4 STUDY FOR DETERMINING THE VEHICLE FLOW THAT ENTERS CANCHARANI'S SANITARY LANDFILL

In order to determine the vehicle flow that enters the sanitary landfill, Puno's Municipal Government's collecting trucks were not considered.

Objective

To determine the amount of non municipal vehicles that enter Cancharani's sanitary landfill to place their solid residuals.

Materials and Methods

Materials

- A survey format, a scale map 1: 50,000.
- Stationery, an antiseptic mask.
- A double cabin station wagon.

Procedure

On November 30th. and on December 2nd. and 4th. 2 students who were previously trained in the usage of surveys recorded the entrance of vehicles to Cancharani's sanitary landfill among 8:00 a.m. and 6:00 p.m.

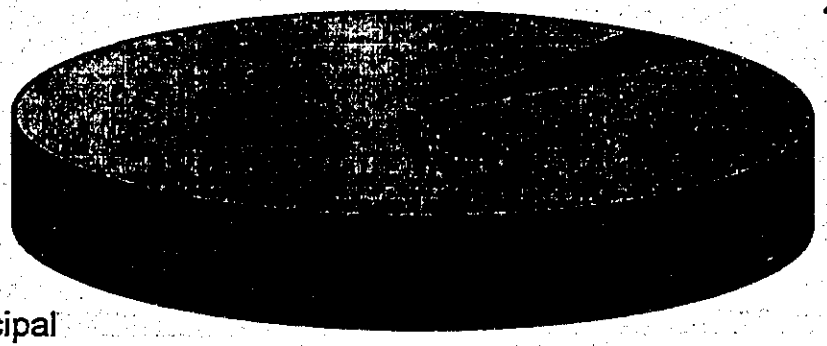
Results appeared in the respective survey. During November 29th. and 30th., and December 1st., 2nd and 3rd. students counted on the Study Manager's guidance and supervision.

FLOW OF NON MUNICIPAL VEHICLES TO THE SANITARY FILLER OF CANCHARANI

DATES	CLIMATIC CONDITION	HOUR OF BEGINNING	HOUR OF END	TYPE OF RESIDUE	SOURCE PLACE	VOLUME	WEIGH DEAR	OBSERVATION
30/11/98	CLOUDY	8:00am	6:00 pm	OFFICE PAPERS, PLASTIC, CARDBOARDS	MINISTERIO DE AGRICULTURA	3 CYLINDER	240 kgr	
30/11/98	CLOUDY	8:00am	6:00 pm	VEGETABLE WASTE, CANS, CARDBOARD, PLASTICS	CUARTEL DEL EJERCITO	2M3	200 kgr	
30/11/98	CLOUDY	8:00am	6:00 pm	REMAINS OF FOODS, GAUZES, PLASTICS	HOSPITAL REGIONAL	4 CYLINDERS	320 kgr	
02/12/98	CLOUDY	8:00am	6:00 pm	DEBRIS	NUEVA ESPERANZA ZONA MANTO (PARTICULAR)	21/2M^3	1,200 kgr	
02/12/98	CLOUDY	8:00am	6:00 pm	PACKING OF MEDICATIONS, DEXTROSA, GAUZE,	HOSPITAL REGIONAL	21/2M^3	250 kgr	
02/12/98	CLOUDY	8:00am	6:00 pm	PAPER, PLASTIC, WASTE OF GREENNESS	IPSS	4 CYLINDERS	320 kgr	
04/12/98	CLOUDY	8:00am	6:00 pm	OFFICE PAPERS, BOTTLES OF GLASS	PALACIO MUNICIPAL	2 CYLINDERS	160 kgr	
04/12/98	CLOUDY	8:00am	6:00 pm	PAPER, REMAINS OF FOODS AND GARDENING	UNIVERSIDAD DEL ANTIPLANO	3M^3	300 kgr	

1 cylinder of the solid residues has been estimate in 80 Kg. based on the visits to the diverse institutions
1m^3 of the solid residues has been estimate in 100 Kg.
1m^3 of the debris se has been estimate in 12 bags of 40 Kg.

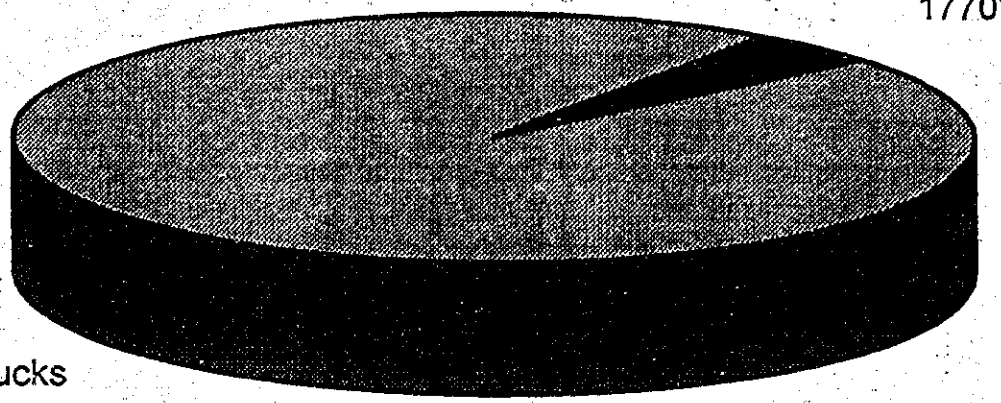
GRAPHIC DIARY PERCENT DISTRIBUTION OF THE GARBAGE THROW UP TO CANCHARANI GARBAGE DUMP



Reference Day: Wednesday 25/11/98
Reference Day: Wednesday 02/12/98 Non Municipal vehicles

GRAPHIC DIARY GARBAGE AMOUNT THROW AWAY TO CANCHARANI GARBAGE DUMP

Total 35,570



Reference Day: Wednesday 25/11/98
Reference Day: Wednesday 02/12/98 Non Municipal vehicles

5 DESCRIPTION OF THE STUDY OF THE LOCATION DE CLANDESTINE DUMPS OF THE MICROCUENCA OF THE PUNO'S CITY (INSIDE BAY); INVENTORY AND EVALUATION

The study of the location of clandestine dumps which include the localization and determination of the main characteristics of the existent dumps in the microcuenca of the Puno's city.

The clandestine dumps is presented in 2 forms:

In punctual accumulations and along of the irrigation channels.

Dumps in punctual accumulations: Its are presented forming heaps of diverse material sometimes associated to it debris. Due to the rains, other water courses and to the wind, its suffer dispersion processes.

Dumps along irrigation channels: These are garbage heaps located inside the channels or in their riverside, associated with debris and sometimes also with drainage collectors. Most of those channels arrive to the lake and when their discharge this waters originate a strong eutrofication of the lake waters.

Objectives

1. To establish the number of clandestine dumps located in the microcuenca of the Puno's city.
2. To determine the characteristics of the localization of the clandestine dumps.
3. To calculate the volume of the solid residuals and to establish the possible causes of their origin.

Participant personnel

- Director of the Study; performer of the work.
- Auxiliary: vehicle Chauffeur

Materials and Methods

- Plane to scale 1:10,000 of the microcuenca
- Plane provided by the Municipality of Dumps and Gather Points
- Plane provided by the Project Special Lake Titicaca 1:20,000

Vehicles

- Pick-up double booth

Procedure

Of the 20 at November 30 was carried out field exits to diverse places of the microcuenca. Among the days 1, 2 and 3 of December with the use of a vehicle the verification of the gather points was made.

The results are shown in the Tables and maps that are attached to the present report.

6 DATA OF EACH EXPERIMENT

a . TIME AND MOTION STUDIES

The time and movement sudies involves the time expended in the first and second traveled periods, that give us the total duration time.

The time traveled in each period is the result of the sum of the whole activities carried out, as follow:

$$TR = Tre + Tmov + Trsc + TrC + Te$$

where:

TR	=	traveled time
Tre	=	time to make the garbage collection
Tmov	=	movement time
Trsc=		Time requiered to go from the final gather point to the Cancharani´s sanitary filler, and go back to the inicial point (first period to the mechanical workshope, and second period to the Municipal work shope).

The mechanical workshope are the common sites where the drives eat breakfast, they call it like that because in this places have richness of these self-driven establishments.

Note: This is the ecuation that is used in the present report, to make the travel analysis.

DETAIL OF THE COMPONENT VALUES OF THE TRAVELED TIME

ROUTE Nº	Tre	Tmov	Tsci	TrC	Te	Time traveled first period	Tre	Tmov	Tsci	TrC	Te	Time traveled second period
1	1h 45'	26' 30"	49' 31"	4' 35"	1h 23' 35"	4h 29' 11"	1h 49' 26"	29' 14"	49' 53"	06' 49"	12' 51"	3h 31' 55"
2	1h 36' 24"	40' 16"	55' 21"	8' 50"	12' 21"	3h 33' 12"	2h 07' 46"	1h 22' 29"	36' 04"	17' 05"	3' 29"	4h 26' 48"
3	2h 13' 11"	29' 53"	40' 00"	15' 10"	23' 45"	4h 03' 43"	1h 59' 09"	47' 34"	49' 33"	14' 10"	2' 24"	3h 36' 16"
4	2h 04' 21"	23' 30"	52' 37"	4' 55"	32' 32"	3h 59' 55"	3h 20' 50"	1h 02' 11"	57' 30"	5' 45"	23' 43"	5h 49' 59"
1	2h 23' 35"	7' 56"	26' 32"	18' 40"	51' 46"	4h 07' 29"	2h 04' 51"	47' 34"	51' 15"	5' 10"	6' 38"	3h 43' 40"
2	2h 29' 3"	50' 48"	57' 46"	9' 15"	6' 28"	4h 29' 27"	1h 58' 35"	1h 04'	42' 32"	6' 12"	3' 01"	3h 56' 30"
3	1h 49' 04"	36' 51"	40' 43"	10' 32"	-	3h 17' 10"	2h 04' 19"	59' 50"	1h 01' 20"	11' 05"		4h 14' 34"
4	1h 53' 27"	20' 53"	1h 04' 20"	8' 20"	-	3h 27'	3h 21' 17"	2h 28' 01"	48' 55"	6' 26"	-	5h 44' 59"
2	3h 14' 32"	40' 55"	47' 20"	15' 18"	17' 49"	5h 15' 54"	-	-	-	-	-	-
3	1h 32' 1"	38' 44"	44' 30"	10' 21"	23' 31"	3h 35' 20"	2h 22' 39"	58' 58"	56' 06"	11' 56"		4h 28' 39"

b.STUDY OF THE FLOW OF NON MUNICIPAL VEHICLES TO CANCHARANI'SSNITARY LANDFILL

Date of the study	04/12/98
Climate	Clear up
Hour of beginning of the study	8:00 AM
Hour of finish of the study	6:00 PM
Name of the inquets man	Rene Velasco Vega Rene Flores Flores

	TRUCK	TRANSPORT	PICK UP	VEHICLE	RESIDUE
	Number Type	Residue type	Place name	Badge	Volume
1	Pick-Up	Office papers, bottles	Municipal Palace	PU-2160 Red color	2 cylinders
	Toyota 2000	Cardboards, reject pack, broken glasses			
2	Mercedes Benz	Cardboards, residues of the food, plastic, office papers, gardening waste	Altiplano National University	WU-2168 Red color	3m3

Date of the study	02/12/98
Climate	Clear up
Hour of beginning of the study	8:00 AM
Hour of finish of the study	6:00 PM
Name of the inquets man	Rene Velasco Vega Rene Flores Flores

	TRUCK	TRANSPORT	I PICK UP	VEHICLE	RESIDUE
	Number Type	Residue type	Place name	Badge	Volume
1	Truck Ford 600	Dismount	Nueva Esperanza Mount	XU-1314 Blue color	2 1/2M3
2	Pick-Up Dodge 100	Containers of medications dextrosa, gauzes, cardboards.	Ministry of Health. Regional Hospital	PEQG-2513 White color	2 1/2M3
3	Pick-Up Dodge 200	Plastic papers, gardening waste, vegetables and fruits waste	Social Security Peruvian Institute	PH 449A Cream color	4 cylinders

Date of the study	30/11/98
Climate	Cloudy
Hour of beginning of the study	8:00 AM
Hour of finish of the study	6:00 PM
Name of the inquets man	Rene Velasco Vega Rene Flores Flores

	TRUCK	TRANSPORT	I PICK UP	VEHICLE	WASTE
	Number Type	Residue type	Place name	Badge	Volume
1	Pick-Up Toyota 2,200	Office papers	Ministry of Agriculture	PCOQ-5434 Blue color	3 cylinders
2	Mercedes Benz truck	Waste, cardboards, tins, plastics	Barracks of the Army	EP-7243 Green color	2 M3
3	Pick-Up Dodge	Remains of foods, gauzes, cardboards, plastics	Ministry of Health Regional Hospital	PEQG 2513	4 cylinders

C.LOCATION OF SECRET DUMP IN THE PUNO'S CITY MICROBASIN

INVENTORY AND ASESSMENT OF THE LOCATION OF THE DUMPS INSIDE PUNO'S BAY

N° BOT	ADDRESS	MUNICIPAL NUMBER	SECTOR OR URBANIZATION	CHARACTERISTIC OF THE PLACE	POSSIBLE CAUSE OF THEIR ORIGIN	SURFACE	VOLUME	TYPE OF MATERIAL OBSERVED
1	San Lazaro / Samaritano Streets	Cemetery	Los Angeles Urbanization	Area in qualification process with lands in construction	Low frequency of the cleaning service	180 m2	3m3	Varied excused materials, and paper.
2	Without denomination. To the west of El Mirador Urbanization	S/N	El Mirador Urbanization	Plane land without building boundary wall	Low frequency of the cleaning service	70 m2	3m3	Plastics and excused papers, cans, cardboard
3	Without denomination. To the west of El Mirador Urbanization	S/N	El Mirador Urbanization	Cliff	Lacks on the frequency of the cleaning service. Garbage dispersion of the by the rain and the wind.	170 m2	6m3	Glass and plastic bottles, tin cans containers, paper and cardboard
4	Forest of the U.N.A.* University City	S/N	Side of the infirmary ability	Forested area with eucalyptus and with half slope to high	People that traffic in those places, like the personal of the University. Garbage dispersed.	20 m2	2m3	Tin cans, papers, plastic bottles and dead animals
5	Enter to Villa Alto Copacabana with Sesquicentenario Street	S/N	Villa Copacabana	To the side of the affirmed road that enters to Copacabana village neighborhood	The gathering service is not very frequent	12 m2	4m3	Paper, cardboard, plastic and glass bottles, tin cans, and organic wastes.
6	Side of the Pumping plant	S/N	Aguaje Neighborhood	Inundated plane area, near a tank of water. Dispersed garbage	People of another place or of the high zones	120 m2	3m3	Burnt garbage, beat, papers, plastic bottles
7	Near Miramar and Sesquicentenario Streets	S/N	Villa Copacabana	Adjacent plane area to the Sesquicentenario Avenue	People that don't receive the public cleaning service. Dispersed garbage	140 m2	4m3	Papers, cardboard, plastic bags, plastic bottles
8	Amancaes with Alto Puno Avenues	S/N	Yanamayo Urbanization	Wavy land with gravel and gelifraction	Accumulation in mounds by lack of frequency on the service	10 m2	2m3	Tin cans, plastic bags, cardboard, paper and bottles
9	Alto Puno Avenue	S/N In front of the stadium	Yanamayo	Plane land with brown and Gelifraction material.	Lack of frequency of the cleaning service. Area only assisted by manual operatives	30 m2	1m3	Tin cans, plastic bottles, papers and plastic bags
10	José Balta Street	S/N	Exit of the El Mirador Urbanization	Hillside of the Hill and Cliff	Dispersed by the rain and wind. The cleaning services is only carried out by manual operatives.	140 m2	4m3	Excused bottles, excretions, vegetable residuals
11	Confraternidad Street	S/N	4 de Noviembre neighborhood	Near hillside to the highway of strong pending spread garbage	There is not a regular gathering service in the area	270 m2	9m3	Organic wastes, plastic and glass bottles and paper.
12	Alto de la Alianza corner with 9 de Octubre Avenues	S/N	4 de Noviembre neighborhood	Near the hillside of the hill with moderate hillside	Low frequency of the collecting truck	4 m2	2m3	Diverse garbage, plastic, glass, also on decomposition organic matter.
13	9 de Diciembre with Las Torres Avenues	S/N	4 de Noviembre neighborhood	Without qualification works with half slope	Their I pick up it is partially, considered by the workers as it dismounts and they don't pick up it	2 m2	1m3	Construction materials with papers, tin cans, plastic bottles
14	Alto de la Alianza Avenue at the base of White Christ's	S/N	Alto Huáscar neighborhood	To the foot of the highway and on the edge of the cliff	People that traffic for the place dispersed the garbage	14 m2	2m3	Waste vegetables, bottles and plastic bags
15	Romulo Dianderas Avenue and López Albújar Street	S/N	Huáscar Urbanization	Unoccupied land, in slope beside the highway.	People of the part high lack of the population's education	120 m2	4m3	Dismount with diverse garbage, vegetable, burnt remains
16	Corner of Alto de la Alianza with 6 de Diciembre Avenues	S/N	Machallato and Alto de la Alianza Neighborhood	Area with medium slope to bowed land.	Low frequency of the collector truck. People of the high zone throw their garbage	18 m2	2m3	Organic debris and different kind garbage
17	Alto Tribunal Street	S/N	Bellavista Neighborhood	Place of pending hillside, adjacent to the road.	There is not cleaning service. People that traffic, they throw the garbage	3 m2	1m3	Papers, plastic bags, tin cans, and excused bottles
18	Alto Tribunal Street with Alto de la Alianza Avenue	S/N	Bellavista Neighborhood	Street with Slope.	Low frequency of the gathering service. Lack of people's education that lives in the high zone	25 m2	6m3	Dispersed garbage, varied composition, plastic bottles, bags, paper, cardboard
19	San Miguel Street	C.1	Valley Neighborhood	Slope area, dispersion of garbage and it's bum.	Lack of service, the Truck doesn't arrive to this area for the slope	1000m2	7m3	Varied composition, organic and inorganic garbage
20	Back of the National Police Sanity Hospital (José Balta Street)	S/N	Alto Huáscar neighborhood	Hillside of the hill with high to medium slope.	Service people's of the parts high dispersed garbage little frequency	200 m2	21/2m3	Glass bottles and plastic, papers and bags, excretions
21	José Balta Street	It curves S/N	Alto Huáscar neighborhood	Border of the highway, stony sewer system with qualification.	Originated by people of the high zone.	160 m2	8m3	Beat of diverse type, diverse excused materials, also organic waste.

* National University of the Highlands.

INVENTORY AND ASESSMENT OF THE LOCATION OF THE DUMPS INSIDE PUNO'S BAY

N° BOT	ADDRESS	MUNICIPAL NUMBER	SECTOR OR URBANIZATION	CHARACTERISTIC OF THE PLACE	POSSIBLE CAUSE OF THEIR ORIGIN	SURFACE	VOLUME	TYPE OF MATERIAL OBSERVED
22	Bnsas del Lago Street intersection with San Marcos Street	S/N	Alto Huascar Neighborhood	Urban area not consolidated, affirmed roads but not very accessible	Little frequency of the collecting truck. Lack of a good education	12 m2	3m3	Different kind of materials, excused plastics and organic matter.
23	Circunvalación Avenue	C.10	Andrés Avelino Cáceres Neighborhood	Side of the Road	Lack of Control and Regularity in the service	40 m2	4m3	Diverse tin cans, plastic and glass bottles, also paper.
24	Corner Av. Las Torres and Av. Huaraz	S/N	Las Torres Neighborhood	Area in urban process, near to a drainage channel	People that traffic people of the high part	8 m2	3m3	Plastics, papers, burned materials and tin cans
25	Av. San Francisco height of the block eleven of Circunvalación	S/N	Andrés Avelino Cáceres Neighborhood	Strong slope area. Dispersed garbage	There is not a garbage gathering service	70 m2	4m3	Plastic and glass bottles, cans and paper
26	Alto de la Alianza Avenue	C.4	Vista Alegre Neighborhood, In front Amazonas street	Hill hillside, cliff	People of the high zone, by the lack of the gather service or by the difficulty to arrive to the gathering trucks.	12 m2	2m3	Burnt material, diverse plastics, papers and cans
27	Alto de la Alianza Avenue with Chiclayo	C.5	Alto Bellavista neighborhood	Plane Area, side of the football court	The gathering garbage service is irregular	60 m2	7m3	Dismount, plastic bags, bottles, papers, cardboard
28	Circunvalación Norte	C.9	Las Cruces Neighborhood	Area near to the hint	People that are not able to throw away their garbage	7 m2	1m3	Varied garbage, cardboard, plastic bottles, organic waste
29	Iquitos Passage	C.2	Miraflores Neighborhood	Slope, hillside of hill park dedicated to the enclosed balcony	To be open area	6 m2	1m3	Papers, cardboard, cans, organic matter, plastic bags
30	Circunvalación Avenue	C.12	Azoguine Neighborhood	Dispersed garbage in the cliff	The service is not very frequent	21 m2	2m3	Glass and excused bottles, also organic residuals
31	Circunvalación Avenue near Las Carmelitas Street	C.15	28 de Julio precarious Human Establishment	Dispersed garbage to the side of the hint	People of the high part that doesn't reach to the collector truck	14 m2	2m3	Diverse paper, cardboard, excused articles
32	Tiahuanaco Street with Libertad Street		Azoguine Neighborhood	Area of soft slope	Lack of frequency of the collector truck	27 m2	4m3	Waste variable cardboard, paper bag of plastic
33	Titicaca Avenue	S/N	Jetty	Inundated area, near to the shore	Garbage accumulation, that is the result of the water flow and of the direct dumped.	12 m2	2m3	Different kind of materials. These are dispersed in small accumulations.
34	Tiahuanaco and Libertad Streets	Height of the circumvallation	Purhua Pirhuani Neighborhood	Garbage accumulation along the channel and adjacent streets, high slope.	The trucks don't arrive to the high part due to the slope			Dismount, organic and inorganic very varied garbage
35	Circunvalación Avenue near Sayhuani Street	S/N	Mañazo Neighborhood	Location in full Circunvalación Avenue, near the intersection with Sayhuani Street	People that are not able to throw away their garbage	5 m2	1m3	Papers, excused bottles in general, cans
36	Drainage channel in Ricardo Palma Street	S/N	Simón Bolivar Neighborhood	Channel ends to the Lake surrounded by garbage accumulations	Lack of the population's education, is not a good service	200 m2	7m3	Plastic bags, paper, excused organic matter
37	Antonio Encinas with Juli Streets	S/N	César Vallejo Neighborhood	Inundated area near to the shore	Accumulation of dismounts and garbage padded cone	17m2	4m3	Material of disassembles organic waste, plastics and papers
38	Near Choquehuanca between Vigil and Juan Paulo Streets	S/N	Orkapata Neighborhood	Slope area doesn't have rising topographical. Dispersed garbage and dismounts	Doesn't exists regular attention, there are only single sweepers cleaning operatives	70 m2	2m3	Excused plastic bags
39	Banchero Rossi Intersection 1 de Mayo Streets	Botadero at the end of the channel	Tupac Amaru Neighborhood	Hidromorphic plane area plane, outlet of the channel	Open place without municipal counting habit of throwing the garbage here.	600 m2	4m3	Dismount and very different kind of garbage, also excretions.
40	Luz Victoria Avenues	Channel	Ricardo Palma and S. Miguel Neighborhood	The accumulation is carried out along the whole channel. High slope area.	Due to the topography, the trucks don't goes up, because the roads are not very accessible			Dismount and very variable organic and inorganic waste
41	Corner of Benjamin Pacheco with Viru Streets	S/N	San Miguel Neighborhood	Area of medium slope. Road without a pavement cover.	People that cannot lower until the place of gather	4 m2	1m3	Waste variables, papers, plastic bags, organic and inorganic matter
42	Viru Street	S/N	San Miguel Neighborhood	Street with medium slope. Area in qualification process	People that traffic for the place coming from the high part	3 m2	1m3	Beat, papers, excused bottles

INVENTORY AND ASESSMENT OF THE LOCATION OF THE DUMPS INSIDE PUNO'S BAY

N° BOT	ADDRESS	MUNICIPAL NUMBER	SECTOR OR URBANIZATION	CHARACTERISTIC OF THE PLACE	POSSIBLE CAUSE OF THEIR ORIGIN	SURFACE	VOLUME	TYPE OF MATERIAL OBSERVED
43	5 de Octubre Avenue	S/N	Pro-housing the Sun Association	Inundated area. Dispersed accumulations with human excrements.	Area in qualification process without basic services, little access for the service.	35 m2	2m3	Dismount, human debris, paper and plastics, cans, metal.
44	Walls Suárez Street	Outlet of the channel	Cerro Colorado Neighborhood	Inundated area, hydromorphic lands.	Lack of education Habit of throwing the garbage.	20 m2		Excused material, glass bottles and plastic, paper cardboard
45	Paucarcolla Street	S/N	Cerro Colorado Neighborhood	Inundated area with dismounts accumulations.	Considered by the population like a dump.	27 m2	4m3	Disassemble paper, bags metals, diverse, beat bottles, plastics and of glass
46	Primavera Avenue	S/N	Cerro Colorado Neighborhood	Inundated area with accumulations of diverse material, dismounts.	Qualification process. Intentioned throwing, Inundated area.	300 m2	6m3	Dismount with human debris, plastics and glasses
47	Lacustre passage	S/N	Cerro Colorado Neighborhood	Inundated area, in qualification process, dispersed garbage.	Fallow land conditioned with garbage and dismount.	60 m2	2m3	Excused Materials with organic waste. Dismount
48	Revolución Avenue in route to the Cancharani's Santuary	S/N	Santa Rosa high zone Neighborhood	Rural area, highways in hillside of the hill or hillside.	There is not service to this area.	10 m2	2m3	Plastic bottles, broken glasses, beat, dismount
49	Near Estrella and Pichacani Streets (Revolución Avenue). High zone.	S/N	Santa Rosa Neighborhood	Rural area continuation of the highway to Cancharani	There is not service to this area.	4 m2	1m3	Waste of the construction with excused material, organic material and bottles
50	Leoncio Prado with Gamaniel Streets	S/N	Santa Rosa Neighborhood	Area of medium slope in Qualification process.	They are people that are not able to throw away their garbage to the gathering truck.	5 m2	4m3	Different kind of garbage, organic and inorganic garbage
51	Bartolina Cisa Street side of the I deposit of customses	S/N	San Martin Neighborhood	Fallow land in slope. Dispersed garbage.	The trucks don't arrive to this alone area sweepers they enter.	200 m2	4 m3	Papers, cans, plastic bottles and of glass, plastic bags
52	Ciudad de la Paz Avenue	Channel	San Martin Neighborhood	Slope area.	The cleaning service is carried out only by operatives.			Disassemble diverse garbage, human debris, animal excretions and papers.
53	Tupac Yupanqui Avenue with Manto gab.	Channel	Barrio Alto Manto Neighborhood	Area with strong slope. Garbage Accumulation along and adjacent to the channel.	Lack of service. There is not service in the high part that have houses construction process			Different kind of garbage, plastics, glasses, human debris, animal excretions
54	Bartolina Cisa and Tupac Yupanqui Streets	S/N	San Martin Neighborhood	Adjacent area to the channel. In qualification process. Not consolidated.	Little frequency of the service is not access of the trucks	40 m2	3m3	Excused containers, cans, excretions, human debris, papers.
55	Urubamba Street	Channel	Alto Manto Neighborhood	Channel of where the dismounts are accumulated, Different kind of garbage. Area with slope.	The trucks don't ascend to the high part			Very varied garbage dismounts, human debris
56	Side of the Senate	S/N	Salcedo Industrial Area	Fallow land in front of one manufacture. Area in qualification process	There is not regularity in the service	30 m2	2m3	Papers and plastic bags
57	Las Casuarinas Boulevard		Agriculture Urbanization	Plane area in qualification process. Dispersed garbage.	It lacks the regular gathering garbage service.	400 m2	3m3	Papers, plastic bags, bottles cans, organic residuals
58	Los Estudiantes Avenue. Channel of watering of INIA and Technological Institute	S/N Channel	Salcedo Provincial Association	Agriculture experimental area.	People that traffic for the place irregular service			Dismount, overgrowth, paper, cardboard, bottles of diverse type, bags.
59	Los Estudiante Avenue. Salcedo Channel	Channel	Salcedo Provincial Association 1st. Stage	Plane area in qualification process, friable land. Furrow evolution.	It lacks of the service regular schedule of the service he/she should settle down			Beat, glass bottles and plastic, papers, bags, dismount.
60	Salcedo, Hillside of the hill		San Juan de Dios Urbanization.	Inferior hillside. Skirt of the hill without enabling.	There is not a regular garbage collecting service	8 m2	3m3	Beat, papers cardboard, burnt organic, inorganic garbage dismounts
61	In front of the Salcedo Health Post	Quarries	Rinconada Salcedo	Abandoned quarry, adjacent land to the gap.	There is not regular service, lack of the population's education.	6 m2	2m3	Papers, cans, excused bottles, dismount.
62	Salcedo gap that it crosses the quarries			The gap crosses areas in qualification process and a quarry of clay extraction.	There is not service of cleaning in this area			Plastic bottles and of glass, papers, cans.
63	Principal Avenue	Watering channel	Rinconada Salcedo	Agricultural area in qualification process without slope	Lack of attention of the service the trucks only make operative			Beat, paper, plastic bottles

(2) THE QUESTIONNAIRE SURVEY AND THE WASTE COLLECTION EXPERIMENT

INTRODUCTION

The present document is prepared as part of the Study on the Integrated Water Pollution Control for Puno Interior Bay of Lake Titicaca in Puno City. This study is carried out jointly in between PELT (Special Bi-national Project of Lake Titicaca), The Municipality of the Province of Puno, JICA (Japan International Cooperation Agency) and INADE (National Institute of Development), with the purpose of achieving an integral management for the decontamination of the Interior Bay of Puno.

Three components contribute to the pollution of the Interior Bay of Puno, being one of them the one caused by the garbage received by the lake (See Annex : Photos).

The solid waste problem s is common in most of the cities of Peru, thus Puno City could not be the exception.

To improve the population's quality of life, to avoid the proliferation of illness, and to maintain the ornament and cleaning of the city, conducts us to know all what is related to the generation, and storage of solid waste, its collecting, transporting and specially its final disposal.

The dump areas are found mainly in the ravines of the micro watersheds in the outskirts area, (Alto Puno, Salcedo, Aziruni), the low zone and high zone of Puno City (See Annex : Photos). The dump at this areas are collected only during cleaning campaigns carried out weekly or biweekly by the Municipality with great effort. This indicates us that the current solid waste handling does not satisfy the requirements of the city.

In order to consider that solid waste is the main factor, it is necessary to know approximately the amount of solid wastes generated in Puno City, data which we will obtain by knowing the generation per capita and the population of the city.

A survey questionnaire was carried out to gather information in order to know more about the city, the inhabitants type of housing, if adequate sewerage collection system exists, if inhabitants have knowledge about the handling of solid wastes and the cooperation level they would provide in case of requiring it.

In the same way, the generation per capita and the physical composition of solid waste was obtained through the samples that were taken. All these was made possible with the assistance of a group of students of the Universidad del Altiplano, the Municipality and PELT, whom provided the locations, and some tools for the preparation of the present document.

1. ANTECEDENTS

Puno City is located in the south of Peru, near Lake Titicaca, and at present has a population of 101,400 inhabitants.
Lake Titicaca is in the Altiplano of Peru and Bolivia, at an altitude of 3803 Mts. over sea level and has a total area of 8167 Km2.

The Lake shows tree zones:

- the big lake with 6311 Km2 and a maximum depth of 281 m.
- the small lake with 1292 Km2 and a maximum depth of 45 m
- Puno bay with 564 Km2 and a maximum depth of 30 m.

Within the bay, it can be identified the Interior Bay of Puno with 16 Km2, which is located in front of Puno City.

2. OBJECTIVES

- Determine the generation per capita of solid wastes in Puno City.
- Determine the physical composition of solid wastes generated in Puno City.

2.1. SECONDARY OBJECTIVE

- To know the amount of solid wastes generated in Puno City.

3. DETERMINATION OF THE STUDY ZONES

The sectors and the selected zones for each sector that were determined for the realization of the Pilot Project are the following:

Sector	Characterization	Zone
A	Commercial sector of urban area.	A-1: Jr. Lima A-2: Mercado Central
B	Residential sector of urban area.	B-1: Torres de San Carlos B-2: Urb. Huáscar
C	Residential sector of non urban area.	C-1: Barrio Aziruni C-2: Mirador de Yanamayo
D	Residential sector of zones surrounding the hills.	D-1: Comunidad de Chimu D-2: Cancharani

See Annex 8 : Photos, for each Zone.

3.1 BRIEF DESCRIPTION OF THE ZONES:

Zone A-1 : Jirón Lima
Location : In the center of Puno city, starting at the corner of Pino park up to the corner of the Plaza de Armas. It includes 3 blocks of Jirón Lima, with an approximate extension of 280 m.

This zone is composed mainly by commercial establishments as money exchange houses, bars, restaurants, tourism agencies, banks, public dependencies, in between others. During the last years, the zone has been transformed exclusively as pedestrian corridors.

Zone A-2 : Mercado Central
Limit : By the East with Jr. Tacna
By the West with Jr. Teodoro Valcárcel
By the North with Jr. Oquendo
By the South with Jr. Fermín Arbulú

Sections : **First floor:** Section of vegetables
Section of goods
Section of meat

Second floor: Section of juices
Section of food
Section of clothes

Zone B-1 : Torres de San Carlos
Location : In the South area with an approximate area of 1000 m^2
Distribution : First stage, conformed by 9 towers.
Second stage, conformed by 4 towers.
Third stage conformed by 5 towers.

Zone B-2 : Urbanizacion Huascar.
Location : In the north part of the city, in an approximate area of 15 ha.

Zone C-1 : Aziruni (2^{nd} stage)
Location : 4 Km South of Puno city, its streets are not paved and some houses are not occupied still. It is distributed in 3 stages.

Zone C-2 : Mirador de Yanamayo
Location : In the North part of the city, houses are built in an inclined zone, in an area of about 6 ha.

Zone D-1 : Comunidad Chimu.
Location : It is located in between kilometers 7 and 8 of the highway to Ilave. It can be observed houses constructed at both sides of the highway and at the hillside also.

Zone D-2 : Cancharani
Location : At about 5 Km. of the Puno-Moquegua highway.
Limits : By the North with Barrio Los Andes.
By the South with Rinconada de Salcedo.
By the West with Cancharani hill. The sanitary fill of Puno City is located 1 Km. away.

4. METHODOLOGY

The development of the Pilot Project was carried out following the instructions given by the JICA Study Team.

The Study includes two parts:
- The survey questionnaire
- The solid waste collection survey

4.1 THE SURVEY QUESTIONNAIRE

The survey was carried out in the following way:

After determining the zones to be surveyed, it was established that the students grouped by couples should interview directly the homes and commercial establishments following the questionnaire, (see Annex 1). A specific date was determined at each zone to carry out the interviews. The interviewers handed plastic bags, 4 per interviewed, to be used at the garbage collection survey, informing them also of the date that the collection experiment was going to be carried and requesting their assistance to the Study.

4.2 THE SOLID WASTE COLLECTION SURVEY

The necessary materials for the experiment are the following:

	Materials	Quantity	Dimensions
1	Bucket (big)	2	75 lt.
2	Bucket (small)	2	5 lt.
3	Plastic bags	1,650	100 lt.
4	Plastic canvas	16	25 m2
5	Shovel	8	
6	Machete	4	
7	Scissors	8	
8	Scale	1	200 Kg
9	Gloves	50	
10	Plastic gloves	50	

The empty plastic bags are weighed before their distribution calculating the weight per bag. Once the bag containing the garbage is weighed, the weight of the bag is subtracted.
The collection of domestic waste from homes and commercial establishments is done as follows:

- The bags to deposit all the generated wastes are handed at each home during the interviews. The necessary information is obtained by means of the interview. (The necessary questions for the experiment are included in the questionnaire).

- The bags should be marked, identifying the name of the zone included in one of the 4 sectors. Likewise, the interviews and the delivery of bags should be carried out at least 3 days before the collection experiment.

- **Bags collection**

  The experiments are carried out 4 times for week: as Monday, Wednesday, Friday and a complementary day. The bags with wastes are collected the next days following the experiment, as Tuesday, Thursday, Saturday and a complementary day. The collected bags are taken to a place to be assigned later. The place has to be located within Puno city and should have a roof and a cement floor to avoid the problems caused by rains.

- **Weighing**

  The bags with garbage are weighed jointly according to each zone of the sectors, being the weight registered, without forgetting to subtract the weight of the bag.

- **Breaking the bag.**

  Then, the bags are broken and their content is placed in plastic canvas. The broken bags are separated from the solid wastes collected.

  The sample is deposited in a bucket in order to obtain its weight and volume. The net weight of the sample is obtained after subtracting the weight of the bucket. The volume in litters is obtained from the bucket.

- **Composition Analysis**

  - All the wastes are reduced to the same size and mixed.
  - Wastes are reduced dividing them in quarters as follows
    a) Wastes are extended on the floor
    b) Separate them in quarters of the same size (see figure)
    c) A and A are taken for the next step while B and B are discarded. Do a) until obtaining a sample of about 5 and 10 kg, registering the weight.

A	B
B	A

- Separate the wastes by type.
- Weigh each type of waste in a bag, subtracting the weight of the bag.

- Final disposition of wastes after measurement

After weighing, wastes should be transported to the final disposal place using trucks or any other mean of transportation.

Collection of wastes from Hotels and Schools

- This collection experiment is carried out on the same days programmed for houses and commercial establishments, this is Tuesday, Thursday, Saturday and a complimentary day.

Steps followed :

- Wastes are collected by means of trucks or collection vehicles from the garbage deposits used at markets, hotels and schools. The collection vehicles are weighed on scales for trucks (the weight of the truck should be known to subtract it), then the characterization is done, and the weight and volume per unit is found.

- Finally, garbage should be transported to its final disposal place.

5. DEVELOPMENT OF THE PILOT PROYECT

5.1 QUESTIONNAIRE SURVEY OF THE INVESTIGATION

This survey has been elaborated for the Study on the Integrated Water Pollution Control for the Interior Bay of Puno on Lake Titicaca in Puno City by considering all the factors which could influence in the contamination of the lake.

This survey covers 7 parts, which are:
(A) Profile of the interviewee
(B) Housing conditions.
(C) Personal characteristics of the interviewee
(D) Environmental and sanitary characteristics
(E) Characteristics of wastes water.
(F) Characteristics of solid waste.
(G) Aspects concerning the possibility of payment and cooperation.

As for the solid wastes, the most representative results are going to be considered in this part.

5.1.1 PROCEDURE OF THE QUESTIONNAIRE SURVEY

- To conduct the interviews on homes and commercial establishments it was requested the collaboration of the Students of the faculty of Economical Engineering of the Altiplano National University.
- To visit the designated zones the students were grouped in couples (14), each couple received 4 surveys: 14 X 4 = 56.
- Two vans were used for the initial transportation of the interviewers.
- Interviews started in zone C, considering that there were higher possibilities to find somebody at home at that time of the day.
- For the first day in the morning it was planned to go to Barrio de Aziruni (C-1) and in the afternoon to Mirador de Yanamayo (C-2).
- The survey was carried out of Monday 23 to Thursday 26 of November.

The schedule for the questionnaire survey was :

Date	Place
November 23rd (morning) November 23rd (afternoon)	C-1: Barrio Aziruni C-2: Mirador de Yanamayo
November 24th (morning) November 24th (afternoon)	D-1: Comunidad de Chimu D-2: Cancharani
November 25th (morning) November 25th (afternoon)	B-1: Torres de San Carlos B-2: Urb. Huascar
November 26th (morning) November 26th(afternoon)	A-1: Jr. Lima A-2: Mercado Central

5.1.2 SURVEY OF CHARACTERISTIC ON SOLID WASTE (F)

The number of interviews made once the survey was finished, is shown in the following table:

NUMBER OF INTERVIEWS MADE IN PUNO CITY

ZONES	INTERVIEWS
A – 1	53
A – 2	59
B – 1	56
B – 2	56
C – 1	56
C – 2	56
D – 1	54
D – 2	51

Source: Survey of Investigation. November 1998.
Own elaboration

The results obtained after processing the survey are:

Table No. 1, shows that 90.9% know that there is a problem with a solid waste.

TABLE No.1

CONCERN WITH THE GARBAGE DISPOSED
(Public Areas)

Answers	Number	Percentage
Yes	401	90.9 %
No	22	5.0 %
Don't Know	18	4.1 %
Total	441	100.00 %

Source: Survey of Investigation. November 1998.
Own elaboration
See Annex No.2 for details of each zone

Table No. 2, shows that only a 39,2% of the interviewees know about the procedure of the solid waste are collected, while 60,8% have no knowledge about this. It can be confirmed one of the problems is the lack of knowledge of the inhabitants about these topics.

TABLE No.2
DO YOU KNOW METHODS OF SOLID WASTES COLLECTION

Answers	Number	Percentage
Yes	173	39.2
No	198	44.9
Don't Know	70	15.9
Total	441	100.0

Source: Survey of Investigation. November 1998.
Own elaboration
See Annex 2 for details of each zone.

Table N° 3, shows that most of the people agree that the handling of solid waste is a responsibility of the Municipality (Local Government). The do not realize that this is a problem that requires not only the participation of regional and local authorities, as well as of the Central Government, but that it also involves the cooperation of the inhabitants, as main generators of the wastes.

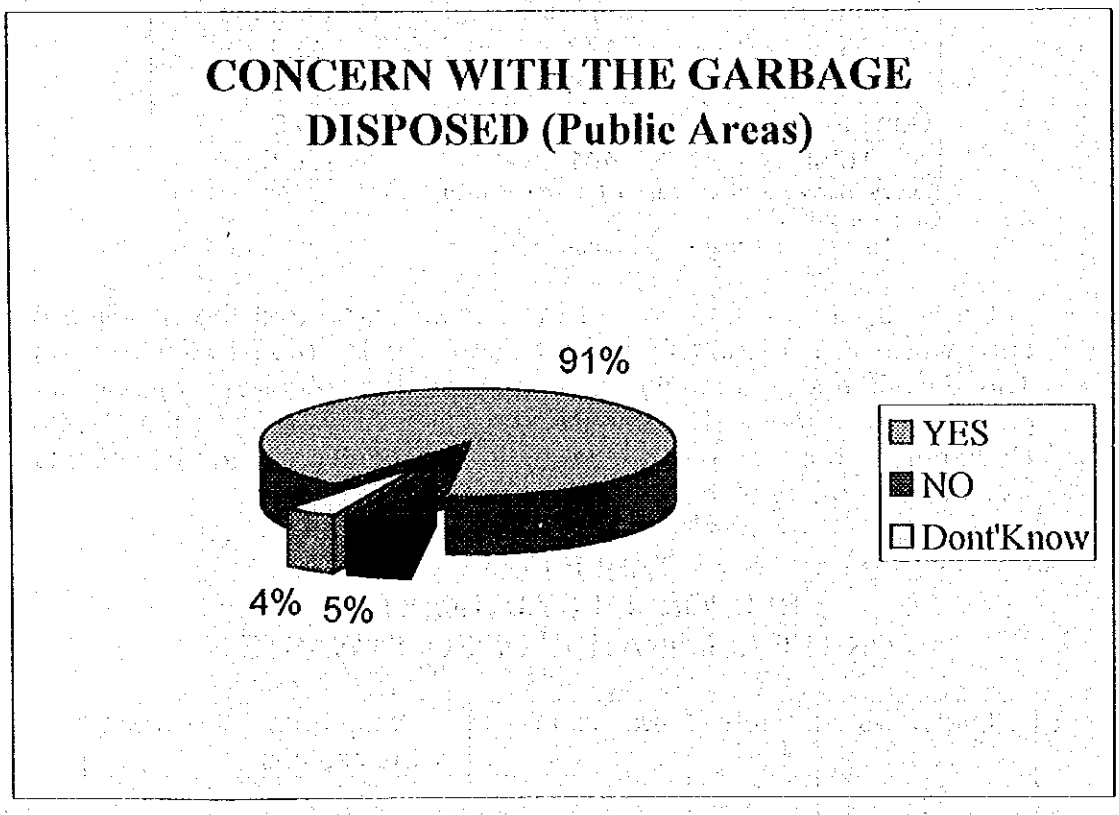
TABLE No.3
RESPONSIBLE AUTHORITY
FOR THE ELIMINATION OF SOLID WASTE

Interviews	State	Municipality	Neighbors themselves	Others
441	3	393	7	38

Source: Survey of Investigation. November 1998.
Own elaboration

GRAPHIC TABLE N°1

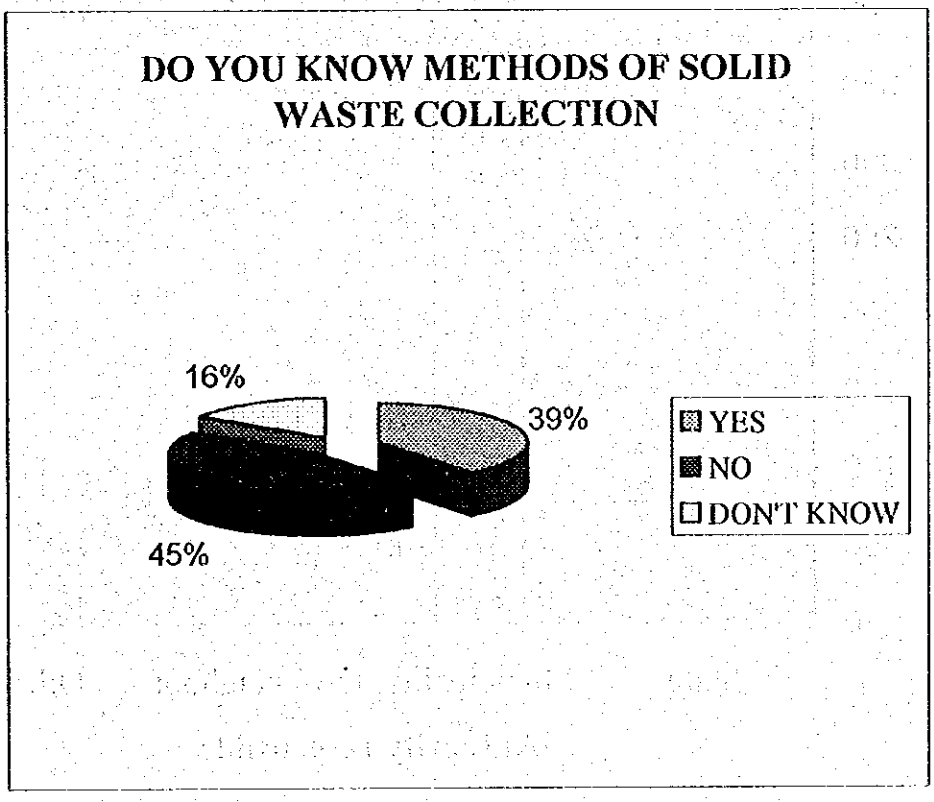
Concern with the garbage disposed (Public areas)		Percentage %
YES	401	90.90
NO	22	5.00
Dont'Know	18	4.10
Number of interviee	441	100.00



GRAPHIC TABLE N°2

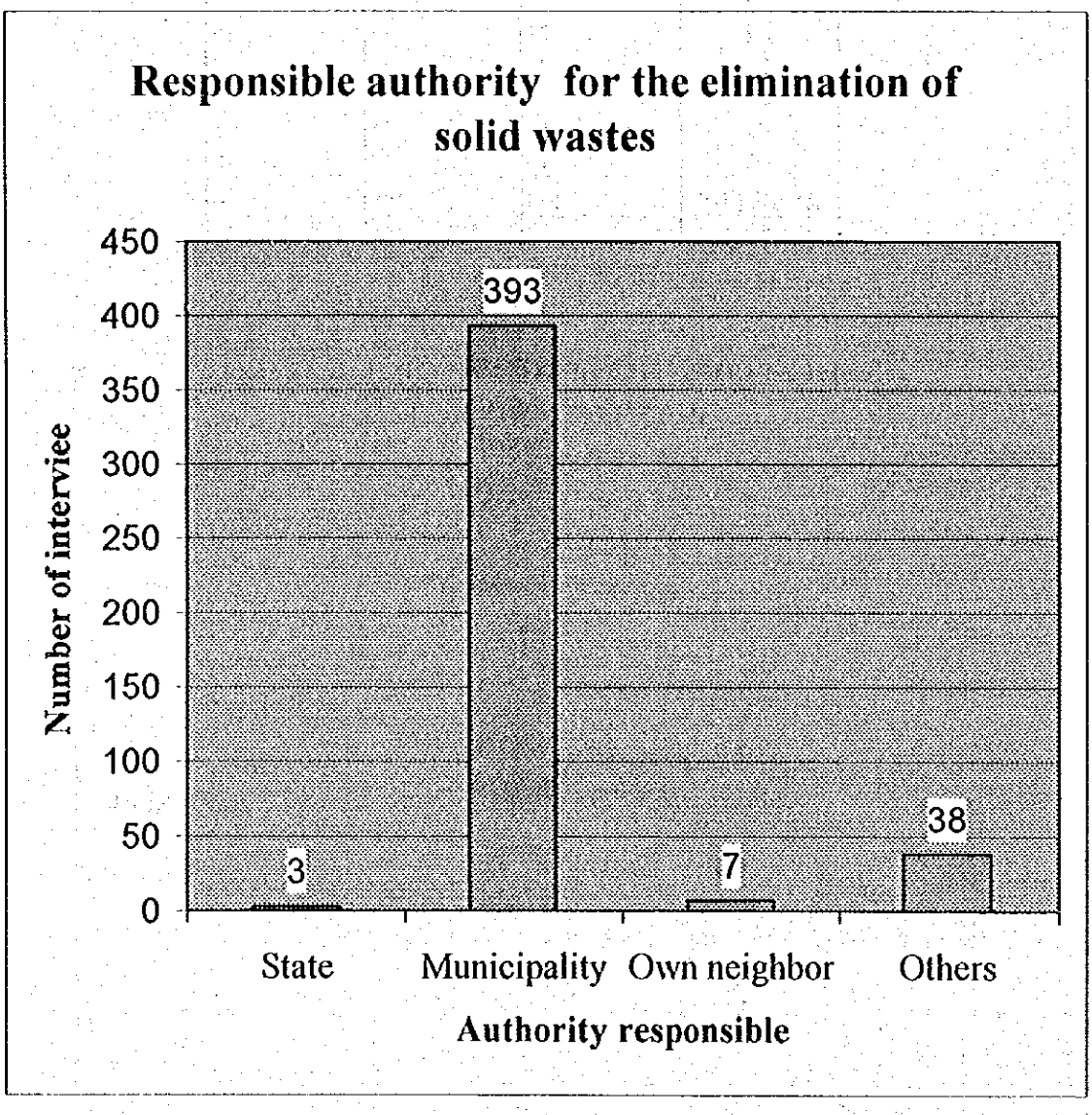
DO YOU KNOW METHODS OF SOLID WASTE COLLECTION

ZONAS	YES	NO	DON'T KNOW
A1	23	23	7
A2	20	29	10
B1	31	22	3
B2	21	25	10
C1	23	25	8
C2	21	30	5
D1	18	25	11
D2	16	19	16
ANSWERS	173	198	70
%	39	45	16



GRAPHIC TABLE N°3

	Number of intervice	Percentage %
State	3	0.7
Municipality	393	89.1
Own neighbo	7	1.6
Others	38	8.6
Total	441	100.0



5.2 COLLECTION OF WASTE

Once the questionnaire survey was finished it was programmed a day to distribute the bags where the samples would be collected; one bag per day was distributed.

- The bags were distributed in the houses where the survey had been carried out for 4 days, or about 50 interview X 8 zones X 4 bags= 1, 600 bags.
- The bags were identified with the number of the survey questionnaire, name of the person, address and zone they belong to.
- Bags were handed to the same people who carried out the survey.
- Two vans to transport the collectors and two pick up trucks to collect the bags with the wastes were used. (See Annex : Photos)
- A route was established and meeting points were fixed so the trucks could go to unload and then continue with the collection of bags.
- In order to weigh the samples, once the bags with wastes arrived they were removed from the truck, separated by zones, and finally the weight of each one was registered in the number corresponding to the questionnaire survey. (See Annex : Photos)

5.2.1 GENERATION PER CAPITA

- Through the about fifty (50) interviews carried out in each zone we can know the approximate population that participated in the survey.
- During the collection of the samples we will know the amount of generated waste, by weighing the bags corresponding to each family.(See Annex: Photos)

To obtain the generation per capita we consider the following points:

- It will be considered the continuity in the collection of samples of any of the families that were interviewed.
- The data, with no registers in any of the four days of the collection process, those registered only during one day, and those with extreme values will be discarded.
- An average generation per capita per zone will be obtained.

Obtaining the generation per capita:

Generation = Total weight of wastes collected in a zone (for a determined family)
Per Capita Quantity of inhabitants in the zone (determined family)

By obtaining an average generation per capita for the zones, we will obtain finally the generation per capita in Puno City.

Table No.4, shows the Generation per capita to obtain in the survey zones. The commercial sector will be shown afterwards.

TABLE No. 4

GENERATED WASTE PER CAPITA BY ZONES

ZONES	GENERATED WASTE PER CAPITA (Kg/person/day)
B-1	0.30
B-2	0.39
C-1	0.22
C-2	0.25
D-1	0.41
D-2	0.41

Source: Survey of Investigation. November 1998.
Own elaboration
See Annex No.3-B for details of each zone

The generation per capita (Kg/person/day) will not be obtained for Sector A, the commercial sector, which is reflected in Table No. 4-A. The amount of waste for A-1 is considered by indicating the amount generated in one day (Kg/day) and the number of establishments participating in the sample. For Sector A-2 it should be considered the number of stands in the Mercado Central.

TABLE No. 4 -A

ZONE	GENERATED WASTE (Kg/day)
A-1	24.48 [1]
A-2	42.12 [2]

Source: Survey of Investigation. November 1998.
Own elaboration
See Annex No.3-A for details of each zone
1) Samples 31 commercial establishments in Jr. Lima.
2) Samples 27 stands in the Mercado Central

5.2.2 SPECIFIC GRAVITY (Kg./lt.)

The volumes of the samples were obtained from the ones indicated in the corresponding buckets, thus weighing these ones on a scale, and discounting the weight of the bucket. (See Annex : Photos)

Obtaining the specific gravity:

$$\text{Specific gravity} = \frac{\text{Total weight of the sample (Kg)}}{\text{Volume of the bucket with the sample(lt.)}}$$

GRAPHIC TABLE N° 4

ZONES	GENERATED WASTE PER CAPITA (Kg./person/day)
B - 1	0.30
B - 2	0.39
C - 1	0.22
C - 2	0.25
D - 1	0.41
D - 2	0.41

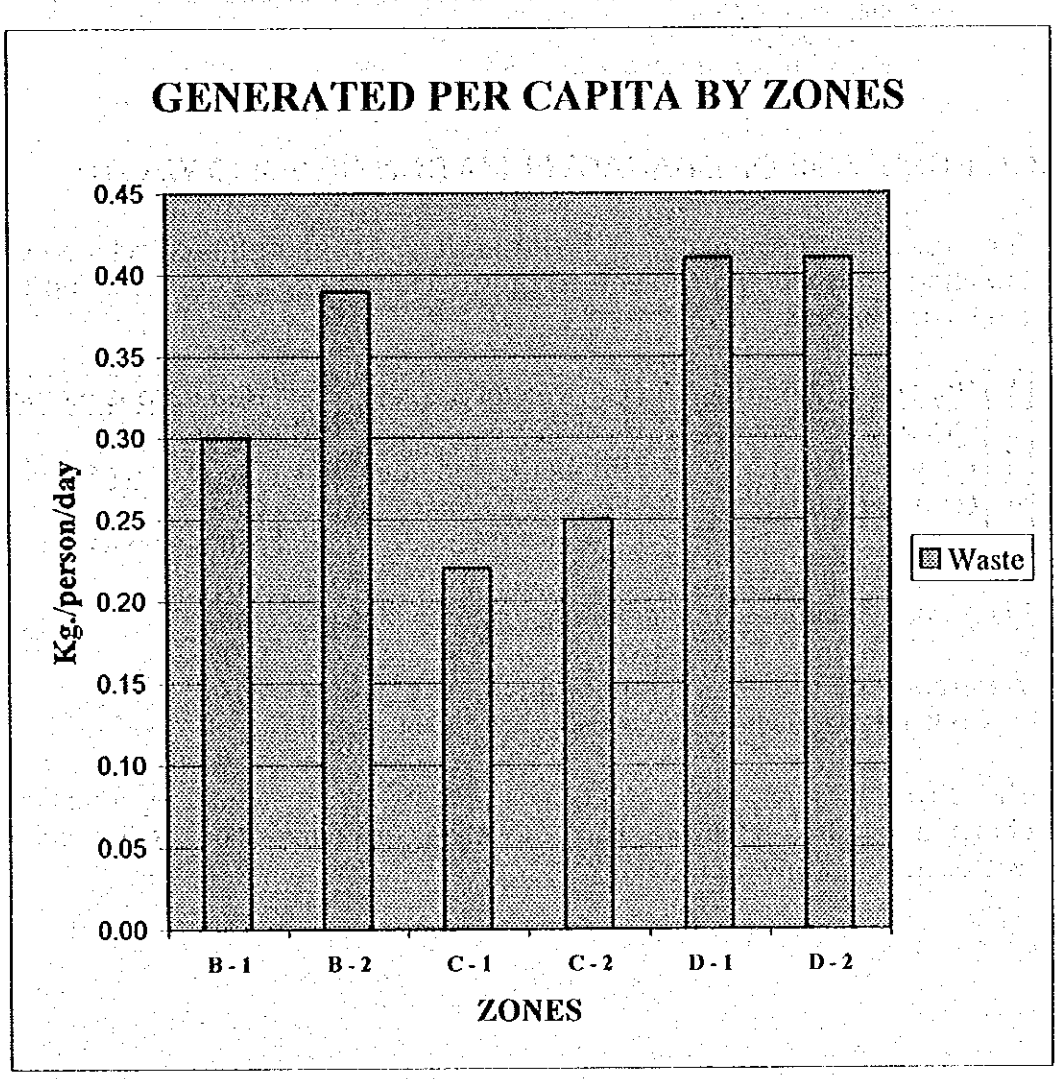


Table No. 5 indicates the specific gravity obtained in the survey zones

TABLE No. 5

SPECIFIC GRAVITY BY ZONES

ZONES	SPECIFIC GRAVITY (Kg/lt.)
A-1	0.20
A-2	0.29
B-1	0.17
B-2	0.16
C-1	0.15
C-2	0.21
D-1	0.12
D-2	0.15

Source: Survey of Investigation. November 1998.
Own elaboration
See Annex No.4 for details of each zone.

5.2.3 PERCENTAGE OF CHARACTERIZATION OF SOLID WASTE

A representative sample (5 to 10 Kg.) is considered in the calculation of the characterization percentage. Then wastes are separated according to the following categories:

1	Paper, cardboard	5	Other combusible	9	Non ferrous metals
2	Organic waste	6	Plastic	10	Glass
3	Fiber and cloth	7	Rubber and leather	11	Stone and ceramic
4	Grass and trees	8	Ferrous metals	12	Other non combustibles

Each waste category is weighed and expressed in percentage.

$$\text{\% Percentage of Characterization} = \frac{\text{Weight of any type of waste}}{\text{Total weight of sample}} \times 100$$

The physical composition of the solid waste for each of the zones is obtained. Finally, an average of the physical composition of the solid wastes in Puno City is obtained.

GRAPHIC TABLE N°5

ZONES	S.G. (Kg./lt)
A - 1	0.20
A - 2	0.29
B - 1	0.17
B - 2	0.16
C - 1	0.15
C - 2	0.21
D - 1	0.12
D - 2	0.15

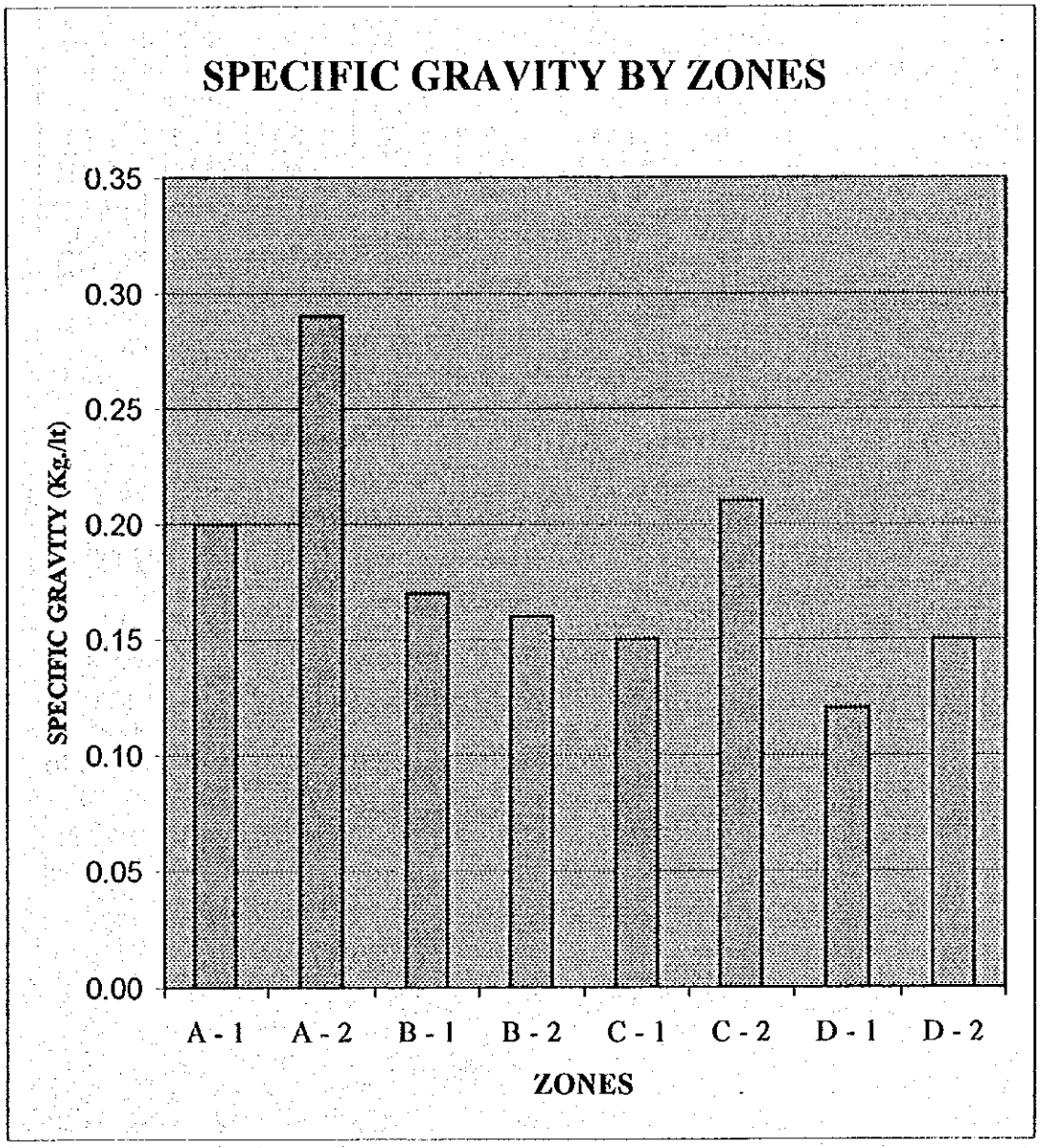


Table No.6, shows the percentage of the components found in each of the survey zones.

TABLE No. 6

CHARACTERIZATION OF THE WASTE COMPONENTS BY ZONES

ZONES	A – 1	A – 2	B – 1	B – 2	C – 1	C –2	D – 1	D –2
Items	%	%	%	%	%	%	%	%
Paper, waste	24.02	6.03	13.81	11.09	12.83	7.81	7.88	5.38
Organic garbage	38.14	62.22	47.86	59.56	39.68	29.82	38.38	47.09
Fiber, cloth	3.60	2.22	2.53	3.41	4.01	3.35	3.23	1.74
Wood		1.11			0.60	0.64	0.40	0.44
Plastic	20.72	5.08	20.04	11.95	17.23	16.75	22.02	17.15
Rubber, leather		8.89	2.53				3.64	1.45
Ferrous metals	3.30	1.11	4.28	4.61	6.21	10.37	8.08	8.72
Glass	7.52	1.11	1.95	1.87	0.60	8.61	7.08	9.59
Stones, ceramics					0.40		1.21	1.46
Bones		8.42	3.89	0.68			0.40	0.58
Soil	0.15	3.81	3.11	6.83	18.44	22.65	7.68	6.40
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Survey of Investigation. November 1998.
Own elaboration
See Annex No.5 for details of each zone.

5.2.4 WASTES GENERATED IN SCHOOLS AND HOTELS

- For the collection of solid waste, a total of six schools were chosen: two of initial education, two of primary education and two of secondary education; and two hotels.
- The collection was carried out during two days, December 7 and 9.
- Information as number of students, teachers and administrative staff was requested to the schools in order to know the quantity of people that generated the volume of wastes collected.
- The number of guests lodged during the previous day was requested to the hotels.
- The sample was weighed and registered.

GRAPHIC TABLE N°6

CHARACTERIZATION OF THE WASTE COMPONENTS BY ZONES

SAMPLING POINTS	A-1	A-2	B-1	B-2	C-1	C-2	D-1	D-2
Items to be measured	%	%	%	%	%	%	%	%
Paper, Cardboad	24.02	6.03	13.81	11.09	12.83	7.81	7.88	5.38
Kitchen garbage	38.14	62.22	47.86	59.56	39.68	29.82	38.38	47.09
Fiber and cloth	3.60	2.22	2.53	3.41	4.01	3.35	3.23	1.74
Other combustibles(Wood)		1.11			0.60	0.64	0.40	0.44
Plastic	20.72	5.08	20.04	11.95	17.23	16.75	22.02	17.15
Rubber and leather		8.89	2.53				3.64	1.45
Ferrous metals	3.30	1.11	4.28	4.61	6.21	10.37	8.08	8.72
Glass	7.52	1.11	1.95	1.87	0.60	8.61	7.08	9.59
Stones and ceramics					0.40		1.21	1.46
Other no combustibles(Bone)		8.42	3.89	0.68			0.40	0.58
Land	2.70	3.81	3.11	6.83	18.44	22.65	7.68	6.40
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

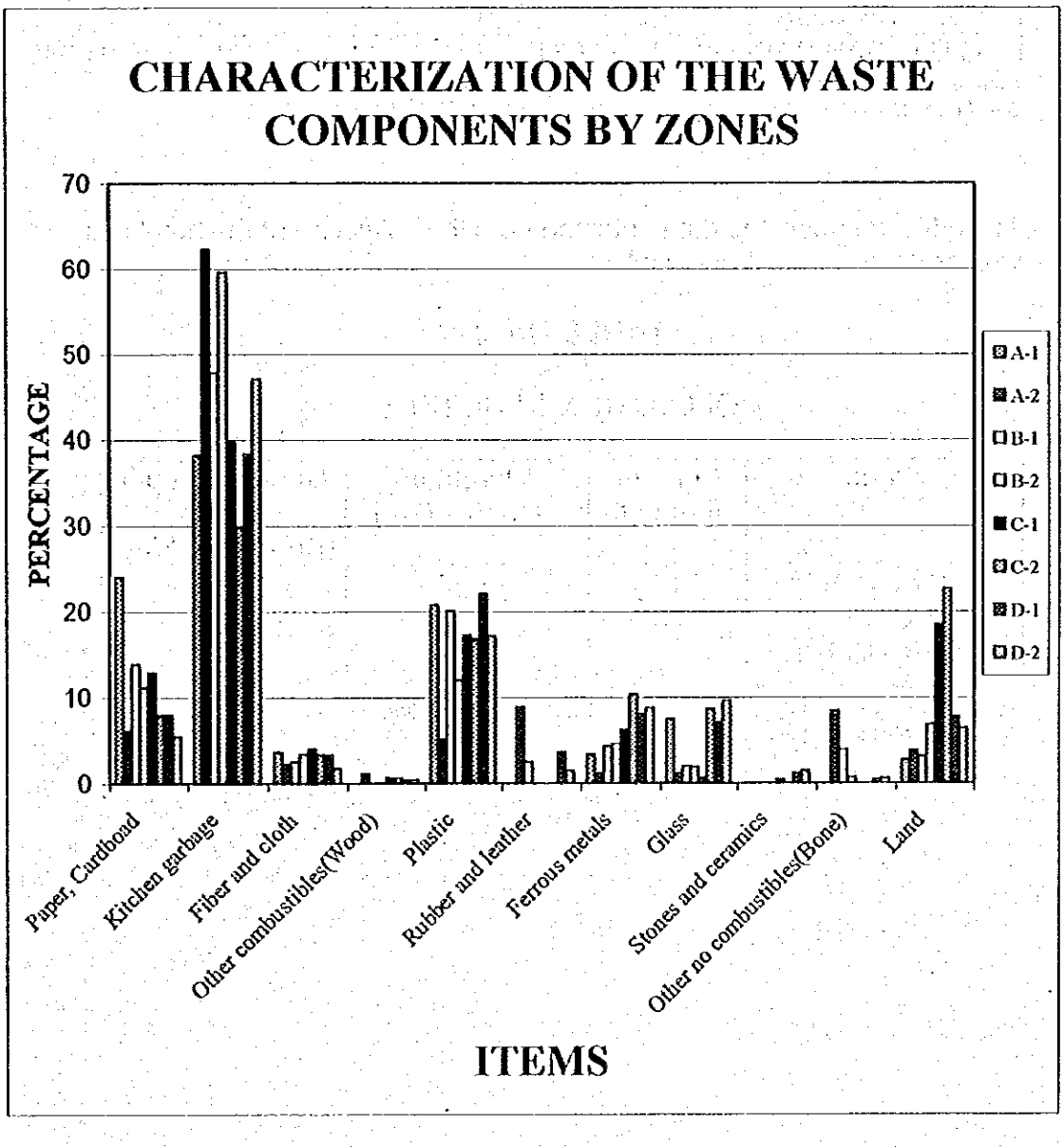


Table No.7 shows the results of the collection obtained at the schools, as well as its generation per capita.

TABLE No. 7

COLLECTION IN SCHOOLS

Name	Number of people	Weight of samples (Kg.)	Generation per capita (Kg/person/day)
CEI 192	268	3.7	0.0138
CEI 193	241	6.4	0.0265
70010	1240	22.1	0.0178
71013	1171	26.6	0.0227
GLORIOSO SAN CARLOS	1539	4.25	0.0028
G.U.E. SAN CARLOS	2631	11.9	0.0045

Source: Survey of Investigation. November 1998.Own elaboration
See Annex No. 6 for details.

Table No. 8 shows the data obtained from the collection at the hotels as well as its generation per capita.

TABLE No. 8

COLLECTION IN HOTELS

Name	Number of guests	Weight of samples (kg.)	Generation per capita (Kg/person/day)
HOTEL ITALIA	19	6.4	0.33
HOTEL FERROCARRIL	20	2.6	0.13

Source: Survey of Investigation. November 1998.Own elaboration
See Annex N°6 for details.

6. RESULTS

The results obtained from the solid waste collection survey and some data coming from the questionnaire survey are presented.

Table No. 9, shows the generation per capita in Puno City obtained from the average generated in the residential sectors.

TABLE No. 9

GENERATION PER CAPITA IN PUNO CITY

PUNO	WASTE PER CAPITA (Kg./person/day)
Average	0.33

Source: Survey of Investigation. November 1998. Own elaboration

Table No.10 shows the value of specific gravity found at Puno City.

TABLE No. 10

SPECIFIC GRAVITY IN PUNO CITY

PUNO	S.G. (Kg./lt.)
Average	0.18

Source: Survey of Investigation. November 1998. Own elaboration

Table No.11 shown the average result obtained of all the zones of the sample. These values are the characterization of wastes to Puno City.

TABLE No. 11

CHARACTERIZATION OF SOLID WASTE IN PUNO CITY

COMPONENTS	PERCENTAGE %
Paper, cardboard	10.4
Organic garbage	43.7
Fiber, cloth	2.9
Wood	0.5
Plastic	16.5
Rubber, leather	2.5
Ferrous metals	6.2
Glass	5.4
Stones, ceramics	0.5
Bones	2.0
Soil	9.4
TOTAL	100.0

Source: Survey of Investigation. November 1998.
Own elaboration .See Annex N°7 with details

GRAPHIC TABLE N°11

CHARACTERIZATION OF SOLID WASTE IN PUNO CITY

COMPONENTS	PERCENTAGE
Paper, Cardboad	10.4
Kitchen garbage	43.7
Fiber and cloth	2.9
Wood	0.5
Plastic	16.5
Rubber, leather	2.5
Ferrous metals	6.2
Glass	5.4
Stones, ceramics	0.5
Bone	2.0
Land	9.4
TOTAL	100.0

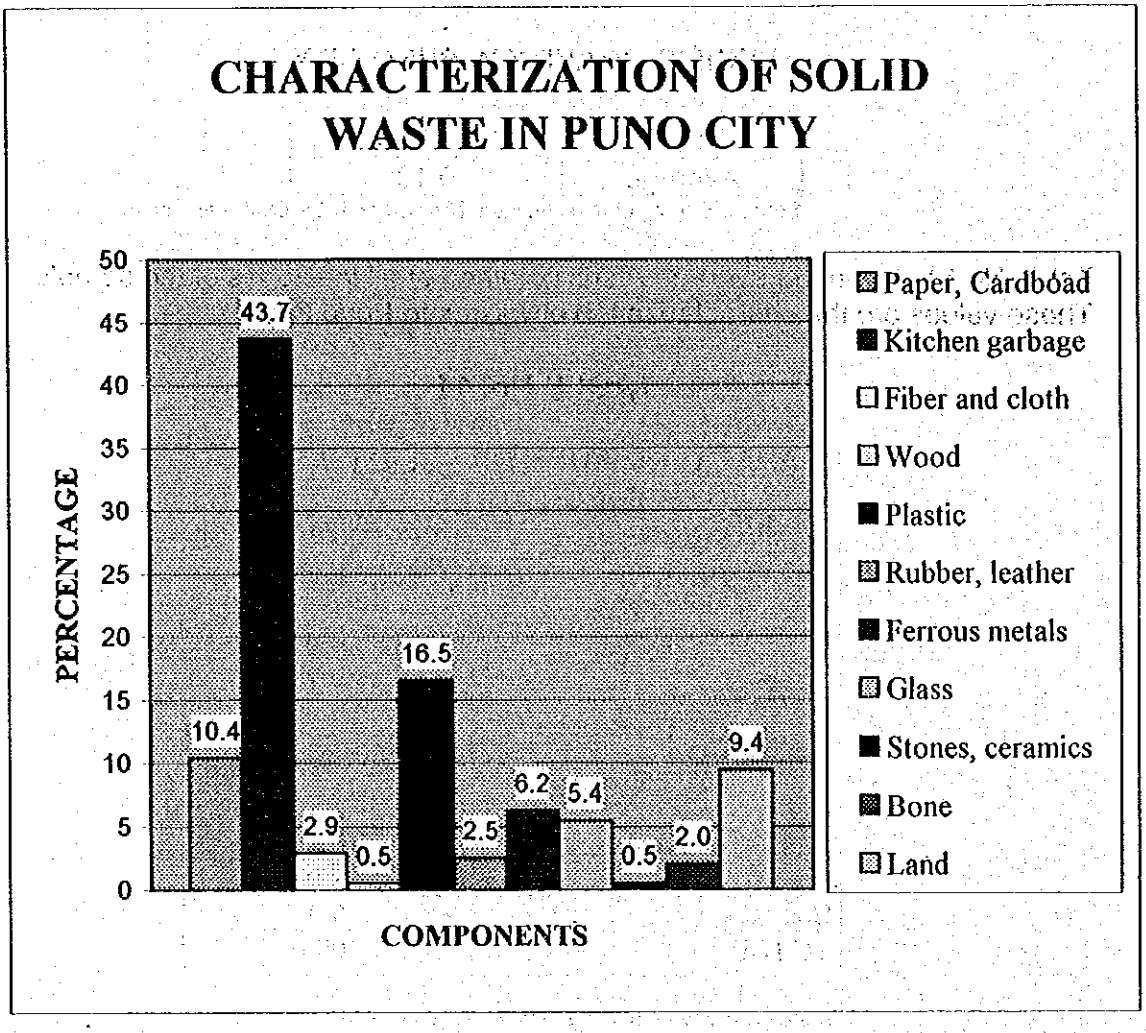


Table No.12, shows the solid waste generated in ton/year and ton/month, in the city of Puno, calculated through to the generation per capita and the population forecast.

TABLE No.12

GENERATION OF SOLID WASTES IN PUNO CITY

Population 1998 [1] (Thousand Inhabitants)	Generation (Kg./person/day)	Generation Total	
		(ton /day)	(ton /year)
101.4	0.33	33.5	12,213

Source: (1) Instituto Nacional de Estadística (INEI)
Elaboration CUANTO S.A.

Table No.13, shows comparative values of the characterization of wastes obtained years before the project by the Municipality of Puno.

TABLE No. 13

COMPARATIVE TABLE OF THE CHARACTERIZATION OF SOLID WASTE IN PUNO CITY

Components	1994 [1]	1997 [1]	1998 [2]
Paper, cardboard	9.5	8.2	10.4
Kitchen garbage	49.3	39.8	43.7
Fiber, cloth			2.9
Wood			0.5
Plastic	10.3	11.4	16.5
Rubber, leather			2.5
Ferrous metals	1.2	4.9	6.2
Glass	5.8	6.7	5.4
Stones, ceramics			0.5
Bones			2.0
Soil	24.0	29.0	9.4
Total	100.0	100.0	100.0

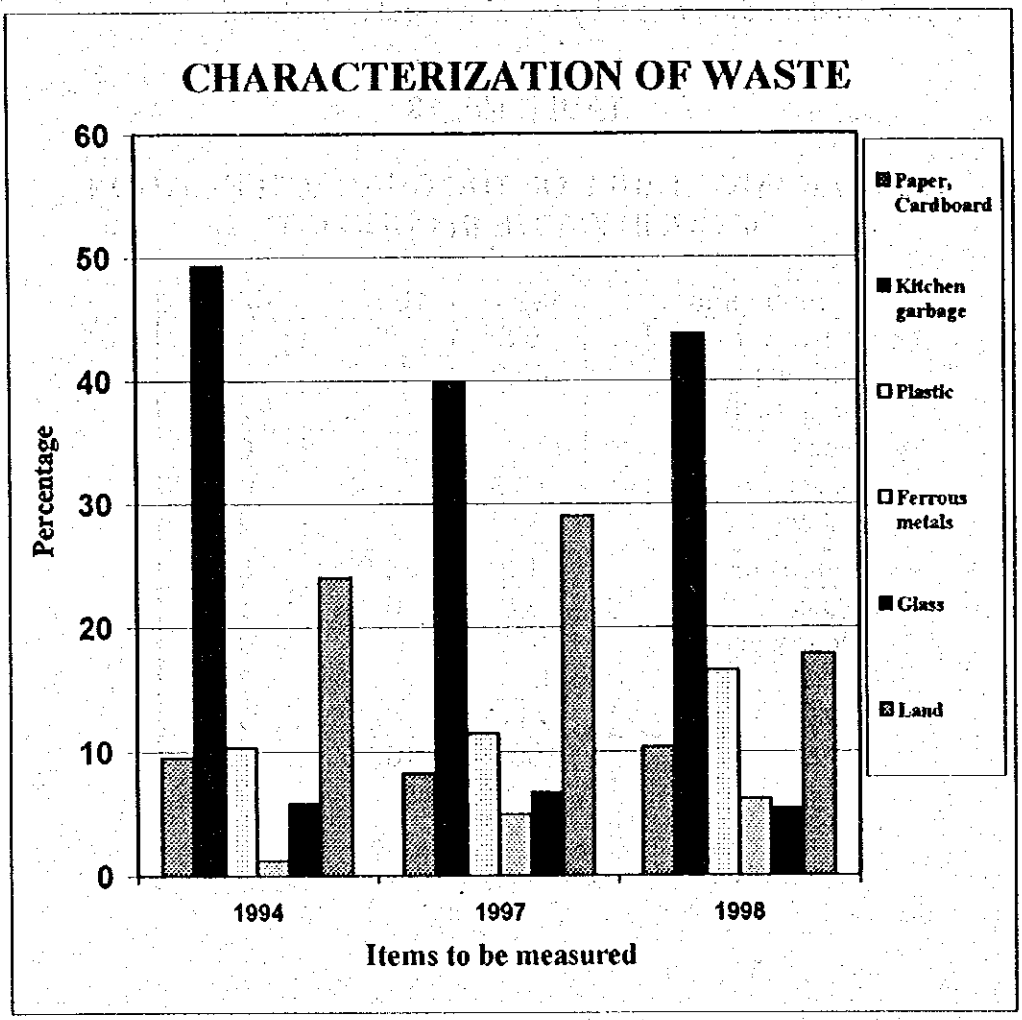
Source: (1) Municipalidad Provincial de Puno
(2) Survey of Investigation. November 1998.
Own elaboration

GRAPHIC TABLE N°13

TABLE COMPARATIVE TO THE CHARACTERIZATION OF SOLID WASTE IN PUNO

Items to be measured	1994 %	1997 %	1998 %
Paper, Cardboard	9.50	8.20	10.36
Kitchen garbage	49.30	39.80	43.73
Plastic	10.30	11.40	16.53
Ferrous metals	1.20	4.90	6.15
Glass	5.80	6.70	5.39
Land	24.00	29.00	17.84

(*) The land in this case to include fiber, wood, rubber, leather, stones, ceramics and bone.



7. CONCLUSIONS

- The generation per capita obtained in the survey is referred to the residential sector.
- For the commercial sector, the amount of waste is considered by indicating the amount of waste generated daily (kg/day) and the number of places considered.
- The weight of the samples during the collection of solid wastes from schools, is not representative. During the days of the survey the students went to the school only to give their exams. Their stay in the schools as well as of the teachers was minimum.
- The waste collection at hotels is minimum if we compare it with the number of people lodged there. Mostly the service they offer is lodging and breakfast.
- A good acceptance of the samples collection was observed in the zones surrounding the hill (Zone D), due that the collection of wastes is usually done weekly, biweekly or scarcely (cleaning campaigns).
- No collection was carried out in zone A1 on the first day of the survey, December sixth, due that most part of the commercial establishments in Jr. Lima remain closed during Sundays.
- For the commercial zones (A-1, A-2), we had to modify some questions of the survey in order to get the necessary information. This was because some of the interviewees were answering as if they lived there.
- The high percentage of organic waste in zone A-2 is justified due that the samples are originated at the Mercado Central.
- The questionnaire survey was difficult to carry out in the zones far away of Puno City, (Zone D), due to the location of the zones (near the hills), the distance between houses and the absence of roads to move along..
- Generation per capita in zone D (Comunidad Chimu, Cancharani) is slightly higher than in other zones. As it can be appreciated in the results of the physical composition, there is soil, stones and ceramics. This is because on these zones away from the city there are small farms, and its cleaning makes that these heavy elements be found in the waste of these.

8. RECOMMENDATIONS

- It is necessary to consider more days for the waste collection survey (at least seven days), because the type of waste can change according to the inhabitants activities.
- To work with samples from schools, we must be sure that the samples will be collected during regular school days.
- Samples of the commercial establishments should be collected during regular working days of the week.
- If services are provided in the places where samples will be collected, (as clothes, food, vegetables, etc), it should be specified in the survey questionnaire the approximate number of clients that are attended daily, because they are the ones that generate the waste on a higher proportion.

- If the questionnaire survey is to be carried out in commercial establishments, the questions should consider that these are places where people are in transit and that people work there instead of living there.

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