prevents the accumulation of waste.

To a great extent, these collection systems will prevent the generation of bad odor in the collection area.

Conclusively, these 4 habitat factors were not considered for EIA.

d. Environmental Survey and Assessment

Originally, environmental surveys and assessments are carried out for the two environmental impact factors aforementioned. But since they will not considerably produce the 4 habitat factors given above, none will be carried out.
Conclusively, MSWM is considered to have none of the given impacts.

e. Environmental Protection Measures

MSWM is assessed to have no adverse impact on the environment. However, this assessment was made assuming that the residents will carry the collection system out exactly as planned. To successfully uphold this assessment, environmental protection measures in the form of education programs that would completely inform the residents of the waste disposal plan and objectives should be adopted therefore.

O.5.3 Evaluation of the ANPLS Construction Project

a. Assessment Methods

The habitat factors subject to EIA were determined by forming a matrix showing their relationship with the environmental impact factors of the project, based on the details of the Project and the surrounding environmental condition. Matrix is shown in Table O.5.3a.

The preliminary surveys and assessments carried out were substantial but few, in light of the fact that they were taken for the basic plan.

b. Project Outline

The construction of the final disposal site will be carried out in 4 phases and the areas to be reclaimed per construction phase are shown in Table O.5.3b.

Table O.5.3a Matrix for evaluation of environmental impacts and factors

	Air Quality	Water Quality	Soil Contamination	Noise	Vibration	Land Subsidence	Offensive Odor	Meteorology	Topographical and Geological Feature	Soil Erosion	Ground Water	Hydrological Situation	Flora and Fauna	Landscape	Resettlement	Economic Activities	Traffic and Public Facilities	Split of Community	Water right and Right of Common	Public Health condition	Waste	Disaster	Sunny Condition	Radio wave condition	Traffic safety	Damage by wind
Felling of woods													*	*							*					
Passing of Cars for Construction	*			*	*												*									
Making new Land	*	*	*	*				*	*			*	*	*							*					
Transport of Machinery and Materials	*			*	*																				*	
Paving Construction				*	*				*				*													
Passing of Collecting Vehicle	*			*	*												*								*	
Discharge of Leachate		**					**																			
Occurrence of Noise				*																						
Occurrence of Offensive door							*																			
Gathering of cover soil	*													**												
Occurrence of Dangerous Gas	*						*															*				

Note: * Not significant adverse environmental impact
** Significant adverse environmental impact

Table O.5.3b Project Outline

	Construction Period	Landfill Period	Landfill Area	Buffer Zone	Total Area	Capacity
Phase I	1998 - 1999	2000 - 2005	18.8 ha	5.9 ha	24.7 ha	2,600,000m^3
Phase II	2003 - 2005	2006 - 2010	21.7 ha	6.9 ha	28.6 ha	3,000,000m^3
Phase III	2008 - 2010	2011 - 2013	15.2 ha	4.8 ha	20.0 ha	2,100,000m^3
Phase IV	2011 - 2013	2014 - 2016	15.2 ha	4.8 ha	20.0 ha	2,100,000m^3
Total			70.6 ha	22.4 ha	93.0 ha	9,800,000m^3

ba. Land Expropriation

The area directly adjacent to the coast will not be included in the acquisition.

bb. Construction of Approach Road

i The road used by the present Acahualinca disposal site will be extended for future use.
ii The road will be widened to 8m and extended for another 1km, from the present truck scale to the landfill site.

bc. Construction of Enclosure Dike

i A dike will be constructed in each phase.
ii The dike will be 6m high with a banking gradient of 1:2.
iii Turfing will be carried out on the dike slope.

bd. Installation of Leachate Circulation System

i A (sheet) lining will be placed inside the dike.
ii A leachate collection pipe will be installed at the area where the lining is placed.
iii Collected leachate will be circulated within the disposal site by pumping.
iv Daily waste covering will be carried out to prevent scattering, generation of harmful insects and bad odor.
v Soil in street sweeping wastes will be used for waste covering.
vi Gas release pipes will be installed to accelerate aerobic decomposition for the immediate stabilization of the landfill site.
vii Final waste covering material will be extracted from the small hilly area within the disposal site.

be. Provision of Landfill Equipment

To adequately carry out landfill works, a bulldozer, landfill compactor, wheel loader, dump truck, motor grader, wheel excavator, water tanker and a pickup will be provided.

c. Determination of Habitat Factors and Environmental Impact Factors

Given the details aforementioned, the following were determined as the environmental impact factors (a) during the landfill works and (b) after the landfill works:

i During the Landfill Works:

Generation of bad odor from leachate discharge –
The leachate circulation system pond may emit bad odor

Extraction of soil for waste covering –
The extraction of soil from the small hilly area within the disposal site will alter the landscape

ii After the Landfill Works

Leachate Discharge –
Discharge of water coming from the leachate treatment facilities into Managua Lake

Conclusively, [bad odor], [landscape] and [water quality] are the habitat factors determined in this study.

d. Environmental Survey and Assessment

da. Offensive odor

i Survey Method

Qualitative surveys will be carried out to establish the relationship of the leachate circulation pond site, protection measures and prevailing wind direction.

ii Survey Results

The leachate circulation pond will be constructed at the northernmost part of the

final disposal site where the nearest residential population is approximately 250 meters southeast; there is also a village 600 meters south of the area. The wind blows from the east area, and there are no residences within a distance of 3km west of the pond.

Accordingly, the construction of a circulation pond in this site will hardly affect the southeast and southside residents. The same conclusion was made for the westside residential area due to its considerably dispersed layout.

db. Landscape

i Survey Method

Qualitative surveys on the land use conditions in the final disposal site vicinity will be carried out.

ii Survey Result

The proposed landfill site is bordered by Managua Lake to the north and the present disposal site to the east. The southern part of the area is adjacent to an agricultural pasturage, a 90m elevated hill and a part of a residential area. To the west, it is adjacent again to an agricultural pasturage, which extends to a steeply sloping hill. PENINSULA DE CHILTEPE is the only scenic spot near the proposed landfill site, and can be viewed in all its grandeur from the memorial statue established halfway up the road passing by the steeply sloping hill, which connects Managua City and Ciudad Sandino.

The exploitation of the small hill within the proposed disposal site for excavation of waste covering material will not in anyway affect the landscape as it is covered by the mountains adjacent to the lake. It is also possible to view the entire proposed site area 3km to the west at the plateau selected for the installation of the water tank. Although the small hill forms the greenbelt of the hinterland towns, it does not really contribute much to the scenery.

Conclusively, this activity will not adversely affect the landscape of the area.

e. Environmental Protection Measures

As aforementioned, these activities will only slightly affect landscape and water quality, and produce bad odor. Nevertheless, the following protection measures were proposed to further minimize these impacts:

ea. Offensive Odor

The generation of bad odor can be further minimized by the proper operation of leachate circulation system and avoidance of storing leachate for long periods of time;

eb. Landscape

Although the proposed landfill site can be seen from the memorial statue, the hill located within the ANPLS, that will be destroyed is not visible. Nevertheless, the destruction of this hill should be considered in terms of its effect on the landscape. The ground surface will be changed by waste covering activities. Therefore, the following are proposed as environmental protection measures.

- Execution of daily covering of waste .
- Turfing or planting on the slope of enclosure, creating harmony.

O.5.4 Evaluation of the Project for the Improvement of the Los Cocos Workshop

a. Assessment Method

The habitat factors subject to EIA were determined by forming a matrix showing their relationship with the environmental impact factors of the project, based on the details of the Project and the surrounding environmental condition. Matrix is shown in Table O.5.4a.

The preliminary surveys and assessments carried out were substantial but few, in light of the fact that they were taken for the basic plan.

b. Project Outline

ba. Construction of Workshop Building

- A one story workshop will be constructed at the building site.
- The building site will not be subject to any extension or expansion work.

Table O.5.4a Matrix for the evaluation of environmental impacts and factors

	Air Quality	Water Quality	Soil Contamination	Noise	Vibration	Land Subsidence	Offensive Odor	Meteorology	Topographical and Geological Feature	Soil Erosion	Ground Water	Hydrological Situation	Flora and Fauna	Landscape	Resettlement	Economic Activities	Traffic and Public Facilities	Split of Community	Water right and Right of Common	Public Health condition	Waste	Disaster	Sunny Condition	Radio wave condition	Traffic safety	Damage by wind
Passing of Collection Vehicle	*																							*	
Occurrence of Noise	*			*																					
Occurrence of Vibration	*				*																				

Note: * Not significant adverse environmental impact

bb. Provision of Maintenance Equipment

The following equipment and their respective quantity will be provided by the year 2010:

Bulldozer (21 tons)	8
Landfill Compactor (20 tons)	4
Wheel Loader (1.2m^3)	1
Dump Truck (10 tons)	2
Motor Grader (130 PS)	1
Wheel Excavator (0.7m^3)	1
Water Tanker (5m^3)	1
Pickup	2

c. Determination of Habitat Factors and Environmental Impact Factors

Based on the details aforementioned, the environmental impact factors are [operation of construction vehicles] and [transport of construction materials] during construction work, and [increased repair and maintenance services due to increase in machineries and equipment] after the completion of construction work.

The habitat factors that may be influenced by these impact factors are [air quality], [noise], [vibration], [traffic safety].

ca. Air Quality

The operation of construction vehicles, vehicles for material transport and equipment maintenance may pollute the air.

Since this activity involves the construction of a new workshop at the existing workshop site, only a small number of construction vehicles will be used for the preparation of the site. Construction vehicles will not affect air quality therefore.

cb. Noise

The operation of a small number of vehicles will not produce loud irritable noises.

cc. Vibration

The operation of a small number of vehicles will not produce damaging vibrations.

cd. Traffic Safety

Increase in vehicular traffic may affect traffic safety conditions especially since there are a lot of houses within the vicinity of Los Cocos. The effect will be minimal however, since the project will only cause a slight increase in traffic volume.

Conclusively, these habitat factors were not subject to EIA.

d. Environmental Survey and Assessment

Originally, environmental surveys and assessments are carried out for the environmental impact factors aforementioned, but since they will not seriously bring about the given habitat factors, none will be carried out.

Conclusively, this activity is assessed to have no adverse impact on the environment.

e. Environmental Protection Measures

Although the construction works are forecast to have no adverse impact on the environment, they are irrefutably bound to increase traffic volume. Accordingly, the following environmental protection measures are proposed:

- Assign a traffic regulator at the entrance and exit of Los Cocos to secure safety of traffic;
- To educate drivers on safe driving measures and make sure they practice these measures;
- To satisfactorily maintain the vehicles to mitigate the following factors that may come about because of construction vehicle operation: air pollution, generation of noise and vibration.

O.5.5 Evaluation of the Project for the Promotion of Public Awareness, Cooperation and Participation

The environmental impact assessment for "Promotion of public awareness, cooperation and participation" project was not carried out because it only involves the provision of audio visual tools (television, video machine, booklets) for environmental and sanitary public education.

ATTACHMENT OF ANNEX O

FORMACIONES VEGETALES ENCONTRADAS EN MANAGUA.

a)Bosques Bajos o Medianos Caducifolios de Zonas Calidas y Secas:

Este tipo de vegetacion cubre las partes bajas a orillas de lago. abarcando tambien las partes bajas del norte de la ciudad de Managua .De estos bosques,solo quedan fragmentos de los mismos ,encontrandose matorrales y arboles esparcidos del bosque original.

ASPECTO	PROMEDIO ANUAL.
Precipitacion	entre 1000 - 1250 mm .
Temperatura	entre 26 - 28 grados centigrados

ARBOLES MAS COMUNES.

Phylostyllon brasiliendis.	Escobillo.
Caessalpinia coriaria	Nacascolo
Acacia collinsii	Cornisuelo.
Cordia gerascanthus	Laurel macho.
Gyrocarpus americanus	Tatalate.
Bursera simarouba	jiñocuabo.
lysiloma sp	Quebracho.
Tecoma stans	Sardinillo.
Spondias monbin.	Jocote cobo.
Guazuma ulmifolia.	Gucimo de ternero.

ARBUSTOS.

Bromelia pinguin	pinuela.
Cordia inermis	achopaste
Cactaceae	varias sp. **

ANIMALES SILVESTRES.

Sylvilagus floridanus	conejo
Desycus novemcinatus	cusuco
Didelphis marsupialis	Zorro
Odoncoileus virginianus	gato ostache
Coendou mexicanus	puerco spin
Sciurus deppei matagalpae	ardilla
Poplomys pymnurus	rata acorazada.
Dasypracta puntata	guatuza.

AVES

Crotophaga sulgirostris	pijul
Morococcyx erycropigus	relogero
Pitangus sulphuratus	guis
Eutomomota superciliosa	guardabarranco
Campylothynchus rufinucha	saltapiñuelas

b)Bosques bajos o medianos sub caducifolios de zonas calidas semi humedas.

Este tipo de vegetacion cubre las partes de la cuenca sur del lago de managua comprendidas entre unos 55 y 200 metros de altitud. sabana grande, cofradia, veracruz,el arrollo,san Andres y gran parte al sur de la ciudad de managua.

PARAMETROS	PROMEDIOS ANUALES.
Precipitacin	1300mm
Temperatura	28 grados centigrados.

La zonas de este ecosistemas en ligeramente ms fresca que las partes mas cercanas al lago . Entre las especies arboreas de este tipo de vegetacion natural se pueden ver ejemplares aqui y all o en paque*os grupos ,estan las siguientes; Ver listas.

Nota :Para las formaciones Vegetales b y c Corresponden las mismas lista de especies de flora y fauna.

c)Bosques medianos sub caducifolios de zonas frescas semi humedas.

La flora natural de este tipo de vegetacin tiene su asiento entre 200 y 500 msnm , aqui se localizan San Isidro de la Bola,Chiquilistagua,Nejapa,Pochocuape, son poblaciones que gozan de un clima freco y agradable.

PARAMETROS	PROMEDIO ANUAL.
Precipitacin	1200 - 1900mm
Temperatura	26 - 28 grados centigrados.

Nota; En estas listas no se incluyen especies de plantas ornamentales ni frutales, ya que no son especies nativas de los conglomerados vegetales.

Lista de Arboles

Aromo	Acacia farnesiana (L.) Wilid.
Guanacaste blanco	Albizzia caribaea (Urban) Britt & Rose
Guanacaste de oreja	Enterolobium cyclocarpum (Jacq.) Griseb
Guácimo de molenillo	Luehea candida (DC.) Mart.
Chocoyito	Diospyros nicaraguensis Standl
Sardinillo	Tecoma stans (L.) H.B.K
Madroño	Calycophyllum candidissimum (Vahl.) DC.
Chiquirín	Myrospermum frutescens Jacq.
Chaperno negro	Lonchocarpus minimiflorus Donn. Smith.
Espino negro	Pisonia aculeata L.
Jobo lagarto	Sciadodendron excelsum Griseb
Jocote jobo	Spondias mombin L.
Jocomico	Ximenia americana L.
Sangredrago	Pterocarpus rohrii Vahl
Cagalera	Celtis iguanaea (Jacq.) Sarg.
Cerito	Casearia corimbosa H.B.K
Manzano de playa	Crataeva tapia L.
Palo de rosa	Hemiangium excelsum (H.B.K.) A.C. Smith
Pochote	Bombacopsis quinatum (Jacq.) Dug.
Matapiojo	Trichilia hirta L.
Tempisque	Mastichodendron capiri var. tempisque (Pitt.) Cronq.
Panamá	Sterculla apetala (Jacq.) Karst.
Guarumo	Cecropia peltata L.
Ceiba	Ceiba pentandra (L.) Gaertn.
Genízaro	Pithecellobium saman (Jacq.) Benth
Cedro amargo	Cedrela odorata L.
Ojoche	Brosimum alicastrum Swartz
Limoncillo	Trichilla havanensis Jacq.
Gavilán	Albizzia guachapele (H.B.K.) Little
Guacimo de ternero	Guazuma ulmifolia Lam
Mora	Chlorophora tinctoria (L.) Don.
Capulín de comer	Muntingia calabura L.
Espino de playa	Pithecellobium dulce (Roxb.) Benth.
Roble	Tabebuia rosea (Bertol.) DC.

Lonchocarpus latifolius	Chaperno
Ptercocarpus hayesii	Sangredrago
Tecoma stans	Sardinillo
Casearia banquitana	Cerito
Sabal spp.	Palmeto, palma paceña
Ximenia americana	Jocomico
Erythrina costaricensis	Elequeme
Byrsonima crassifolia	Nancite
Godmania aesculifolia	Cacaloguiste
Bauhinia pauletia	Pata de cabro
Hypocratea spp.	Palo de rosa
Solanum verbascifolium	Lavaplato
Neea psychotrioides	Brujo

Arbustos Bush

Rauwolfia heterophylla	Guataco
Cordia inermis	Achopaste
Cassia biflora	Ronrón
Lantana camara	Cuasquito
Walteria americana	Velluda
Indigofera suffruticosa	Añil
Aphelandra deppeana	Huesito
Lippia cardiostegia	Tacote blanco
Malvaviscus arboreus	Quesillo
Hamelia patens	Pintamachete
Capsicum frutescens	Chile montero
Urera baccifera	Chichicaste

Hierbas grass

Panicum trichoides	Zacate conchita
Cyperus rotundus	Coyolito
Portulaca oleracea	Verdolaga
Phyllanthus niruri	Huevos de rana
Boerhaavia erecta	Sancocho
Sida spinosa	Escoba lisa
Ipomoea tiliacea	Batatilla
Physalis angulata	Popita
Digitaria sanguinalis	Manga larga
Cenchrus echinatus	Mozote
Cenchrus browmii	Mozote
Cenchrus pilosus	Mozote

Euphorbia heterophylla	Lechosa
Setaria geniculata	Cusanito
Aristida ternipes	Zacate crin de macho
Lasiacis ruscifolia	Carrizo
Typha latifolia	Tule o junco
Bidens aquarrosa	Mozote
Tinantia erecta	
Cyperus alternifolius	Tule
Eleocharis geniculata	Tule
Hydrocotyle umbellata	Paraguitas chinos
Acrostichum aureum	Helecho dorado de pantano
Nymphaea spp.	Flor de mondongo
Cucumis anguria	Pepino silvestre
Ixophorus unisetus	Zacate chompipe
Petiveria alliacea	Zorrillo
Fimbristylis spadicea	Sontol
Melampodium divaricatum	Me caso no me caso
Heliotropium spp.	Cola de alacrán
Kallstroemia caribaea	Rodadilla
Tridax procumbens	Sulfatillo

Especies de animales silvestres más comunes y mejor conocidas.

Mamíferos

	Sciurus deppei matagalpae	Ardilla
(3)	Mazama americana	Cabro de Monte
(3)	Felis tigrina	Caucelo *
(2)	Mustela frenata	Comadreja
(2)	Caluromys derbianus	Comadreja
(2)	Philander opossum	Comadreja
(1)	Sylvilagus floridanus	Conejo
(3)	Sylvilagus brasiliensis	Conejo
(4)	Eira barbara	Culumuco
(2)	Canis latrans	Coyote
(4)	Potos flavus	Cuyuso
(4)	Tayassu tajacu	Zahino
(4)	Urocyon cinereoargenteus	Gato ostoche
(2)	Agouti paca	Guardatinaja
(2)	Dasyprocta puncteta	Guatuza
(4)	Myrmecophaga tridactyla	Hormiguero
(3)	Felis yagouaroundi	Leoncillo
(4)	Ateles geoffroyi	Mono araña
(4)	Alouatta villosa	Mono congo *

(3) **Felis pardalis** **Tigrillo** *

Aves Birds

(1)	Calocitta formosa	Urraca
(4)	Cissilopha melanocyanea	Urraca
(4)	Chiroxipiá linearis	Toledo
(3)	Carpodectes nitidus	Paloma blanca
(4)	Tityra semifasciata	Kancho
(3)	Platypsaris aglaiae	Pájaro degollado
(1)	Momotus momota	Guardabarranco
(1)	Eumomota superciliosa	Guardabarranco
(4)	Trogon citreolus	Viudita común
(4)	Ceryle torquata	Martin
(4)	Chloroceryle amazona	Martin
(4)	Micrastur semitorquatus	Guas **
(3)	Herpetotheres cachinnans	Guas
(1)	Piaya cayana	Pájaro León
(.)	Crotophaga sulcirostris	Pijul
(3)	Ramphastos wainsonii	Tucan
(1)	Ramphocelus passerinii	Sargento
(3)	Accipiter chionogaster	Gavilán **
(.)	Tyto alba	Lechuza **
(.)	Geococyx velox	Alma de perro
(3)	Ciccaba virgata	Mochuelo
(.)	Pitangus sulphuratus	Güis
(1)	Colonia colonus	Tijeretilla
(1)	Campylorhynchus rufinucha	Saltapiñuela
(2)	Thryotorus pleurostictus	Reyezuelo
(2)	Amblycercus holosericeus	Quibrapalítos
(1)	Cassidix mexicanus	Sanate
(2)	Cassidix nicaraguensis	Sanatillo
(2)	Icterus pectoralis	Chichiltote
(4)	Icterus gularis	Chichiltote
(1)	Agelaius phoenicus	Sargentillo

Ocurrencia:

(1) Muy abundante
(2) Abundante
(3) Poco
(4) Muy poco

* :En peligro de extincion

** :Amenazdas