CHAPTER - VIII NON-STRUCTURAL MEASURES

CHAPTER – VIII

NON-STRUCTURAL MEASURES

1. TARGET AND STRATEGY

The non-structural measures described in this chapter are proposed to supplement the structural measures (the sewerage development and the solid waste management) mentioned in the previous chapters of this report, for the integrated pollution control of the Lake Titicaca.

These non-structural measures have the targets aiming at: (1) the development and sustainment of the organizational functions of the entities involved in the conservation of Puno Bay's environment; (2) the motivation of public participation into the activities developed for the conservation of the Puno Bay's environment.

The following strategies are suggested to achieve these targets:

(1) Development of an **institutional consolidation plan** for strengthening the Puno Provincial Municipality's institutional capacity, the Multisectorial Committee, and the coordination between these entities involved in the conservation of Puno Bay's environment;

(2) Development of a **public educational program** to promote and motivate the public participation into the tasks for the conservation of the Puno Bay's environment.

2. POSSIBLE MEASURES

In other chapters of this report, several specified measures have been discussed for strengthening the managerial capacity of the Puno Municipal Enterprise for Potable Water and Sewerage (EMSAPUNO) and the Division of Public Cleaning of the Puno Province Municipality. To supplement these measures, the following four non-structural measures are proposed:

(1) The **institutional consolidation plan;**

(2) The **public education program;**

(3) The **enlightenment campaign (installation of *the Clean Day)***;

(4) The **enforcement of environmental regulations.**

2.1 INSTITUTIONAL CONSOLIDATION PLAN

The **institutional consolidation plan** proposed here aims at the strengthening of the Puno Province Municipality's institutional capacity, and the Multisectorial Committee, as well as the strengthening of the coordination between the entities involved in the conservation of Puno Bay's environment, by identifying the roles of the most important entities.

(1) Identification of the roles of the main relevant entities

There are many entities involved in the conservation of Puno Bay's environment as shown in *Figure VIII.2.1.* This figure also presents the inter-relationships between these entities, as observed by the Study Team. Each of these entities has a specified characteristic, and has some channels to access to some groups of the Puno City's residents.

At this present time, it is observed that the following three entities are taking the most important role in the conservation of the Puno Bay's environment: **(1) the Puno Province Municipality, (2) the Multisectorial Committee of Ecology and Environment** (Multisectorial de Ecología y Medio Ambiente, or "the Multisectorial Committee" in short), and **(3) the PELT** (Binational Special Project of Lake Titicaca).

The institutional capacity of each entity should be strengthened to effectively carry out the tasks aimed at the conservation of Puno Bay's environment. Besides, the role of each entity in the framework of conservation of the Puno Bay's environment should also be identified, and the coordinational relationship between these three entities should be improved.

The roles that these three main entities should take can be identified as following:

1) **The Puno Province Municipality** is responsible as a competent local government for the administrative management of all activities for the socio-economic development and the conservation of natural environment of the

Puno Province. Taking this responsibility, the Municipality should develop the projects for improving the services of water, urban sanitation, urban sewerage, etc. oriented to the Puno City's residents, organize the programs or campaigns for motivating the residents into the conservation of the environment, formulate and execute the regulations and the plans necessary for the sanitary services, environmental management, etc.

2) **The Multisectorial Committee** takes the role as a coordinator between the state government, the PELT, the provincial municipality, the mass media, and other relevant entities. Through these entities, the Multisectorial Committee shall access to as many residents as possible, to promote the educational programs, and to motivate the residents into the events, campaigns, and other activities which are performed for the conservation of the Puno Bay's environment.

3) **The PELT** takes the role as a technical adviser, and is responsible as a competent state government for monitoring the changes in environment, advising the relevant entities on the environmental conservation technology, conducting the projects to utilize the new technology for the conservation of the Puno Bay's environment, raising and managing funds for the projects, encouraging environmentally-friendly regional development, etc. The projects conducted by the PELT should not be duplicated with the ones conducted by the Puno Province Municipality.

The three above-mentioned entities should concentrate their efforts in performing their respective function , in order to avoid duplicate efforts, and to effectively push forward the programs and campaigns aiming at the common purposes.

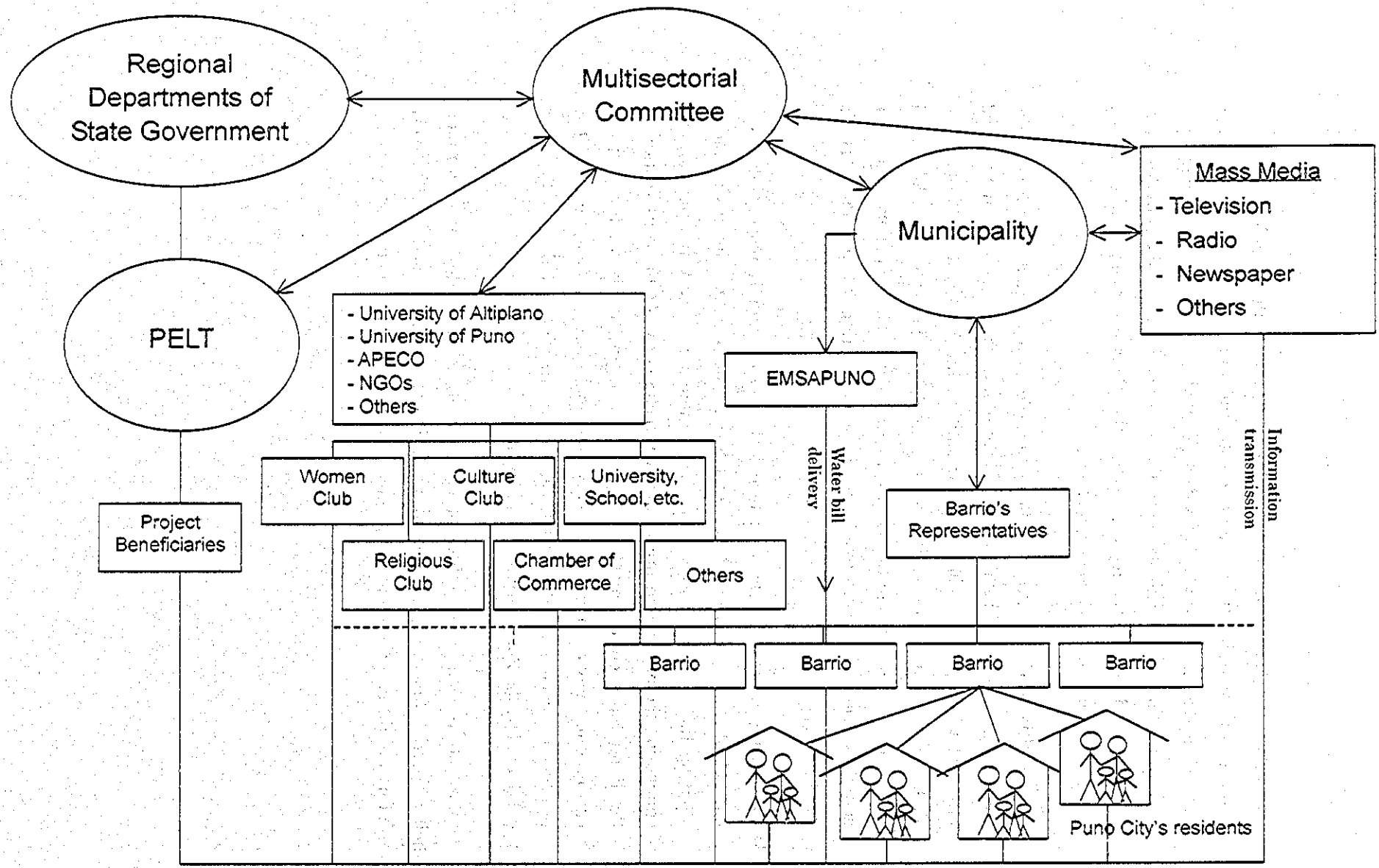

Figure VIII.2.1 Existing Entities Involving in the Puno Bay's Environment, and Their Inter-relationships

(2) Strengthening of the Puno Province Municipality's institutional capacity

It is undoubted that the Puno Province Municipality is taking the most important role in the conservation of the Puno Bay's environment. There is no entity other than the Municipality who can take the role as the administrative manager of the urban development plans, the land use plans, the urban sanitary management, etc. in the Puno City, the biggest pollution source of the Puno Bay. Also, the Municipality is the sole entity responsible for the formulation of regulations and plans related to the sanitary services provided to the Puno City's residents, as well as the execution of these regulations and plans.

At this present time, the Municipality has not been prepared enough to assume its competence and its functions. While it is facing a series of problems such as the rapid population growth, the rapid urbanization, the degradation of the environment, etc., it remains short of financial resources, skillful experts, appropriate and timely decision-making system, coordination between the administrative organs, cooperation from the residents and private organizations, etc.

However, the development of the Municipality's institutional capacity should be considered as an urgent need. Several measures aiming at the strengthening of the Puno Province Municipality's institutional capacity had been proposed in the "Plan of Institutional Strengthening of the Puno Province Municipality (November 1998)", a part of the Program of Rehabilitation and Urban Management for the Republic of Peru (Programa de Rehabilitacion y Gestion Urbana en la Republica del Peru, or "PRGU" in short) funded by the World Bank.

Apart from the measures discussed in the Plan mentioned above, the following measures are considered to be very important for the strengthening of the Puno Province Municipality's institutional capacity for successfully carrying out the projects proposed by this Study.

1) Improvement of the tax collection system and the public service tariff charge collection system

The lack of financial resources seems to be the most serious problem that the Municipality is facing.

Since the enactment of Decree 776 in December 1993, the main financial sources of municipal revenues are local taxes, including property tax, tax on the transfer of property, taxes on vehicles, and some minor taxes on gambling, raffles, and games. However, the use of these instruments is restricted by central government regulations.

To increase the revenue, at this present time, the Municipality has no other choice than the improvement of the system of collection of local taxes, and non-tax revenues (such as the solid waste collection fee).

The Municipality's tax collecting capacity is now being constrained by its weak institutional and administrative capacity. Under the present passive tax collection system, only few residents pay property taxes and public service fees on a voluntary basis. (Throughout the year 1998, there were only 12,000 taxpayers among about 25,000 households in the Puno District). Furthermore, the method of determining this fee is not reasonable: it bases on the characteristic and the value of resident's existing properties, instead of on the quantity or quality of the service provided to each specified district of the City. And all resulted a low rate of tax and fee collection.

This existing system of collection of taxes and fees should be revised. The organs in charge of collecting taxes and fees of the Municipality should be equipped with more skillful experts, and should be able to make and implement the plans aiming at the revision of the existing tax and fee collection system, in order to increase the Municipality's revenue, and to make the system more reasonable without partiality.

Besides, it is suggested that the application of a kind of *environmental fee* can be studied as a tool to motivate the participation of the tourists visiting Puno City and Puno Bay for the conservation of the Puno Bay's environment. The tourists are generally in favor of environmental conservation, and it is expected that such kind of environmental fee will be acceptable to a major part of tourists who visit and admire the historic values and beautiful landscapes of the Puno Bay and the Titicaca Lake.

2) Improvement of public relation

Since January 1999, the newly selected Mayor of the Puno Province Municipality has made efforts to reinforce the organs in charge of improving public relations. The Unit of Public Relation and Institutional Image, as well as the Directorate of Public Promotion and Participation has been established among the few organs newly installed in the organization structure of the Municipality since January 1999.

However, the operational capacity of the Unit of Public Relation and Institutional Image mentioned above should be strengthened to enable the diffusion of information on the Municipality' services to the residents, and to motivate the participation of residents and other private entities to the tasks for the conservation of the Puno Bay's environment.

This Unit of Public Relation and Institutional Image can be assigned as the main organ in charge of carrying out the public education program recommended by this Study. Taking this responsiblity, the Unit of Public Relation and Institutional Image should be appropriately equiped to be able to perform the tasks such as the followings:

- Conducting the educational campaigns, the public enlightenment campaigns, etc.;
- Staging the campaigns and the events, such as the Clean Day, the Puno Bay's Clean Day, etc.;
- Publishing the municipal newsletters, making up and managing the educational tools, such as the educational video, the educational booklet;
- Operating and maintaining the tools for the public enlightenment campaign, such as the video projection wagon cars, etc.;
- Maintaining and improving the cooperational relationship with the representatives of the barrios, the regional public agencies, the NGOs, and other private organizations.

(3) Strengthening of the Multisectorial Committee

As mentioned previously, the Multisectorial Committee is considered to be one of three main entities that are taking the most important roles in the conservation of

the Puno area. Beside the Municipality (as an administrator), and the PELT (as a technical adviser), the Multisectorial Committee should perform effectively the role of a coordinator among the Municipality, the state governmental organizations, the mass media, and other groups of residents.

However, at this present time, only with the meetings organized occasionally, the Multisectorial Committee can not perform its role efficiently. The Multisectorial Committee should be strengthened to be able to work permanently, with at least a small office and an adequate number of permanently working staff members.

The central government, and the international cooperation agencies should give initial supports to the strengthening of the Multisectorial Committee. And then the members of the Multisectorial Committee should give concrete contributions to the Committee in order to make it work effectively and sustainably.

2.2 PUBLIC EDUCATION PROGRAM

The **public education program** proposed here aims at the heightening of Puno City residents' awareness, and consciousness on environmental issues, as well as the promotion of these residents' participation in the tasks for the conservation of Puno Bay's environment.

(1) Objectives of the Public Education

The objectives of the public education are set as follows:

- Explain the magnitude and urgency of the environmental issue of Puno Bay.
- Stress the benefits of an adequate behavior to conserve the environment, and to the contrary, the harm of an improper one on public health, welfare and the environment as related to the daily life of the general population.
- Point out that only through the active participation of the whole population can the problems related with the polluted Puno Bay be solved.
- Point out the main factors causing the degradation of the environment of Puno Bay.
- Promote the use of on-site facilities for preventing the flush of untreated polluted water to the Puno Bay.

- Underline the costs involved in sewerage and solid waste management as a public service, and the effects of the residents' improper waste management habits on SWM, i.e. illegal dumping increases the costs and reduces efficiency and so forth. Also, explain the problems faced by the Municipality in extending services to non-collection areas.
- Promote better understanding on bearing the costs to improve the lake environment.
- Promote adequate waste disposal habits and public participation in matters related to solid waste management, treatment of liquid waste water, as well as maintenance and use of relevant facilities.

(2) Methods of Public Education

Generally, public education methods are divided into (1) the campaigns targeting the general or large segments of the population; and (2) those trying to reach limited and confined target groups. The first method utilizes mainly the mass media or indiscriminate general campaigns, while the second concentrates on reaching specific groups through educational programs, enlightenment campaigns (such as events, lectures, meetings, etc.) and other costume designed campaigns.

Target of the education campaign	Availabe methods
General or large segment of population	- Mass media (advertisement, press release, etc. in TV, radio, newspapers, etc.) - Indiscriminate general campaigns (posters, street wall painting, etc.)
Specified group of resident	- **Educational programs** - **Enlightenment campaigns** - Other costume designed campaigns.

In case of the Puno Province, the effective methods of public education seem to be: **(a) the educational program**, and **(b) the enlightenment campaign.**

Some specified educational tools, such as the educational video, educational booklet, etc. shall be prepared to improve the effectiveness of these educational programs and enlightenment campaigns.

1) Educational Program

The educational programs target mainly the students of elementary and secondary schools. Schools particularly present an effective audience because children are very impressionable, curious and idealistic, so that it is very easy to transmit the message. However, by the same principle, it is also very easy for them to forget the issue at stake. Therefore, the biggest challenge regarding to the public education at schools is how to design the programs in such a way that the students can remember the main points of the programs.

The possible measures are the followings:

- Expand the regular curriculum relevant to environmental conservation (to convey the basics of environmental conservation to the students);
- Train the teachers (on the most important facts on environmental conservation and provide them with educational materials to support their teachings);
- Develop extra-curricular activities (to organize the field trips for the students to learn the relevant issues through live experience);
- Develop an educational tool (to produce the pamphlets, booklets, video tapes, etc. as materials for educational programs);
- Other measures.

The tools developed for these educational programs oriented to the students can however be also used to enhance the awareness of common residents, and the staff members of the agencies or organizations involved in the activities for environmental conservation.

2) Enlightenment Campaign

The enlightenment campaigns shall complement the educational programs, which aim at the specific target groups. The strategy for the enlightenment campaigns is the 'repeat and incite to crisis' method, wherein several tools are used for the same topic, and are then repeated many times. For general and common information, mass media (such as TV, radio) are effective tools. On the other hand, meetings and seminars, events and campaigns can be used for specific topics and areas.

- Meetings with the Community

These meetings should be carried out at all candidate communities. During these meetings, the issues such as the followings are discussed: (1) benefits to health, economic development and the environment of the relevant programs; (2) relationship between diseases and polluted water, solid waste; (3) common diseases in the community; (4) benefits of the regular sewerage system and the waste management system; (5) the solid waste generated by each individual should be his responsibility, while the environment should be everybody's; (6) need for changes in bad habits and attitudes; (7) need for cooperation by the community.

- Staging of Events and Campaigns

The staging of events and campaigns on environmental conservation can focus on the topics similar to the ones for the meetings with the community. The events and campaigns may be conducted by any organization, such as the Multisectorial Committee, the Municipality (the Unit of Public Relation and Institutional Image, or the Division of Public Cleaning), the Communities, the NGOs, etc. The Puno Province Municipality and the PELT should identify these efforts, try to coordinate and support them, as well as develop their own initiatives.

3) Educational tools

After determining the public education techniques, proper tools must be prepared. Beside the background study and the preparation of lecturers, the educational tools such as the educational videos and booklets should be prepared.

These educational tools can be used at the educational programs carried out by the organs in charge of public environmental education in all sectors. These organs should establish a program to utilize these educational tools.

The educational videos and booklets should be identified by a specified slogan to create a homogeneous and global campaign.

The contents of the educational tools should be carefully studied in order to make them attractive and easy to transmit the specified messages to the residents.

The Municipality should be equipped with a *'video projection station wagon'* which can also be used as a campaign car for supporting the enlightenment campaigns. This wagon car can be equipped with the audio-visual instruments such as the video projector, the cassette desk, the speakers, the placard, etc. The Unit of Public Relation and Institutional Image may be assigned the responsibility for operating and maintaining this wagon car. A program should be made to utilize this wagon car at the schools, the parks, the markets, the commercial streets, etc. on a daily basic in order to carry out the environmental campaigns effectively.

2.3 INSTALLATION OF THE CLEAN DAY

The questionnaire survey on the public consciousness related to environmental issues carried out by the Study Team in November 1998 indicated that the Puno City's residents have a relatively favorable custom of cleaning the roads and other public areas around their houses. A major part of interviewed residents had also expressed their willingness to cooperate with the municipal authority in the tasks for improving the Puno Bay's environment. And according to the relevant agencies, a significant number of residents had participated in the campaigns organized occasionally in the past for clean up the Puno Interior Bay.

Therefore, in order to improve the residents' consciousness on environmental conservation, the installation of the Clean Day as a fixed day on the Puno City's calendar was recommended. On this day, the Puno City's residents can express their willingness to keep their district clean, by sweeping the roads, remove the littered wastes around their houses, etc.

However, to successfully conduct this Clean Day, the Municipality's capacity should be strengthened at first. The Municipality should be capable to mobilize a great part of its residents, by cooperating with the mass media, other public and private organizations to instruct and motivate the residents. The enterprises, shops, hotels, tourist agencies, and other commercial entities which can earn more benefits from the improvement of the City's cleanliness, should share a part of the cost required for carrying out this Day. A competition between the districts can be applied, so that the ones which show significant efforts can be awarded appropriately.

2.4 ENFORCEMENT OF ENVIRONMENTAL REGULATIONS

Regarding to the management of wastewater, a legal norm aiming at the control of wastewater quality applied to all areas of the country is now being prepared by the Ministry of Health with the cooperation of other relevant authorities. Apart from this, the Puno Provincial Municipality had approved the Municipality Ordinance on sanitation and public health in January 1994. So then, the legal framework on management of wastewater and solid waste in the Puno Province seems to be conformable to the region where the heavy industrial factory does not exist, and there is only a few number of medium scale factories.

However, these legal norms and ordinances should be enforced with detailed documents defining the violating individuals, their magnitude, the corresponding fines to be imposed, as well as the entities in charge of supervising these violations.

Besides, it is necessary to establish a proper and sound legislation for the control of contaminated wastes generated by the hospitals and the slaughterhouse in the city.

- In general, it is difficult to effectively control non-point pollution sources by structural measures. An appropriate land use should be encouraged to minimize the outflow of pollution loads. Municipal ordinance should also regulate land use from the viewpoint of pollution control. For example, development of the steep slope area or grazing in the inundation area should be restricted. Not only regulatory ways but also instructive ways should be adopted. For example, it must be useful for pollution load control to instruct livestock farmers how to treat and reuse waste/dung of livestock.

3. COST ESTIMATION FOR PUBLIC EDUCATION AND INSTITUTIONAL CONSOLIDATION PLAN

The costs for carrying out the institutional consolidation plan and the public education program proposed for improvement of Puno Bay's environment are estimated as shown in *Table VIII.3.1* and *Table VIII.3.2* respectively. As the whole non-structural measures, the disbursement schedule is shown in *Table VIII.3.3.*

Table VIII.3.1 Estimated Cost for Institutional Consolidation Plan

1. Institutional Consolidation

1.1 Puno Provincial Municipality

1) Improvement of tax/charge collection system

	assignment	Chief	Clerk	Assistant	total
Personnel expenses	number of staff	1	2	10	13
	unit (soles/man/month)	1,000	800	400	2,200
	sub total (soles/year)	12,000	19,200	48,000	79,200
Training expenses	unit (soles/year)	1,000	2,000	0	3,000
Administration (1% for personnel expenses)		120	192	480	792
Total (soles/year)		13,120	21,392	48,480	82,992

2) Improvement of public relation (educational program, enlightenment campaign)

	assignment	Chief	Clerk	Assistant	total
Personnel expenses	number of staff	1	3	6	10
	unit (soles/man/month)	1,000	800	400	2,200
	sub total (soles/year)	12,000	28,800	28,800	69,600
Training expenses	unit (soles/year)	1,000	3,000	0	4,000
Administration (1% for personnel expenses)		120	288	288	696
Total (soles/year)		13,120	32,088	29,088	74,296

1.2 Multisectorial Committee

	assignment	Chief	Clerk	Assistant	total
Personnel expenses	number of staff	1	1	3	5
	unit (soles/man/month)	1,000	800	400	2,200
	sub total (soles/year)	12,000	9,600	14,400	36,000
Training expenses	unit (soles/year)	3,000	3,000	0	6,000
Administration (1% for personnel expenses)		120	96	144	360
Total (soles/year)		15,120	12,696	14,544	42,360

1.3 PELT (management of fund)

	assignment	Chief	Clerk	Assistant	total
Personnel expenses	number of staff	1	4	0	5
	unit (soles/man/month)	1,000	800	400	2,200
	sub total (soles/year)	12,000	38,400	0	50,400
Training expenses	unit (soles/year)	6,000	12,000	0	18,000
Administration (1% for personnel expenses)		120	384	0	504
Total (soles/year)		18,120	50,784	0	68,904

4. Enforcement of Environmental Regulations (Ministry of Health)

	assignment	Chief	Clerk	Assistant	total
Personnel expenses	number of staff	1	2	4	7
	unit (soles/man/month)	1,000	800	400	2,200
	sub total (soles/year)	12,000	19,200	19,200	50,400
Training expenses	unit (soles/year)	6,000	4,000	0	10,000
Administration (1% for personnel expenses)		120	192	192	504
Total (soles/year)		18,120	23,392	19,392	60,904

Table VIII.3.2 Estimated Cost for Public Education Program (Unit: S/.)

Measures			Cost (S/.)	Remarks
Educational Program	Video projection station wagon			
		Procurement	289,800	The cost includes the cost for procurement of video deck, display monitor, cassette desk, amplifier, speakers, etc. (soles/13years)
		Operation cost	2,268	= gasoline cost = 2liters/day * 360 days/year * 1US$/liter (soles/year)
		Maintenance cost	14,490	= 5% of procurement cost (soles/year)
	Making of educational videos		25,200	= 1 tape/year * 8,000US$/tape (soles/year)
	Making of educational booklets		12,600	= 2 booklets/year * 5,000US$/booklet (soles/year)
Enlightenment Campaign	Making of promotion posters		31,500	= 2 posters/year * 2,000US$/poster (soles/year)
	Holding of events and campaign		63,000	= 2 events/year * 10,000US$/event ; including "the Clean Day" (soles/year)
	Holding of meetings		37,800	= 12 meetings/year * 1,000US$/meeting (soles/year)

Table VIII.3.3 Implementation and Disbursement Schedule for Non-structural Measures

(thousand soles (S/.1000))

Non-structural Measures	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1. Institutional Consolidation														
1.1 Puno Provincial Municipality	157	157	157	157	157	157	157	157	157	157	157	157	157	157
1) Improvement of tax/charge collection system	83	83	83	83	83	83	83	83	83	83	83	83	83	83
2) Improvement of public relation	74	74	74	74	74	74	74	74	74	74	74	74	74	74
1.2 Multisectorial Committee	42	42	42	42	42	42	42	42	42	42	42	42	42	42
1.3 PELT (management of fund)	69	69	69	69	69	69	69	69	69	69	69	69	69	69
sub total	269	269	269	269	269	269	269	269	269	269	269	269	269	269
2. Public Education Program														
2.1 Video projection station wagon	307	17	17	17	17	17	17	17	17	17	17	17	17	307
1) Procurement	290													290
2) Operation cost	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3) Maintenance cost	14	14	14	14	14	14	14	14	14	14	14	14	14	14
2.2 Making of educational videos	25	25	25	25	25	25	25	25	25	25	25	25	25	25
2.3 Making of educational booklets	13	13	13	13	13	13	13	13	13	13	13	13	13	13
sub total	344	55	55	55	55	55	55	55	55	55	55	55	55	344
3. Enlightenment Campaign														
3.1 Making of promotion posters	32	32	32	32	32	32	32	32	32	32	32	32	32	32
3.2 Holding of events and campaigns	63	63	63	63	63	63	63	63	63	63	63	63	63	63
3.3 Holding of meetings	38	38	38	38	38	38	38	38	38	38	38	38	38	38
sub total	132	132	132	132	132	132	132	132	132	132	132	132	132	132
4. Enforcement of Environmental Regulatic	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Total	806	516	516	516	516	516	516	516	516	516	516	516	516	806
IGV [18% for Item 2.1.1), 2.1.3), 2.2, 2.3 and 3.1]	67	15	15	15	15	15	15	15	15	15	15	15	15	67
Grand Total (including IGV)	873	531	531	531	531	531	531	531	531	531	531	531	531	873

Non-structural Measures	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025		Total
1. Institutional Consolidation														
1.1 Puno Provincial Municipality	157	157	157	157	157	157	157	157	157	157	157	157		4,089
1) Improvement of tax/charge collection system	83	83	83	83	83	83	83	83	83	83	83	83		2,158
2) Improvement of public relation	74	74	74	74	74	74	74	74	74	74	74	74		1,932
1.2 Multisectorial Committee	42	42	42	42	42	42	42	42	42	42	42	42		1,101
1.3 PELT (management of fund)	69	69	69	69	69	69	69	69	69	69	69	69		1,792
sub total	269	269	269	269	269	269	269	269	269	269	269	269		6,982
2. Public Education Program														
2.1 Video projection station wagon	17	17	17	17	17	17	17	17	17	17	17	17		1,015
1) Procurement														580
2) Operation cost	2	2	2	2	2	2	2	2	2	2	2	2		59
3) Maintenance cost	14	14	14	14	14	14	14	14	14	14	14	14		377
2.2 Making of educational videos	25	25	25	25	25	25	25	25	25	25	25	25		655
2.3 Making of educational booklets	13	13	13	13	13	13	13	13	13	13	13	13		328
sub total	55	55	55	55	55	55	55	55	55	55	55	55		1,998
3. Enlightenment Campaign														
3.1 Making of promotion posters	32	32	32	32	32	32	32	32	32	32	32	32		819
3.2 Holding of events and campaigns	63	63	63	63	63	63	63	63	63	63	63	63		1,638
3.3 Holding of meetings	38	38	38	38	38	38	38	38	38	38	38	38		983
sub total	132	132	132	132	132	132	132	132	132	132	132	132		3,440
4. Enforcement of Environmental Regulatic	61	61	61	61	61	61	61	61	61	61	61	61		1,584
Total	516	516	516	516	516	516	516	516	516	516	516	516		14,004
IGV [18% for Item 2.1.1), 2.1.3), 2.2, 2.3 and 3.1]	15	15	15	15	15	15	15	15	15	15	15	15		496
Grand Total (including IGV)	531	531	531	531	531	531	531	531	531	531	531	531		14,500

CHAPTER - IX ENVIRONMENTAL MONITORING

CHAPTER - IX

ENVIRONMENTAL MONITORING

1. TARGET AND STRATEGY

The environmental monitoring shall be practiced for several purposes of environmental administration in Puno Interior Bay as shown below.

- to evaluate the environment quantitatively and qualitatively,
- to identify the problems concerning environmental deterioration,
- to consider appropriate measures against the problems,
- to monitor the expected effects which the measures are to produce,
- to check the adverse effects on the environment which the measures may unexpectedly produce,
- to inform the problems to the citizens based on clear data in order to ask for their awareness, understanding and cooperation,
- to enforce effluent regulation on the pollution sources based on rational data, and
- to predict the future environment which will be affected by a certain development plan/project.

To succeed in the above-mentioned purposes, the monitoring program has been established based on the following strategies.

- The monitoring program consists of two parts; one is for effluents from factories, workshops, slaughter house or wastewater treatment facilities, the other is for water bodies of the lake and drainage.
- The monitoring parameters for the lake water are classified into two categories; one is related to physical and chemical conditions and the other is related to biological conditions.

- The monitoring should be practiced periodically to understand the trend for a certain period, and annual/seasonal/monthly/daily average or variation.

- Monitoring parameters should be selected or evaluated follow the laws and regulations regarding water quality standards and effluents standards.

- Methods of the environmental monitoring should be standardized by the competent organizations such as DIGESA or CEPIS.

- To avoid wasting manpower and money, relevant organizations should collaborate with others sharing a laboratory, equipment, instruments, know-how and manpower.

- The PELT's laboratory should take the initiative in sampling and water analysis, because through this Study it has been provided with some instruments and know-how necessary for water and sediment quality analysis. Some parameters that can not be analyzed by the existing capacity of PELT should be analyzed by the competent organizations.

- The monitoring results should be accumulated, compiled, statistically processed, and disclosed to the public by the responsible organizations for environmental administration.

2. MONITORING PROGRAM FOR EFFLUENTS

Generally, wastewaters from factories and workshops cause hazardous contamination and/or organic pollution in the water environment. For example, plating, chemical and tanning industries are the sources of hazardous contamination, and food, papermaking, slaughter house and some kind of industries are the sources of organic pollution are listed.

According to the field survey in the Study area, factories which are supposed to discharge hazardous contaminants were not found. On the other hand, organic pollution sources such as a slaughter house, food processing or beverage workshops were found, while those workshops are small scale. Therefore, the monitoring program for effluents in the Study area should be concentrated on the organic pollution sources.

Considering the limited manpower and budget for the continuous monitoring, the minimum essentials are proposed to evaluate the problems of organic pollution and eutrophication. A desirable monitoring program is summarized as follows.

Monitoring subjects:	Food and processing industries (4 workshops) Slaughter house (1 facility) Espinar wastewater treatment plant (1 facility)
Frequency :	Workshops / Slaughter house: 2 times a year Espinar WWTP: 12 times a year (see *Table IX.3.1*)
Monitoring parameters:	See *Table IX.3.2*.

3. MONITORING PROGRAM FOR WATER BODIES

3.1 PHYSICAL AND CHEMICAL CONDITIONS

In Puno Interior Bay, several times of water quality monitoring were previously carried out by PELT from 1993 until 1994. After 1995, the monitoring became intermittent and finally stopped in 1997. Consequently, no serial data on water quality are available.

New monitoring program is planned and proposed taking the capacity of the competent organization and the previous program into account.

(1) Monitoring Point

1) Lake water

Monitoring points are at the same points where the lake water quality survey was carried out in this Study (see *Figure IX.3.1*). The monitoring points are classified into two categories. One is the main point to grasp the longitudinal water quality condition from the interior bay to the exterior bay. The other is the supplementary point to grasp a local water quality. One of the main purposes of the lake water monitoring is to grasp the internal pollution loading from the bottom sediment, and so the parameters concerning the sediment quality are important as well as those concerning the water quality.

2) Drainage channel

Monitoring points are at the same points where the drainage survey was carried out in this Study. Five drainage channels are selected as shown in *Figure IX.3.2* based on the amount of pollution load outflow. However, the monitoring points should be reconsidered when the water quality of the channels is significantly improved in future. The main purpose of the drainage monitoring is to grasp pollution load outflow, and so the flow rate is an important parameter to be measured as well as the chemical parameters such as T-N or T-P.

(2) Frequency of the Monitoring

The frequency of sampling is defined as shown in *Table IX.3.1*.

(3) Monitoring Parameter

Physical and chemical parameters to be monitored are shown in *Table IX.3.2*. Besides those data, meteorological and hydrological data observed by SENAMHI should be collected if they can be purchased with a reasonable price.

Table IX.3.1 Frequency of Environmental Monitoring

Item	Water Pollution Sources		Water Environment			Biological Conditions
	Workshop / Slaughter House	Wastewater Treatment Plant	Lake Water	Lake Sediment	Drainage Channel	Lake Water / Sediment
Number of Monitoring Points (point)	5	1	7 (main), 5 (supplem.)	12	5	16 (benthos), 8 (zoo/phyto plankton), 1 (macrophytes)
Frequency of Monitoring (time/year)	2	12	12 (main), 6 (supplem.)	2	12	4 (benthos), 2 (zooplankton), 6 (phytoplankton), 1 (macrophytes)
Number of Sampling Times (time/survey)	1	1	1 (upper and lower layer)	1	3	1
Total Number of Samples (sample/year)	10	12	228	24	180	64 (benthos), 16 (zooplankton), 48 (phytoplankton)

Table IX.3.2 Parameters for Environmental Monitoring Program

Parameter	Workshop / Slaughter House	Wastewater Treatment Plant	Lake Water	Lake Sediment	Drainage Channel
Temperature	o	o	o		o
Transparency			o		
pH	o	o	o		o
ORP				o	
DO	o	o	o		o
SS	o	o	o		o
BOD_5	o	o	o		o
COD_{Mn}	o	o	o		o
Moisture content				o	
Ignition Loss				o	
T - N (Kj-N)	o	o	o	o	o
NH_4 - N	o	o	o		o
NO_2+NO_3 - N	o	o	o		o
PO_4 - P	o	o	o		o
T-P	o	o	o	o	o
Total Coliform	o	o	o		o
Flow Rate Measurement	o	o			o
Biological Conditions (Benthos)				o	
Biological Conditions (Phyto/Zoo Plankton, Macrophytes)			o		

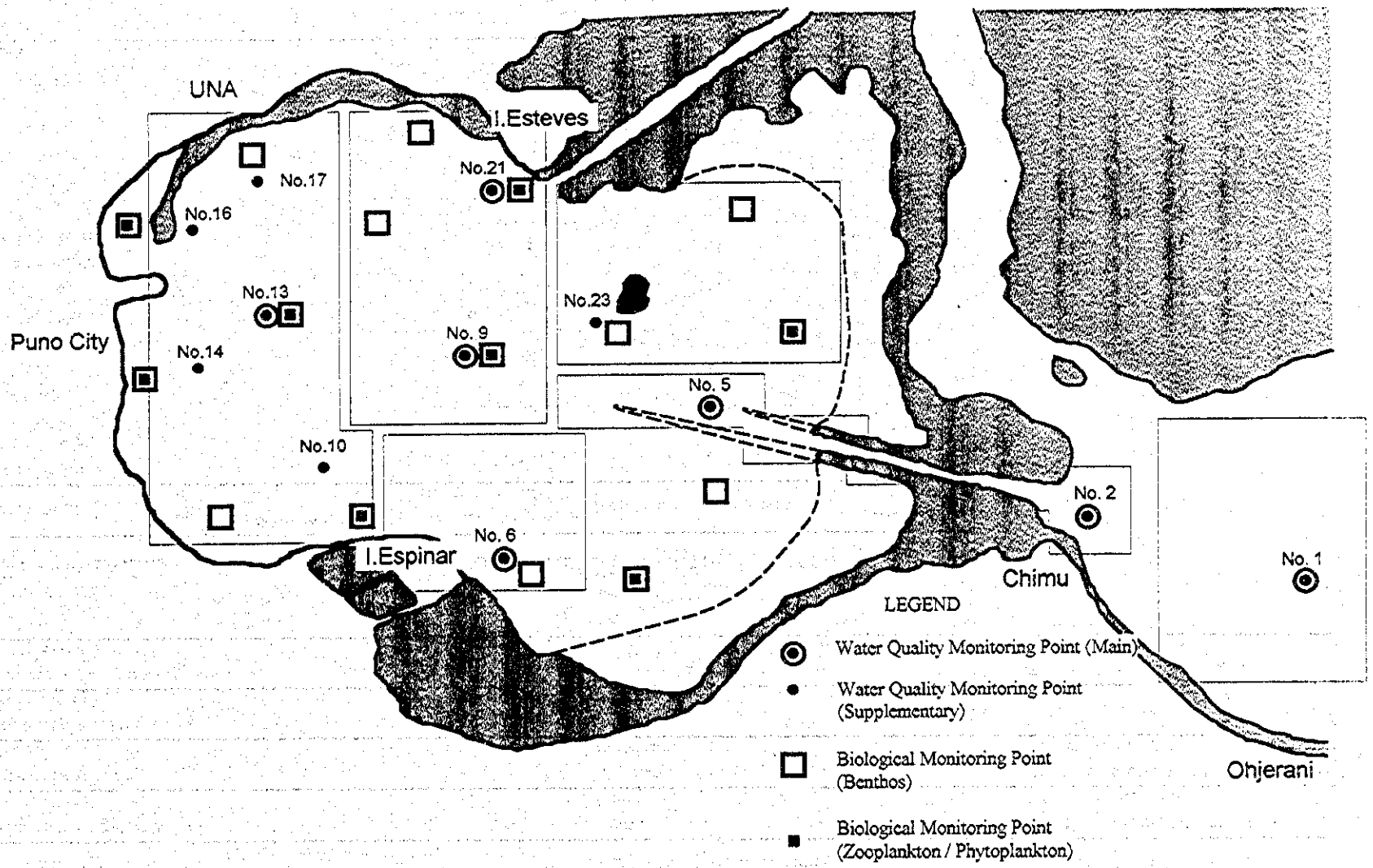

Figure IX.3.1 Monitoring Points in Puno Interior Bay

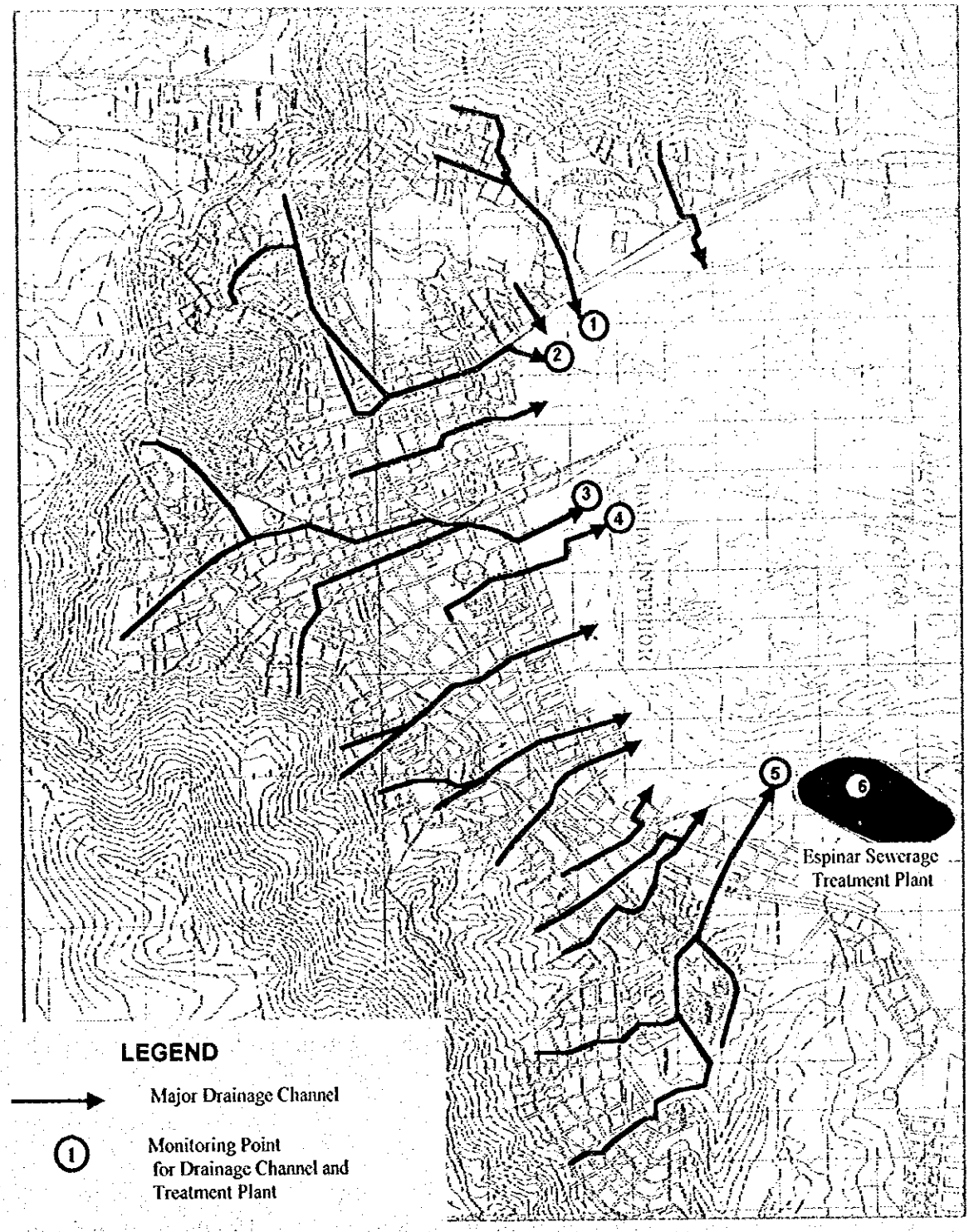

Figure IX.3.2 Monitoring Points in Drainage Channels

3.2 BIOLOGICAL CONDITIONS

In Puno Interior Bay, no periodical monitoring were previously carried out for biological conditions. Consequently, there are few available data that show the relation between biological conditions and chemical conditions. However the biological conditions sometimes suggest a serious environmental deterioration more clearly than the chemical parameters do.

Biological monitoring program is planned and proposed to supplement the environmental monitoring by physical/chemical parameters.

(1) Monitoring Point

Monitoring points are shown in *Figure IX.3.1*. Those locations are summarized as follows:

1) Benthos

- 4 locations (close (about 50 m) to the western shore, 2 to the north and 2 to the south of the main jetty
- 2 locations close (about 100 m) to Esteves Island
- 2 locations close (about 100 m) to Espinar Island
- 4 locations in the center of the interior bay
- 4 locations in the eastern part of the bay, 2 to the north and 2 to the south of the main navigation channel

2) Zooplankton and Phytoplankton

- 2 locations close (about 50 m) to the western shore, 1 to the north and 1 to the south of the main jetty
- 1 locations close (about 100 m) to Esteves Island
- 1 locations close (about 100 m) to Espinar Island
- 2 locations in the center of the interior bay

- 2 locations in the eastern part of the bay, 1 to the north and 1 to the south of the main navigation channel

3) Submerged macrophytes

The whole area of Puno Interior Bay.

All submerged macrophytes of the interior bay should be accurately mapped, while they are mainly restricted to the shallow waters of the eastern side of the interior bay.

(2) Frequency of the Monitoring

The frequency of sampling is defined as shown in *Table IX.3.1*.

1) Benthos

- 2 times in the wet season
- 2 times in the dry season

2) Zooplankton

- once in the wet season
- once in the dry season

3) Phytoplankton

- once every two months

4) Submerged macrophytes

annually mapping

(3) Monitoring Parameter

1) Benthos

Its appearance is a good indication of greatly improved ecosystem conditions.

2) Zooplankton

The great dominance of *Cladocerans* over *Copepods* is a characteristic of highly eutrophic waters.

3) Phytoplankton

Phytoplankton occurs in very large numbers over all Puno Interior Bay, and is particularly abundant in the summer months. These high numbers are due principally to the high levels of nitrate and phosphate nutrients. As water quality improves, phytoplankton biomass and volume will decrease. The monitoring programme has been designed to show this.

4) Submerged macrophytes

Up to perhaps 40 years ago submerged macrophytes occurred over most or all of the interior bay, while they are mainly restricted to the shallow waters of the eastern side of the bay. As ecosystem conditions improve, increases in the distribution, abundance and species diversity will occur. Therefore improvements in submerged macrophyte communities will be a key indicator for improving ecological conditions in Puno Interior Bay.

4. ORGANIZATION FOR OPERATION

(1) Competent Organization

It is expected that the following organization will be responsible for the execution of the environmental monitoring program.

1) PELT (Special Bi-national Project for Lake Titicaca)

- PELT previously carried out the water quality monitoring from 1993 to 1997.

- In this Study, PELT carried out sampling and laboratory analysis for physical, chemical and biological conditions in cooperation with JICA Study Team. Consequently, PELT has obtained enough knowledge and experience to execute the environmental monitoring program.

2) DIGESA (General Administration of Environmental Health, The Ministry of Health)

- DIGESA is responsible for establishment and superintendence of the environmental quality standards. According to the duties, DIGESA is promoting water quality monitoring program for important water bodies all over the country. Lake Titicaca is one of the water bodies.

- Through this Study, PELT and DIGESA has been seeking the possibility to collaborate on the environmental monitoring in Puno Bay. The collaboration is expected to avoid wasting manpower and money, and to realize an effective and accurate monitoring. DIGESA will be able to standardize the monitoring methodology and guide PELT in monitoring technique. PELT will be able to practice the monitoring and feedback the monitored data to DIGESA.

(2) Personnel for the monitoring

The personnel necessary for the environmental monitoring is proposed as follows:

Assignment	Required Number of Personnel	Remarks
Chief	1 person	
Analyst	3 persons	2 chemists, 1 biologist
Assistant Analyst	4 persons	
Labor	1 person	

5. COST ESTIMATION

The costs necessary for investment, operation and maintenance are estimated as shown in *Table IX.5.1*.

- Additional capital investment : S/.246,000 soles
- Operation and maintenance cost : S/.184,200 soles/year

  (not including IGV)

Table IX.5.1 Cost Estimation for Environmental Monitoring Program

Items		unit	Unit Cost (Foreign currency)	Unit Cost Local currency	Foreign C. (soles)	Local C. (soles)	Total (soles)
Capital investment	High pressure steam sterilizer	1 set	15,000 soles/set	0 soles/set	15,000	0	15,000
	Total	-			15,000	0	15,000

$= 3.15 soles
$= 116.7 yen

Items			unit	Foreign currency	Local currency	Foreign C. (soles/year)	Local C. (soles/year)	Total (soles/year)
Maintenance Costs	Personnel expenses	Chief	12 man-month.	- soles/man-month.	2,400 soles/man-month.	0	28,800	28,800
		Analyst	36 man-month.	- soles/man-month.	1,600 soles/man-month.	0	57,600	57,600
		Analysis Assistant	48 man-month.	- soles/man-month.	1,200 soles/man-month.	0	57,600	57,600
		labor	12 man-month.	- soles/man-month.	800 soles/man-month.	0	9,600	9,600
		Sub-total	108 persons	-	-	0	153,600	153,600
	Rental fee	Boat	14 day/year	- soles/day	100 soles/day	0	1,400	1,400
		Car	52 day/year	- soles/day	150 soles/day	0	7,800	7,800
		Sub-total				0	9,200	9,200
	Expendables	Chemicals	1 set	9,450 soles/year	- soles/mon.	9,450	0	9,450
		Sub-total				9,450	0	9,450
	Repair	2%	1 set	2,700 soles/year	- soles/mon.	2,700	0	2,700
		Sub-total				2,700	0	2,700
	Others*	5%	1 set	- soles/mon.	7,680 soles/mon.	0	7,680	7,680
		Sub-total				0	7,680	7,680
	Administration (1% for Personnel expenses)		1 set	- soles/year	- soles/mon.	0	1,536	1,536
						0	0	0
		Sub-total				0	1,536	1,536
Total								184,166

note ; * It is equal to 5% of the personnel expenses.

< Car >		
Lake sampling	12	day/year
Sediment sampling	2	day/year
Treat. plant sampling	12	day/year
drainage c. sampling	12	day/year
preparatory	12	day/year
pollution source	2	day/year
Total	52	day/year

<Boat>		
Lake sampling	12	day/year
Sediment sampling	2	day/year
Total	14	day/year

	Instrument	Machinery
Property (soles)	27,000	135,000
Life (year)	7	15
Remain	0%	10%

CHAPTER - X FEASIBILITY STUDY

CHAPTER - X

FEASIBILITY STUDY

1. INTRODUCTION

1.1 SELECTION OF PROJECT

The project for the feasibility study was selected as follows:

(1) Order of Priority

In the Integrated Water Pollution Control Plan for Puno Interior Bay, each measure has been ranked considering its priority.

1st: Improvement/Upgrading of Sewerage Systems
2nd: Improvement/Upgrading of Solid Waste Management
3rd: Improvement of Urban Drainage Systems
4th: In-lake Measures (dredging/cover of the bottom sediment, removal of *Lemna*, rehabilitation of Totora)

(2) Selection of Project for Feasibility Study

1) Improvement/Upgrading of Sewerage Systems

According to the Discussion Memorandum on Progress Report agreed on February 26, 1999, the feasibility study on improvement/upgrading of sewerage systems were deleted from the Study because of the following reasons.

With regard to wastewater treatment, there exist two alternatives proposed by the Peruvian authorities. Feasibility studies have been already conducted by each authority and definitive studies have been almost completed.

With regard to sewerage network, the feasibility study has been already completed and the German Government will offer a financial assistance for the project as it is feasible.

2) Improvement/Upgrading of Solid Waste Management

Solid waste management should be improved with high priority in order to improve public health conditions of Puno City or tourist attractions of Puno Bay. The following subprojects should be discussed in the feasibility study of this Study.

- Complete removal of illegally dumped wastes by the year 2008
- Stepwise increase of the waste collection rate until the year 2008
- Improvement and expansion of the existing final disposal site following the new standard drafted by DIGESA

3) In-lake Measures (dredging/cover of the bottom sediment, removal of *Lemna*, rehabilitation of Totora)

As explained in the Minutes of Meeting on The Interim Report agreed on July 13, 1999, in-lake measures such as dredging would not necessarily bring an immediate effect or might affect the aquatic ecosystems. These measures should not be implemented until the environmental monitoring is practiced to check the effect and the impact. In that sense, it can not be said that these measures are fully feasible. Therefore they can not be discussed in the feasibility study even though they are proposed in the Integrated Plan.

4) Improvement of Urban Drainage Systems

According to the Minutes of Meeting on The Inception Report agreed on October 14, 1998, the study is dealing with the urban drainage as a part of countermeasures against the lake water quality deterioration. It is out of the scope of the Study to make a plan for the control of storm water including erosion control in the whole catchment area, because it should be another full-scale project.

As a result, the improvement/upgrading of solid waste management by the year 2008 has been selected for the feasibility study.

1.2 DEFINITION OF THE FEASIBILITY STUDY

(1) The term and items of the Feasibility Study

1) Starting year for this Feasibility Study is 2002 and ends 2008.

2) The Study for Collection and Transport of the Wastes is by designating the collection routes and allocation of collection vehicles.

3) The Study for the Sanitary Landfill Site is by Plan for Landfilling in the planned time schedule and Plan for the materials for covering.

4) After the year of 2009, the Puno City itself is recommended to review of this Study and shall make up the plan for execution.

5) Measure taken by the Puno City

For improvement of the present Collection System, in July of 1999 Puno City purchased two of second-hand Japanese compactor cars of which capacity was 4 m^3. These compactor trucks were produced in 1990 and 1993. And since the City plans to increase the collection capacity by procurement of small size compactor truck, then Feasibility Study follows to increase number on the 4 m^3 this City's Plan.

2 DESIGNING

2.1 WASTE COLLECTION

(1) Selected Plan

Referring to the three Alternative Plans (A-1, A-2, A-3) in the Chapter VI of Master Plan, the Feasibility Study is based on the A-1 with F-1 which plans to increase the number of equipment and staff in accordance with the present Vehicle Collection System by the final target year of 2025.

(2) Projected Collection Quantity

1) Improvement of Collection Rate

The present 52% collection rate is projected to be improved to 100% level in between 2002 and 2025 at the annual rate of 1.8% only.

2) Comparison of Quantity of both Waste Generation and Collection

In the *Table X.2.1,* indicated Waste Generation Volume and it's Collection Quantity, which shows the collection Quantity as 58.33 t/d in 2008.

Table X.2.1 Waste Generation and Waste Collection Quantity

		1998	2002	2008	2025
Generation Quantity	Domestic	35.69	41.34	51.00	83.65
	Commercial	4.36	4.33	4.27	4.13
	Market	3.59	3.60	3.60	3.60
	Road Sweeping	23.27	24.70	27.02	34.77
	Direct carried in	1.50	1.59	1.74	2.24
	Total	68.41	75.56	87.63	128.39
Collection Quantity	Collection Volume (t/d)	35.50	44.10	60.07	128.39
	Collection Rate (%)	52	58	68	100

Source : JST

(3) Plan for Supply of Collection Vehicle

1) Condition of Calculation

a. Capacity of Transport

In accordance with the Field Survey made by JST in 1998, the following figures in the *Table X.2.2* are obtained for transport capacity.

Table X.2.2 Transport Capacity of Compactor Cars

	Number of trips (times /day)	Transport Volume (tons/times per vehicle)
12m3 Compactor	2	5.4
6.8m3 Dump Truck	2	3.2
4.0m3 Compactor	3	1.8

Source : JST

b. Life of the present Vehicles

Among the present vehicles, 6m3 vehicle may be possible used for further two years after 23 years utilization since manufactured in 1976 and 12m3 Compactor cars is prospected to be used in a few years. The following calculation is based on those life for use.

c. Purchase Program of Second-Hand Collection Vehicles in Puno City

Puno City plans to purchase of second-hand Collection Vehicles of 4m3 capacity, one in every year from 1999 for 4 years.

Actually, 2 units of second-hand compactor were procured by the City in july,1999.

2) Necessary numbers of Collection Vehicles

After obtained transport capacity in the period of this Feasibility Study by consideration into the aforementioned conditions, the necessary number of Collection Vehicles is clarified in the *Table X.2.3*.

Table X.2.3 Necessary Number of Collection Vehicle And Transport Capacity in 2002 to 2008

			2002	2003	2004	2005	2006	2007	2008
2025-100%	Vehicle	12m3 Compactor	1	1	1	1	1	1	1
		Ditto(Existing)	1	1	1	1	-	-	-
		4m3 Compactor	1	2	2	2	4	4	5
		Ditto(Existing)	2	2	2	2	2	2	2
		6.8m^{3}Dump Truck	1	1	1	1	1	1	1
		5 t Dump Truck	2	2	2	2	1	1	1
	Total (unit)		8	9	9	9	9	9	10
	Supplement Capacity(t/d)		22.6	28.0	28.0	33.4	38.8	38.8	44.2
	Existing Capacity(t/d)		34.4	34.4	34.4	17.2	17.2	17.2	17.2
	Total Capacity(t/d)		57.0	62.4	62.4	50.6	56.0	56.0	61.4
	Collection Quantity(t/d)		42.51	44.84	47.24	49.88	52.61	55.41	58.33
	Direct carried waste(t/d)		1.59	1.62	1.64	1.67	1.69	1.72	1.74

Source: JST

For targeting 100% collection in 2025, 7 vehicles should be supplied from 2002 to 2008..

(4) Plan for Waste Collection

Collection routes by vehicles shall be fixed in the same for wastes of road sweeping and market in the morning as those for household and commercial wastes in the afternoon. (Refer to *Figure X.2.1* and *Figure X.2.2*)

Collection routes for C Zone by north and south areas shall be newly established separately, due to the typical increase Zone of population. (Refer to *Figure X.2.3 and Figure X.2.4*)

Frequency of Waste Collection shall be as the same as the present, three times per week for A and B Zones and shall be additional to the present, twice for C Zone.

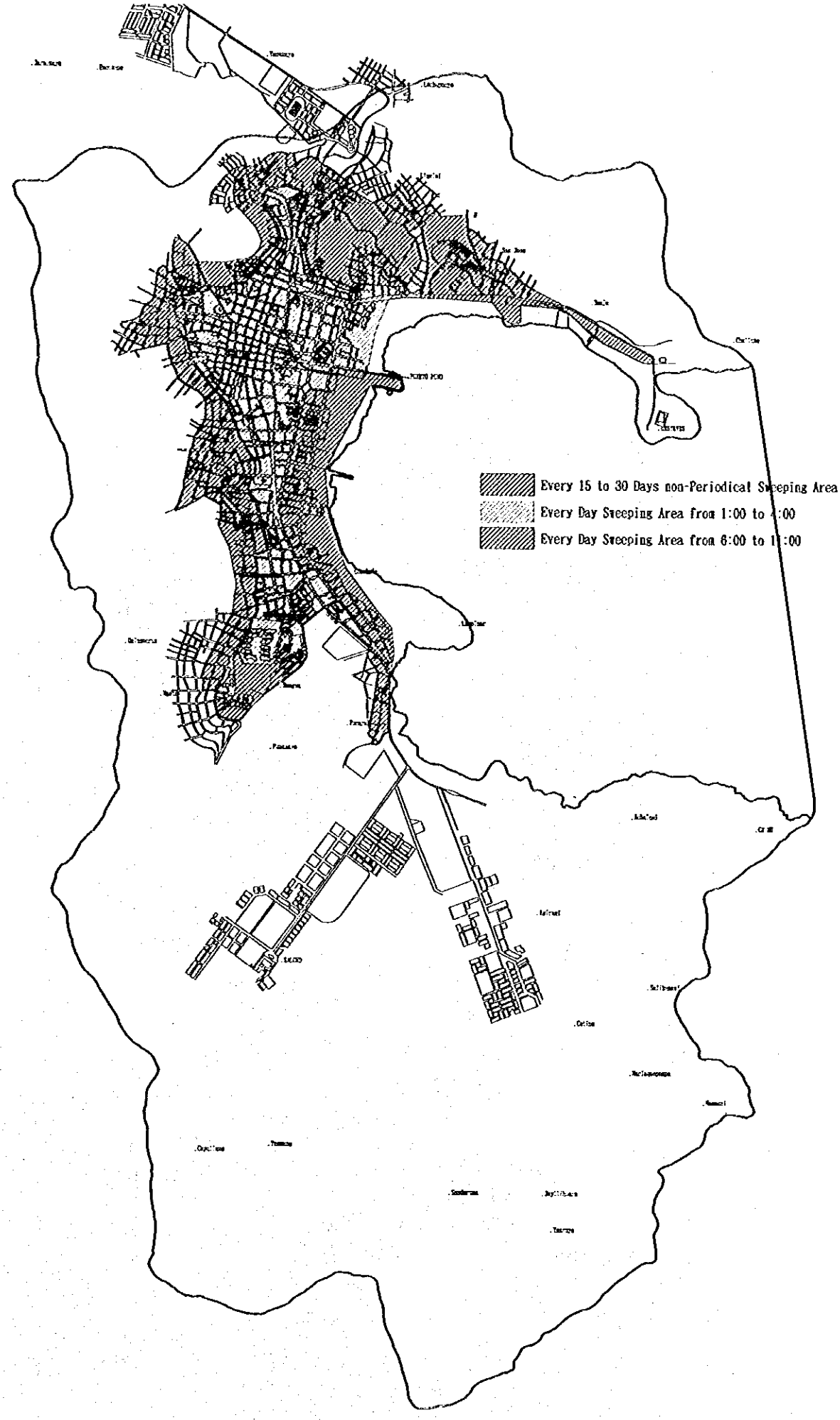

Figure X.2.1 Area and Frequencies of Road Sweeping

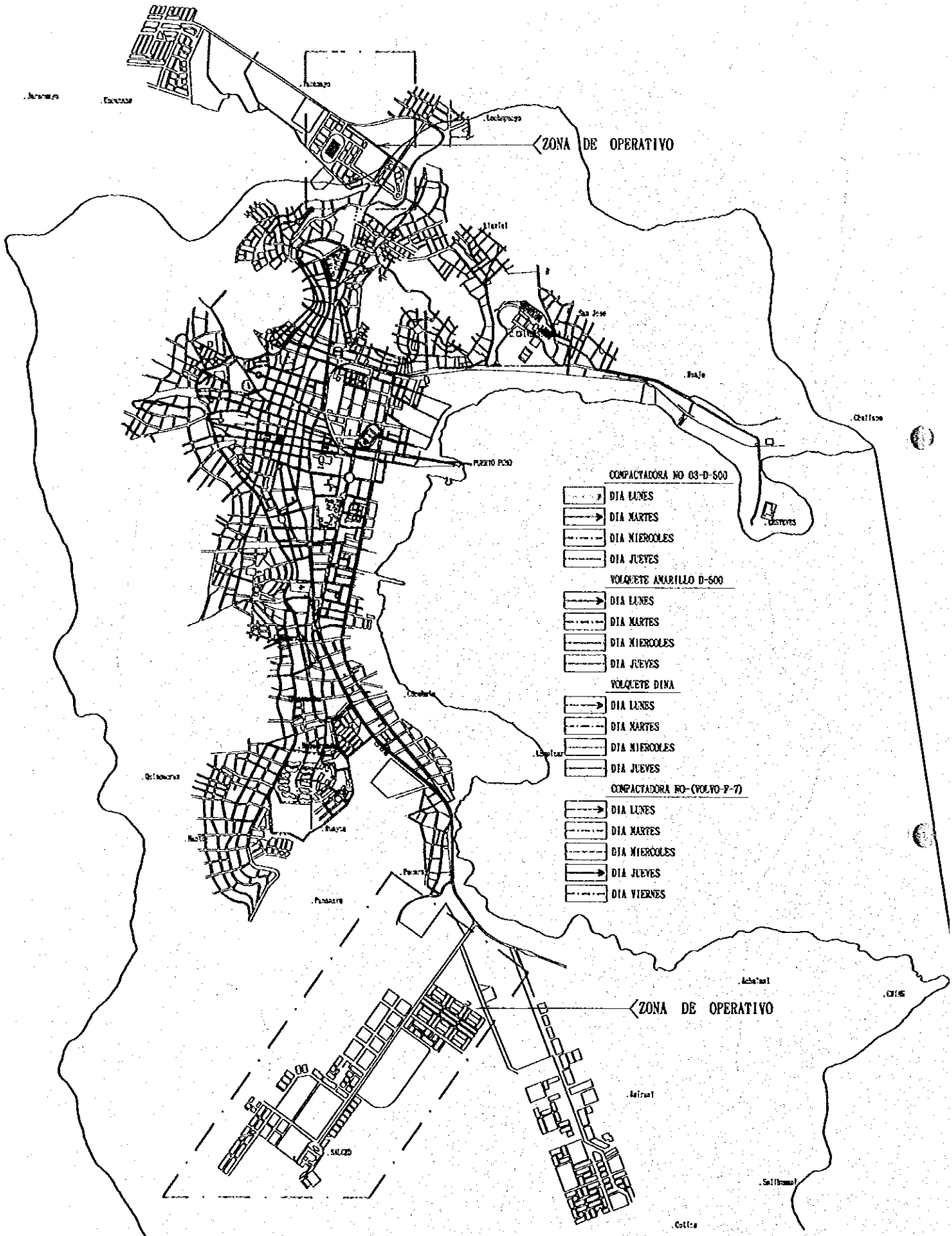

Figure X2.2 Routes under Bell Collection (A & B zone)

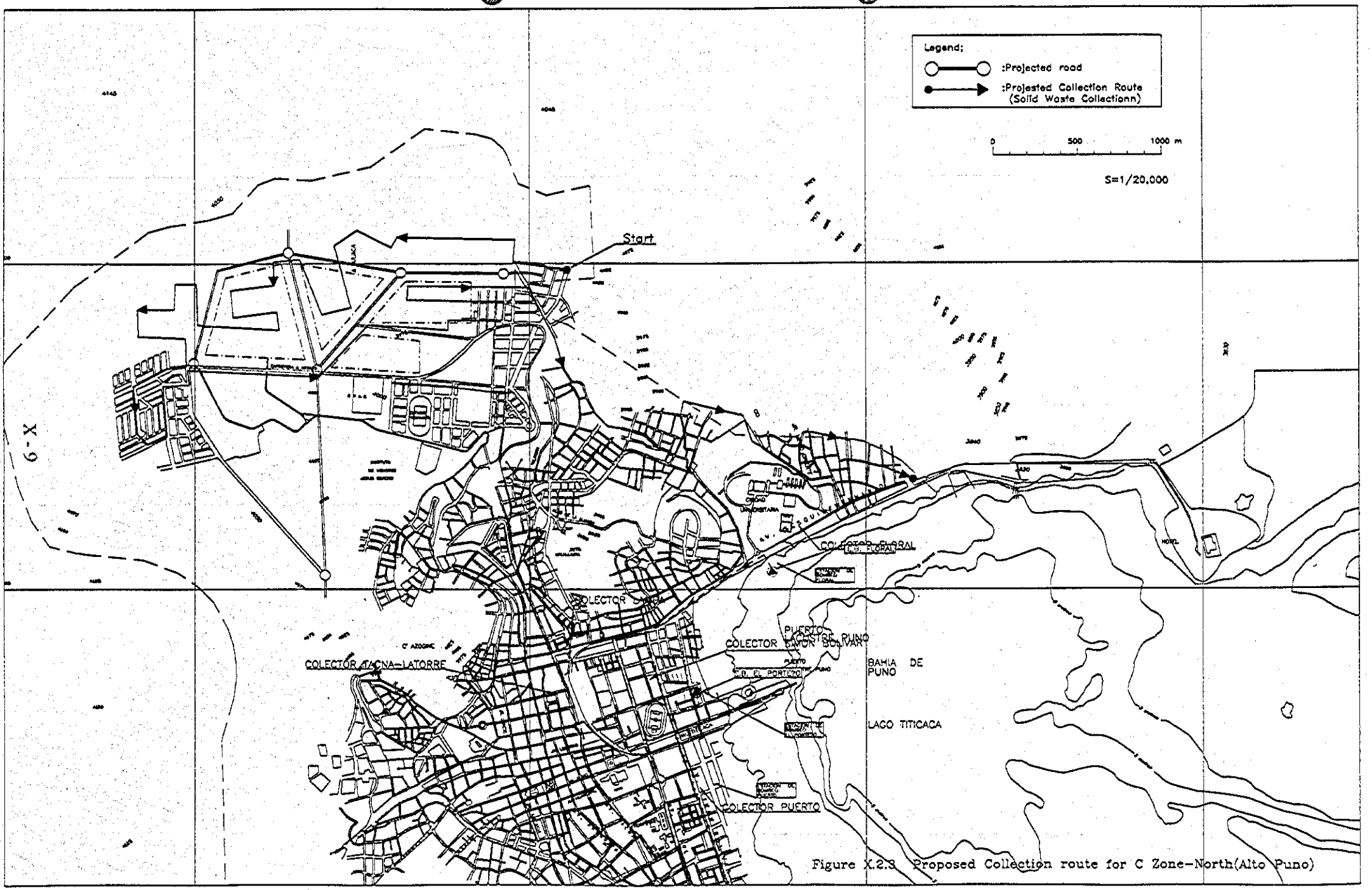

Figure X.2.3 Proposed Collection route for C Zone-North(Alto Puno)

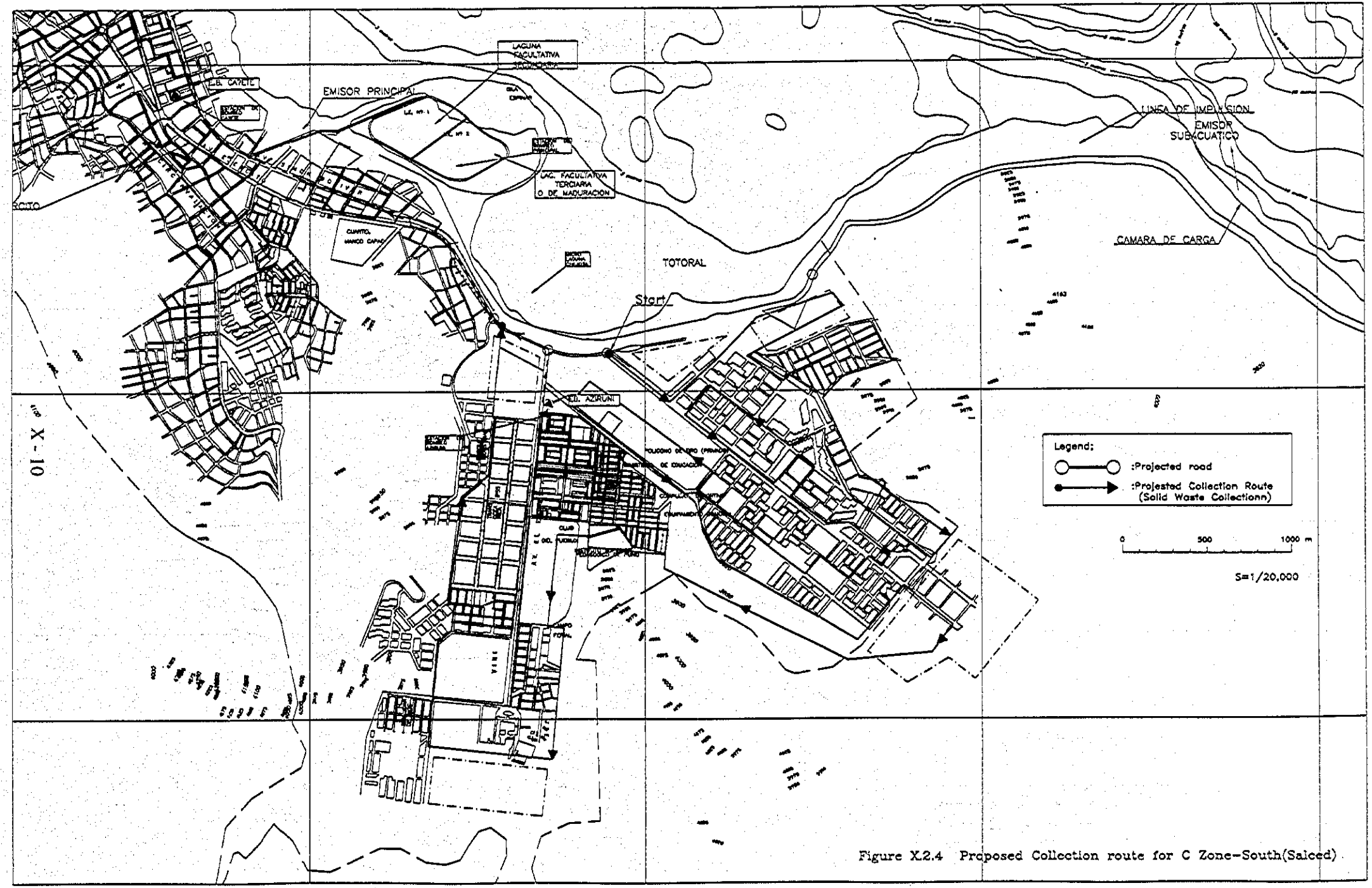

Figure X.2.4 Proposed Collection route for C Zone-South(Salced)

(5) Plan for staff

Based on the present number of staff in the Cleansing Dept. of Puno City for 108, the necessary staff number for this section projected by 2008 is clarified as in the *Table X.2.4.*

Table X.2.4 Staff Plan

	1999 Now	2002	2003	2004	2005	2006	2004	2008
Chief	1	1	1	1	1	1	1	1
Supervisor	4	4	4	4	4	4	4	4
Secretary	2	2	2	2	2	2	2	2
Foreman	3	4	4	4	4	4	4	4
Driver	5	8	9	9	9	9	9	10
Assistant	20	29	30	30	27	20	20	21
Sweeper	60	84	84	84	92	106	106	106
Tricycle	6	5	5	5	5	5	5	5
Paper Collection	6	0	0	0	0	0	0	0
Sanitary Landfill Site	1	6	6	6	6	6	6	6
Total	108	143	145	145	150	157	157	159

100% Collection achieves in 2025

Detailed cost calculation of manpower concerned with the collection and transportation by the year 2008 is shown in Table X.2.5-1.

Table X.2.5-1 Manpower Cost for Collection and Transportation by 2008.

Collection & transportation		Yearly	Monthly	1999	2002	2003	2004	2005	2006	2007	2008
		Soles	Soles	Present							
1	Chief	13,764	1,147	1	1	1	1	1	1	1	1
	Cost			13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764
2	Supervisor	8,760	730	4	4	4	4	4	4	4	4
	Cost			35,040	35,040	35,040	35,040	35,040	35,040	35,040	35,040
3	Secretary	4,800	400	2	2	2	2	2	2	2	2
	Cost			9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
4	Foreman	5,400	450	3	4	4	4	4	4	4	4
	Cost			16,200	21,600	21,600	21,600	21,600	21,600	21,600	21,600
5	Driver	7,668	639	5	8	9	9	9	9	9	10
	Cost			38,340	61,344	69,012	69,012	69,012	69,012	69,012	76,680
6	Assistant driver	7,644	637	20	29	30	30	27	20	20	21
	Cost			152,880	221,676	229,320	229,320	206,388	152,880	152,880	160,524
7	Road Sweeper	4,800	400	60	84	84	84	92	106	106	106
	Cost			288,000	400,800	401,280	401,280	439,680	507,840	508,800	508,800
8	Tricycle	4,800	400	6	5	5	5	5	5	5	5
	Cost			28,800	24,000	24,000	24,000	24,000	24,000	24,000	24,000
9	Paper Collection	4,800	400	6	0	0	0	0	0	0	0
	Cost			28,800	0	0	0	0	0	0	0
10	Total		Persons	107	137	139	139	144	151	151	153
12	Total Wages in 1000 soles				788	804	804	819	834	835	850

Table X.2.5 Prospected Working Vehicles from 2002 to 2008

: In Operation

Vehicle	Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Existing	12m³Compactor											
	6m³ Compactor											
	5 t Open Dump-88											
	5t Open Dump-81											
	4m³Compactor(1)											
	4m³Compactor(2)											
Brand new	12m³ Compactor											
	4m³Compactor											
	6.8m³Garbage dump											

Table X.2.6 Proposed Work Allocation for Collection Vehicle

: For bell collection : For road sweeping waste

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	12m³ Compactor	1	1	1	1	1	1	1	1	0	0	0
	A zone											
	B zone											
	6 m³ Compactor	1	1	1	1	0	0	0	0	0	0	0
	A zone											
	B zone											
	5t Open Dump-81	1	1	1	1	1	1	1	1	0	0	0
	A zone											
	B zone											
	5 t Open Dump-88	1	1	1	1	1	1	1	1	1	1	1
	A zone											
	B zone											
	4m³Compactor(1)	0	1	1	1	1	1	1	1	1	1	1
	A zone											
	B zone											
	Czone(North)											
	4m³Compactor(2)	0	1	1	1	1	1	1	1	1	1	1
	A zone											
	B zone											
	Czone(North)											
Brand new	12m³ Compactor					1	1	1	1	1	1	1
	A zone											
	C zone(North)											
	4m³Compactor					1	2	2	2	4	4	5
	A zone											
	A zone											
	B zone											
	Czone(North)											
	6.8m³Garbage dump					1	1	1	1	1	1	1
	Czone(North)											
	Czone(South)											
Number of Working Unit		4	6	6	6	8	9	9	9	9	9	10