance from the center of Asuncion to this site is 33.8 km. The existing main road on the haulage route is asphalt paved but not wide enough for a large trailer. This haulage route is not suitable for a large trailer but may be possible for a semi-trailer because there are sharp horizontal curves in the urban areas of Nemby and Ypane.

Site No.C--5

Location: Naranjaisy, Villeta



Year of Evaluation: September, 1993

Ownership: Private (Santiago Visconte)

Total Area: 42 ha

Type of Terrain: Platcau

Present Land Use: Pasture

Availability of Coverage Materials:

Although there are no mountains to obtain soil near this site, the overburden within this site is expected to be utilized.

Accessibility:

Improvement of the existing road from the main road until the site is almost unnecessary. The distance from the center of Asuncion until this site is 32.5 km. The existing main road on the haulage route is asphalt paved but not wide enough for a large trailer. This haulage route is not suitable for a large trailer but may be possible for a semi-trailer because there are sharp horizontal curves in the urban areas of Nemby and Ypane.

G.4 Selection of an Inter-municipal Disposal Site

G.4.1 Classification of Potential Sites

Classification of potential sites were carried out to facilitate selection work of the inter-municipal disposal sites. 13 potential sites produced by the Paraguayan side were classified into the following three zones as shown in Table G.4.1a.

Table G.4.1a Classification of Potential Sites

Classification A	Classification B	Name of Zone
Inside of the Study Area	Chaco side	A
	West of the Paraguay R-iver	B
Outside of the Study Area		C

Primarily, it is desired that the proposed disposal site is located inside the Study Area. Because acceptance from neighbors of the site and the municipality where the site will be located have to be obtained prior to the implementation of the project, a meeting for negotiations can be held to settle any disputes if the site is located in the Study Area. However, if the site is located outside of the Study Area, the meeting for negotiation has to be arranged first.

Secondarily, there are big differences between the east and west of Paraguay River in terms of natural environment, social environment, etc.. The Chaco area is much less developed than the east side of the Paraguay River. This area is considered to be very suitable for the disposal site because the population is very small and the living area is very limited.

3 zones are shown in Figure G.4.1a.

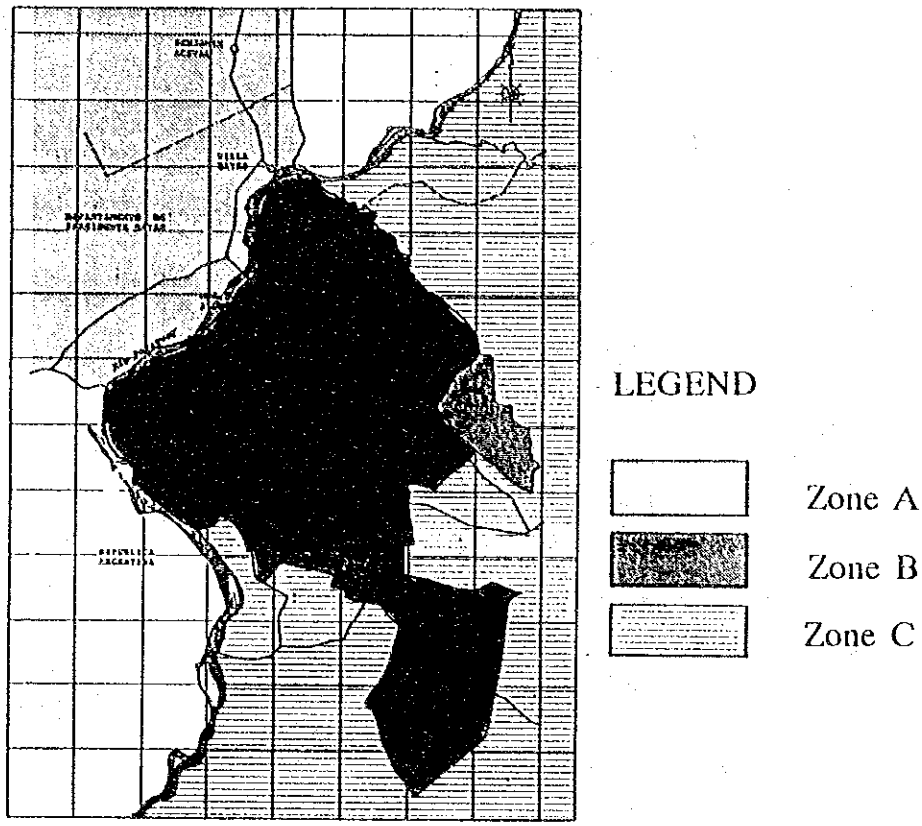


Figure G.4.1a Zoning for Site Selection

The locations of the potential sites are shown in Figure G.4.1b.

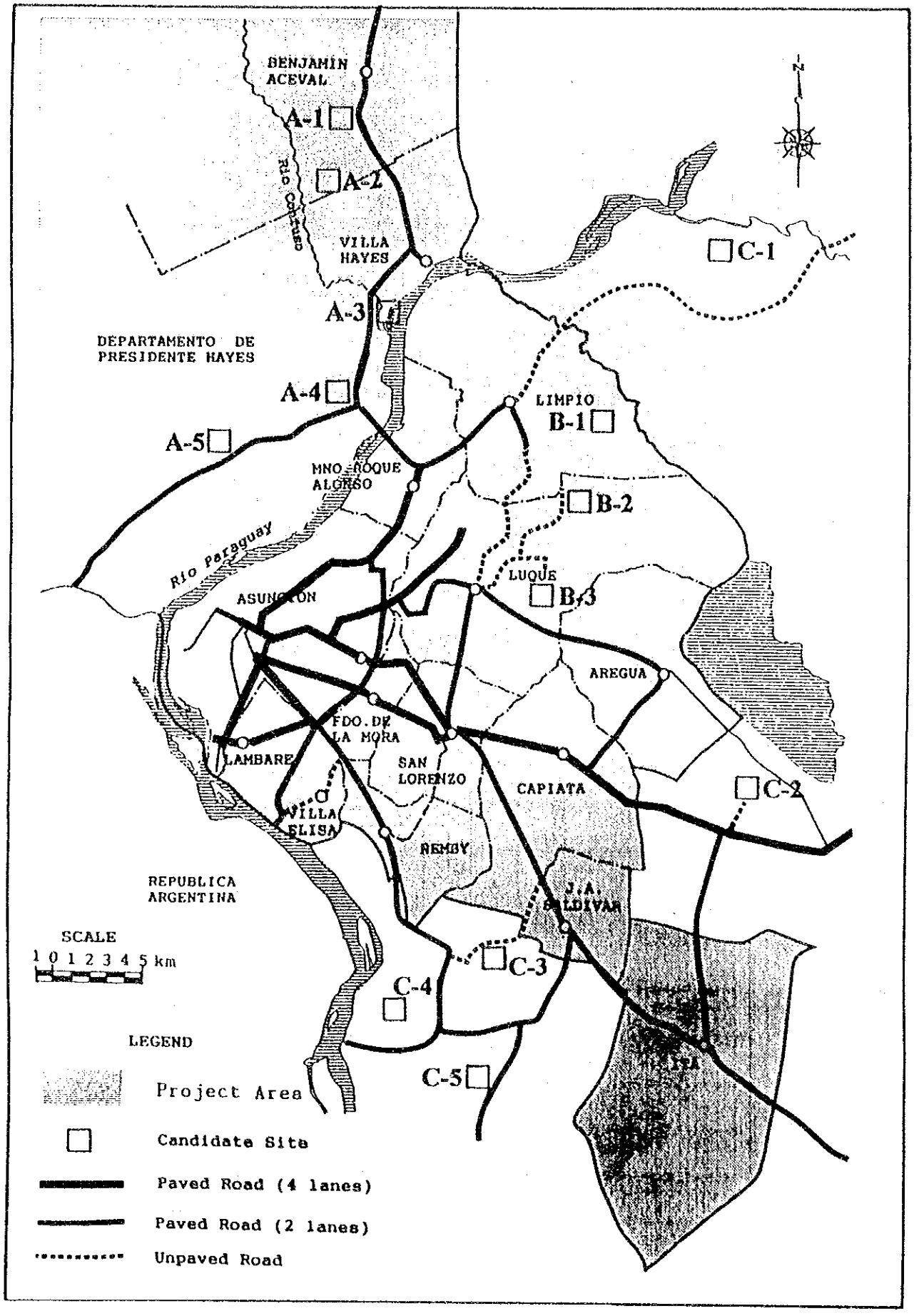


Figure G.4.1b Location Map of Potential Sites

G.4.2 Environmental and Technical Evaluation

a. Method of the Evaluation

aa. Assumed Project for the Evaluation

The project was assumed to be construction of a final disposal site for this evaluation.

ab. Items and Method of the Evaluation

The potential sites were evaluated by giving points to each evaluation items such as environmental, social, environmental pollution, natural aspects and technical aspects based on the data collected through the field reconnaissances.

ac. Data used for the Evaluation

The following data were used for this evaluation.

- Topographical maps, 1 to 50,000 in scale
- Cadastral map
- Acrial photos, 1 to 40,000 in scale

b. Method of Environmental Evaluation

ba. Items of the Environmental Evaluation

The items used for the environmental evaluation are presented in Table G.4.2a.

Table G.4.2a Environmental Evaluation Items and Indices

Evaluation Items	Description	Indices
1. Social Environment		
. Land acquisition	. Landowners' acceptance	. Existence of an agreement
. Peoples' acceptance	. Neighbors' acceptance	. Location and area of communities
. Administrative acceptance	. Other administration's acceptance, whether inside or outside of the Study Area	. Location of the site
. Social separation	. Separation of a community . Disconnection of a community road concerned with school and office commuting	. Location and area of communities
. Forced removal	. Impact on the residential area	. Location and area of communities
. Religious matters	. Removal of a church and a cemetery	. Location of churches and cemeteries
. Public facilities		. Existence of schools and hospitals
. Visibility of landfill site	. Impact on schools and hospitals	. Visibility from the community roads . Existence of an observatory . Existence of scenic places
. Future land use near the site	. Whether inside of future urban area	. Location of the site
. Compatibility with other laws	. Compatibility with land use plan of the town plan	. Compatibility with the law
. Compatibility with other plans	. Other development plans in neighbors	. Compatibility with other plans
2. Environmental Pollution		
. Waste pollution	. River water and ground water Drinking water	. Existence of a river . Existence of a well
. Odor		. Location and area of communities
. Noise		. Location and area of communities
. Vibration		. Location and area of communities
3. Natural Environment		
. Collapse of slope	. Collapse of slope Existence of steep slopes Existence of landslide places	. Condition of present topography
. Inundation		. Condition of present topography
. Flora	. Impact on existing flora	. Existence of natural forest
. Fauna	. Change of flora and land use	. Existence of natural forest
. Landscape	. Change of land use of the site	. Present land use

bb. Allotment of Points

The evaluation result was expressed by points given to each evaluation items. 2 points were given to the site which will make less impact on the environment, 1 point given to the middle site and 0 point given to the worse site.

The areas for the environmental assessment are assumed as follows:

- Noise : 200 m outside from the proposed site
- Landscape : 400 m outside from the proposed site

The standard allotment of points are presented in Table G.4.2b.

Table G.4.2b Standard of Point Allotment

Evaluation Indices	Point	Description
Acceptability of landowner	0	not yet agreed
	1	under negotiation
	2	already agreed
Compatibility with law	0	not compatible
	1	under arrangement
	2	compatible
Compatibility with other plans	0	not compatible
	1	under arrangement
	2	compatible
Location of site (A)	0	outside of the Study Area
	1	nil
	2	inside of the Study Area
Location of site (B)	0	inside of the urbanized area
	1	within 400 m from the urbanized area
	2	outside of the urbanized area
Neighboring houses	0	houses exist within the site or many houses exist nearby.
	1	a few houses exist within 400 m from the site.
	2	no house within 400 m from the site.
Church	0	exist in the site.
	1	exist within 400 m from the site.
	2	not exist within 400 m from the site.
Cemetery	0	exist in the site.
	1	exist within 400 m from the site.
	2	not exist within 400 m from the site.
School	0	exist in the site.
	1	exist within 400 m from the site.
	2	not exist within 400 m from the site.
Medical facilities	0	exist in the site.
	1	exist within 400 m from the site.
	2	not exist within 400 m from the site.
Visibility from roads	0	most of the site can be seen from the community road.
	1	some of the site can not be seen due to trees or buildings.
	2	the most areas of the site can not be seen from the community road.
Observatory	0	exist in the site.
	1	exist within 400 m from the site.
	2	not exist within 400 m from the site.
Picturesque place	0	exist in the site.
	1	exist within 400 m from the site.
	2	not exist within 400 m from the site.
River, stream	0	exist in the site.
	1	exist within 400 m from the site.
	2	not exist within 400 m from the site.
Well	0	exist in the site.
	1	exist within 400 m from the site.
	2	not exist within 400 m from the site.
Present terrain	0	steep slope in the site
	1	gentle slope in or near the site
	2	flat land in the site
Natural forest	0	exist in the site.
	1	exist within 400 m from the site.
	2	not exist within 400 m from the site.
Present land use	0	unspoilt land
	1	cultivated land
	2	waste land

c. Method of Technical Evaluation

ca. Items of the Technical Evaluation

The items used for the technical evaluation are as follows.

- Total available area for the site
- Availability of coverage soil
- Accessibility of the haulage route
- Road improvement cost
- Land acquisition cost

cb. Allotment of Points

The evaluation result was expressed by points given to each evaluation items. 2 points were given to the site with the optimum conditions, 1 point given to an average level, and 0 point given to the poorest condition. The criteria of allotment of marks is presented in Table G.4.2c.

Table G.4.2c Standard of Point Allotment

Evaluation Indices	Point	Description
Total available area for the site	0 1 2	≤ 25 ha 25 ha < A ≤ 50 ha > 50 ha
Availability of coverage soil	0 1 2	Not available in the site N/A Available in the site
Accessibility of the haulage route	0 1 2	≥ 40 km 40 km > L ≥ 20 km < 20 km
Road improvement cost	0 1 2	> 500,000,000 Gs 500,000,000 Gs ≥ V > 0 Gs 0 Gs
Land acquisition cost	0 1 2	> 8,200,000 Gs/ha 8,200,000 Gs/ha ≥ V > 5,800,000 Gs/ha ≤ 5,800,000 Gs/ha

c. Overall Evaluation

The results of the evaluation are presented in Table G.4.2d. The sites with a total area less than 50 ha were disqualified because it is too small for the disposal site until 2006.

Table G.4.2d Summary of Site Evaluation Rank

Zone	Rank	Name of Site	Score
Zone A (Chaco Side in Study Area)	1	A-5	53
	2	A-4	51
	3	A-2	45
	4	A-1	44
	5	A-3	43
Zone B (East side of Paraguay River in the Study Area)	1	B-1	42
	1	B-2	42
	E	B-3	37
Zone C (Outside of the Study Area)	1	C-4	43
	2	C-1	41
	3	C-3	39
	E	C-5	44
	E	C-2	33

N.B. E = Eliminated

The overall evaluation results for each zone are summarized in Table G.4.2e 2f and 2g.

Table G.4.2e Evaluation Result Summary of the Sites in Zone A (Chaco Area within the Study Area)

Evaluation Items		Indices	A-1		A-2		A-3		A-4		A-5	
			Status	Po	Status	Po	Status	Po	Status	Po	Status	Po
Social Environment	Land acquisition	Acceptance of landowners	Yes	2	Yes	2	Yes	2	Negotiate	1	Yes	2
	Peoples' acceptance	Location and area of communities	Several	1	Several	1	Several	1	None	2	None	2
	Administrative acceptance	Location of the site (A)	Inside	2	Inside	2	Inside	2	Inside	2	Inside	2
	District separation	Location and area of communities	Several	1	Several	1	Several	1	None	2	None	2
	Forced removal	Location and area of communities	Several	1	Several	1	Several	1	None	2	None	2
	Religious matters: Churches	Existence of churches	None	2	None	2	None	2	None	2	None	2
	Cemetery	Existence of cemeteries	None	2	None	2	None	2	None	2	None	2
	Public facilities: Schools	Existence of schools	None	2	None	2	None	2	None	2	None	2
	Hospitals	Existence of hospitals	None	2	None	2	None	2	None	2	None	2
	Visibility of landfill site: Roads	From the community roads	Visible	0	None	2	Visible	0	Visible	0	None	2
	Observatory	Existence of observatories	None	2	None	2	None	2	None	2	None	2
	Scenic place	Existence of scenic places	None	2	None	2	None	2	None	2	None	2
	Future urbanize possibility near site	Location of the site (B)	Outside	2	Outside	2	Outside	2	Outside	2	Outside	2
	Compatibility with other laws	Compatibility with the law	Yes	2	Yes	2	Yes	2	Yes	2	Yes	2
	Compatibility with other plans	Compatibility with the other plans	Yes	2	Yes	2	Yes	2	Yes	2	Yes	2
	Sub-total			25		27		25		27		30
Environmental Pollution	Waste pollution: River	Existence of a river	Near	1	Near	1	Yes,	0	No	2	Near	1
	Well	Existence of a well	Near	1	Near	1	Near	1	No	2	No	2
	Odor	Location and area of communities	Several	1	Several	1	Several	1	None	2	None	2
	Noise	Location and area of communities	Several	1	Several	1	Several	1	None	2	None	2
	Vibration	Location and area of communities	Several	1	Several	1	Several	1	None	2	None	2
	Sub-total			5		5		4		10		9
Natural Environment	Collapse of slope	Condition of present topography	Flat	2	Flat	2	Flat	2	Flat	2	Flat	2
	Inundation	Condition of present topography	Flat	2	Flat	2	Flat	2	Flat	2	Flat	2
	Flora	Existence of natural forest	Little	1	Little	1	Little	1	Little	1	Little	1
	Fauna	Existence of natural forest	Little	1	Little	1	Little	1	Little	1	Little	1
	Landscape	Present land use	Pasture	1	Pasture	1	Pasture	1	Pasture	1	Pasture	1
	Sub-total			7		7		7		7		7
Technical aspects and Cost	Area	ha	89	2	85.2	2	216.0	2	100(?)	2	214	2
	Availability of coverage soil		No	0	No	0	No	0	No	0	No	0
	Accessibility: Total Distance	km	38.9	1	38.4	1	28.0	1	20.4	1	31.2	1
	Length of paved road	km	0.0	-	25.9	-	28.0	-	20.4	-	31.2	-
	Length of improvement of unpaved road	km	0.0	-	2.5	-	0.0	-	0.0	-	0.0	-
	Length of new road construction	km	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
	Road improvement cost	mill Gs	0	2	426	1	0	2	0	2	0	2
	Land acquisition cost	mill Gs/ha	2.0	2	3.5	2	4.8	2	4.8(?)	2	3.1	2
	Sub-total			7		6		7		7		7
Score			44		45		43		51		53	
Rank			4		3		5		2		1	

Table G.4.2f Evaluation Result Summary of the Sites in Zone B (West Side of Paraguay River within the Study Area)

Evaluation Items		Indices	B-1		B-2		B-3	
			Status	Po	Status	Po	Status	Po
Social Environment	Land acquisition	Acceptance of landowners	Yes	2	Yes	2	Yes	2
	Peoples' acceptance	Location and area of communities	Several	1	Several	1	Many	0
	Administrative acceptance	Location of the site (A)	Inside	2	Inside	2	Inside	2
	District separation	Location and area of communities	Several	1	Several	1	Many	0
	Forced removal	Location and area of communities	Several	1	Several	1	Many	0
	Religious matters: Churches	Existence of churches	Near	1	None	2	None	2
	Cemetery	Existence of cemeteries	None	2	None	2	None	2
	Public facilities: Schools	Existence of schools	Near	1	None	2	None	2
	Hospitals	Existence of hospitals	None	2	None	2	None	2
	Visibility of landfill site: Roads	From the community roads	No	2	Visible	0	Visible	0
	Observatory	Existence of observatories	No	2	No	2	No	2
	Scenic source	Existence of scenic places	No	2	No	2	No	2
	Future urbanize possibility near site	Location of the site (B)	Outside	2	Outside	2	Near	1
	Compatibility with other laws	Compatibility with the law	Yes	2	Yes	2	Yes	2
	Compatibility with other plans	Compatibility with the other plans	Yes	2	Yes	2	Yes	2
	Sub-total			25		25		21
Environmental Pollution	Waste pollution: River	Existence of a river	Inside	2	Inside	2	Inside	2
	Well	Existence of a well	Near	1	Near	1	Near	1
	Odor	Location and area of communities	Several	1	Several	1	Many	0
	Noise	Location and area of communities	Several	1	Several	1	Many	0
	Vibration	Location and area of communities	Several	1	Several	1	Many	0
	Sub-total			6		6		3
Natural Environment	Collapse of slope	Condition of present topography	Slope	1	Flat	2	Slope	1
	Inundation	Condition of present topography	Slope	1	Flat	2	Slope	1
	Flora	Existence of natural forest	Little	1	Little	1	None	2
	Fauna	Existence of natural forest	Little	1	Little	1	None	2
	Landscape	Present land use	Pasture	1	Pasture	1	Abandoned	2
	Sub-total			5		7		8
Technical aspects and Cost	Area ha		90.0	2	60(?)	2	10.0	0
	Availability of coverage soil		Available	2	Not avail.	0	Available	2
	Accessibility: Total Distance km		25.0	1	26.3	1	20.0	1
	Length of paved road km		21.7	-	15.5	-	15.5	-
	Length of improvement of unpaved road km		3.3	-	10.8	-	4.5	-
	Length of new road construction km		0.0	-	0.0	-	0.0	-
	Road improvement cost mill Gs		562	0	1,840	0	98.3	1
	Land acquisition cost mill Gs/ha		6.5	1	6.5(?)	1	6.5	1
	Sub-total			6		4		5
Score			42		42		37	
Rank			1		1		Out	

Table G.4.2g Evaluation Result Summary of the Sites in Zone C (outside of the Study Area)

Evaluation Items		Indices	C-1		C-2		C-3		C-4		C-5	
			Status	Po	Status	Po	Status	Po	Status	Po	Status	Po
Social Environment	Land acquisition	Acceptance of landowner	Yes	2	No	0	Yes	2	Yes	2	Yes	2
	Peoples' acceptance	Location and area of communities	Several	1	Many	0	Several	1	Several	1	Several	1
	Administrative acceptance	Location of the site (A)	Outside	0	Outside	0	Outside	0	Outside	0	Outside	0
	District separation	Location and area of communities	Several	1	Many	0	Several	1	Several	1	Several	1
	Forced removal	Location and area of communities	Several	1	Many	0	Several	1	Several	1	Several	1
	Religious matters: Churches	Existence of churches	None	2	None	2	Near	1	None	2	None	2
	Cemetery	Existence of cemeteries	None	2	None	2	None	2	None	2	None	2
	Public facilities: Schools	Existence of schools	None	2	None	2	Yes	1	None	2	None	2
	Hospitals	Existence of hospitals	None	2	None	2	None	2	None	2	None	2
	Visibility of landfill site: Roads	From the community roads	No	2	Little	1	Little	1	Little	1	None	2
	Observatory	Existence of observatories	No	2	No	2	No	2	No	2	No	2
	Scenic source	Existence of scenic places	No	2	No	2	No	2	No	2	No	2
	Future urbanize possibility near site	Location of the site (B)	Outside	2	Outside	2	Outside	2	Outside	2	Outside	2
	Compatibility with other laws	Compatibility with the law	Yes	2	Yes	2	Yes	2	Yes	2	Yes	2
	Compatibility with other plans	Compatibility with the other plans	Yes	2	Yes	2	Yes	2	Yes	2	Yes	2
	Sub-total			25		19		22		24		25
Environmental Pollution	Waste pollution: River	Existence of a river	Near	1	Near	1	Near	1	Near	1	None	2
	Well	Existence of a well	Near	1	Near	1	Near	1	Near	1	Near	1
	Odor	Location and area of communities	Several	1	Many	0	Several	1	Several	1	Several	1
	Noise	Location and area of communities	Several	1	Many	0	Several	1	Several	1	Several	1
	Vibration	Location and area of communities	Several	1	Many	0	Several	1	Several	1	Several	1
	Sub-total			5		2		5		5		6
Natural Environment	Collapse of slope	Condition of present topography	Slope	1	Slope	1	Slope	1	Flat	2	Slope	1
	Inundation	Condition of present topography	Slope	1	Slope	1	Slope	1	Flat	2	Slope	1
	Flora	Existence of natural forest	Little	1	None	2	Little	1	Little	1	Little	1
	Fauna	Existence of natural forest	Little	1	None	2	Little	1	Little	1	Little	1
	Landscape	Present land use	Pasture	1	Aban-doned	2	Pasture	1	Pasture	1	Pasture	1
	Sub-total			5		8		5		7		5
Technical aspects and Cost	Area	ha	180	2	1.5	0	55.4	2	58.2	2	42.0	1
	Availability of coverage soil		Little	1	No	0	Avail.	2	No	0	Avail.	2
	Accessibility: Total Distance	km	39.7	1	33.0	1	24.8	1	33.8	1	32.5	1
	Length of paved road	km	21.0	-	31.5	-	22.0	-	32.0	-	32.5	-
	Length of improvement of unpaved road	km	14.7	-	1.5	-	2.8	-	0.0	-	0.0	-
	Length of new road construction	km	4.0	-	0.0	-	0.0	-	1.8	-	1.8	-
	Road improvement cost	mill Gs	3,355	0	256	1	765	0	383	1	0	2
	Land acquisition cost	mill Gs/ha	5(?)	2	5(?)	2	5.4	2	4.7	2	4.7	2
	Sub-total			6		4		7		6		8
Score			41		33		39		43		44	
Rank			2		Out		3		1		Out	

G.4.3 Evaluation of Acceptability of the Citizen and Municipality where the Disposal Site will be located

The potential sites were selected by the Paraguayan Technical Committee based on the possibility of land acquisition as the first priority requirement.

When the land is acquired, the acceptances of the citizen and the municipality where the site is located are absolutely required. Therefore, the evaluation of acceptability of the citizen and the municipality where the site locates was executed in order to confirm this matter on the policy making.

As it has been accepted all over the world, the opinions of most citizens concerning solid waste are described below. Generally, this matter should be taken into account to obtain the acceptances of the citizen and the municipality where the site is to be located when it is selected.

NIMBY	Not In My Backyard
NIMFE	Not In My Frontyard Either
PITTBY	Put It In Their Backyard
NIMTOF	Not In My Term Of Office
NIMEY	Not In My Election Year
LULU	Locally Undesirable
YIMBY/FAP	Yes, In My Back Yard, For A Price

The site evaluation shown in Tables G.4.2e, f and g were carried out in terms of social environment, environmental pollution, natural environment and technical/cost without adding any weight to a specific evaluation item. However, an emphasis was placed on the evaluation of Social Environment, as protests from the residents against the construction of the final disposal site is forseen. The score and rank of social evaluation result are presented in Table G.4.3a.

Table G.4.3a Score and Rank of Site by Social Evaluation

Rank	Name of Site	Score
1	A-5	30
2	A-2	27
2	A-4	27
4	A-1	25
4	A-3	25
4	B-1	25
4	B-2	25
4	C-1	25
9	C-4	24
10	C-3	22
Out	C-5	25
Out	B-3	21
Out	C-2	19

G.4.4 Selection of Candidate Sites by the Supervisory Committee

a. Evaluation report for decision making

The localization of an inter-municipal final disposal site is indispensable for the formulation of the MSWM master plan for the Study area but it is subject to an administrative and policy decision. In order to facilitate decision making by the Supervisory Committee members and municipalities concerned in the Study, the Study Team prepared an evaluation report for the committee to make a decision on the selection of candidate site(s). The whole evaluation report was prepared in Spanish as a part of PR/R(1). In the report, the Study Team recommended the following sites as candidate sites for the alternative study to be carried out in Japan:

i. From the Chaco area within the Study Area

A-2, A-4 and A-5

ii. From the East Side of Paraguay River in the Study Area

B-1 or B-2 with the condition that the objection of the neighborhood against disposal sites would be settled by the Paraguayan side.

iii. From outside of the Study Area

C-4 with the condition that the objection of the neighborhood and the municipality of Villeta against the disposal site would be settled by the Paraguayan side. The construction of the access road to C-1 is too expensive.

b. Selection of Candidate Sites by Supervisory Committee

At the Supervisory Committee meeting for the PR/R(1) held in July 1993, based on the above-mentioned report the Study Team requested the Paraguayan side to make a decision for the selection of candidate sites.

In the meeting the Supervisory Committee informed the Study Team that the Committee cold not identify the landowner of the A-4 site. Consequently, the Committee decided to select the A-2 and A-5 sites as the candidate inter-municipal disposal sites for the study of alternatives of the Master Plan to be carried out during the 1st study work in Japan.

As for the inter-municipal disposal sites for the municipalities of the eastern and southern part of the Study area, the Paraguayan side requested the Study Team to examine the sites for them, because they would not be able to join the inter-municipal disposal operation in the Chaco area due to economic reasons.

In response to the request, the Study Team examined the inter-municipal disposal operations in the eastern and southern parts of the Study area and made recommendations for them.

G.4.5 Selection of an Inter-municipal Disposal Site

In order to find the optimum technical systems for the MSWM Master Plans of 15 municipalities, 62 technical system alternatives were examined, The detailed examination is presented in Annex H. As the results of the examination, the Study Team recommended the optimum technical systems for 15 municipalities as follows:

- Inter-municipal landfill at A-5 (Chaco-i) site for Asuncion, F.Mora, M.R.Alonso, Limpio, Villa Hayes and B.Aceval.

- Inter-municipal landfill (of which the location is not identified) 15 km away from the center of Lambare, San Lorenzo, Capiata, Luque, Villa Elisa, Nemby, J.A.Saldivar, Ita and Aregua.

These recommendations were presented in the IT/R. In the meeting for discussion of the IT/R held in December 1993, the Supervisory Committee approved the above-mentioned recommendations. Consequently, A-5 site (Chaco-i) was selected as an inter-municipal disposal site for the Study area.

In the meeting, the Supervisory Committee also decided that after the approval of the environmental study of the A-5 site by SENASA, they should make every effort to establish regulations through parliament including restrictions on the use of the surrounding land, in collaboration with the concerning municipalities.

As for the inter-municipal landfill 15 km away for the above mentioned 9 municipalities, the team recommended the municipalities whose optimum technical system included the site that they should made their effort on:

- the establishment of an inter-municipal cooperation system among the municipalities;
- the identification of candidate sites for the inter-municipal landfill operation as soon as possible; and
- setting up the cooperation among the municipalities where the total population is more than 300 thousand in 1992.

ANNEX H

EXAMINATION OF TECHNICAL SYSTEM ALTERNATIVES FOR MASTER PLAN

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